



Fetal Alcohol Spectrum Disorder in Yukon Corrections

Final Report to Yukon Justice: Estimating
the Prevalence of FASD, Mental Health,
and Substance Use Problems in the Justice
System

Kaitlyn McLachlan, Ph.D., C.Psych.

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Executive Summary

Key Words: *Fetal Alcohol Spectrum Disorder, Corrections, Screening, Assessment, Diagnosis, Prevalence, Prenatal Alcohol Exposure*

Background and Aims. Individuals who are exposed to alcohol during pregnancy experience a range of cognitive, emotional, and physical difficulties, and may be diagnosed with fetal alcohol spectrum disorder (FASD). Individuals with FASD experience a range of problems in their day-to-day functioning and are overrepresented in criminal justice settings. Limited research has been undertaken to understand how many people in the criminal justice system have FASD. Identifying individuals with FASD in corrections is important for several reasons. Though adults with FASD each have individualized strengths and limitations, at a group level, they often experience brain-based difficulties in areas such as decision-making and problem solving, mental health problems, and problems with addictions. These difficulties may impact their continued involvement in the criminal justice system. As such, the present study aimed to estimate the prevalence of FASD in the criminal justice system in Yukon, along with other neurocognitive deficits, mental health, and substance-related difficulties. The study also sought to evaluate promising FASD screening tools for use in the adult criminal justice context.

Engagement. As individuals of First Nation heritage are overrepresented in Yukon Corrections, it was anticipated that persons of Indigenous background would be disproportionately impacted by this research. Importantly, FASD occurs in the context of relevant social determinants of health. In Yukon, First Nations communities continue to recover from the effects of colonialist policies, including residential schools, intergenerational impacts that include a loss of cultural identity, weakening of community and family integrity, and disproportionate rates of addictions and poverty. Given these factors, a priority of this research involved engaging with First Nations health partners, primarily through regular communication with the Yukon First Nations Health and Social Development Commission (YFNHSD), across all stages of this research. Engagement with the YFNHSD proved particularly critical in ensuring that participant support and benefit was maximized, while minimizing any potential risks associated with research participation. Their engagement influenced key study design components and resulted in an ethical and participant-centered research approach and dissemination of the current findings.

Local Engagement and Supports. While undertaking this research we sought to achieve the highest level of ethical consideration. We intentionally focused on ensuring that the project contributed to the development of increased local professional capacity for supporting individuals with FASD. The study team included physicians, psychologists, and research personnel, primarily recruited and trained from the local community. We also recognized that individuals engaged in the research process would require support during, and after their participation, and sought to ensure those supports were accessible. Participants received individualized feedback sessions and written reports summarizing their study participation. Post-study support services were also

made available to all participants for at least six months following completion of this research to ensure they had an opportunity to connect with necessary supports identified through their participation.

Study Design. This study used a prospective case ascertainment design. All adults (ages 18 to 40) under an active legal supervision order through Yukon Corrections were invited to participate over 17-months between May 2014 and September 2015. Participants were recruited from both the Whitehorse Correctional Centre and Whitehorse Offender and Supervision Services. Participants were enrolled in the study following an informed consent process that was optimized to ensure they understood and appreciated all aspects of the research prior to agreeing to engage in the study. Each participant underwent an interdisciplinary assessment guided by the 2005 Canadian FASD Diagnostic Guidelines, comprising both medical and psychological assessments. Thorough file reviews and maternal and collateral interviews were conducted to collect information about prenatal alcohol exposure (PAE). FASD screening instruments were also completed, including the Asante FASD Screening and Referral Tool for Probation Officers (AST) and the Correctional Service of Canada's Brief Screening Checklist (BSC). Clinical tools were also administered to help estimate rates of mental health and addictions difficulties in the sample. Diagnoses were determined during clinical case conferences.

Results. Eighty participants completed the study protocol, representing between 16% and 19% of the eligible annual correctional population. PAE was confirmed in 25% of cases, ruled out in 25% of cases, and unclear in the remaining 50% of cases. Diagnostic results showed that 17.5% of participants ($n = 14$) met criteria for FASD. Diagnosis was deferred for 13.8% of participants ($n = 11$) where there was insufficient information to make a reliable clinical decision. FASD was ruled out for the remaining 68.7% of participants ($n = 55$). Neurocognitive deficits were observed at high rates in this sample, along with mental health and substance abuse problems. High rates of adversity and victimization were also observed across the sample, along with difficulties in independent living. With respect to FASD screening, implementation challenges were encountered using the AST. While the BSC did not result in efficient screening outcomes using pre-specified cut-off criteria, an optimization of BSC-items resulted in improved sensitivity and specificity, suggesting the potential utility of this measure in Yukon. These findings highlighted the importance of evaluating the utility of tools in individual contexts, populations, and settings.

Conclusions. Findings highlighted the high rate of FASD in justice-involved adults in Yukon, and were in keeping with previous Canadian prevalence estimates in Federally-incarcerated adults. Results underscored the importance of continued efforts to understand how many offenders have FASD in correctional settings, develop effective methods of identifying individuals at risk of FASD through screening, and identifying best practices in assisting offenders with FASD during all stages of criminal justice system involvement.

Project Background

In September 2008, the Yukon Department of Justice, in collaboration with the Department of Justice Canada, and the Steering Committee on Access to Justice for Individuals with Fetal Alcohol Spectrum Disorder (FASD), hosted a national conference on Access to Justice for Individuals with FASD. This was the first conference of its kind in Canada and highlighted the manner in which FASD impacts upon the justice system. Four recommendations for improvement emerged from these discussions:

- (1) Education and awareness
- (2) Identification
- (3) Information Sharing and establishing linkages;
- (4) Specialized programming or initiatives

One of the primary recommendations from the conference identified the need for research related to the prevalence of FASD in the criminal justice system. Currently, there is very little empirical data on how many individuals within the justice system have FASD. This is particularly true in the adult offender population where diagnosis and identification can be more challenging. One way of addressing this challenge is through a study of the prevalence of FASD. Yukon, along with its partners, committed to undertake such a project. In early 2010, the Yukon Department of Justice formed a partnership with the Canadian Centre on Substance Abuse (CCSA) and the Research and Statistics Division of the Department of Justice Canada to undertake the present study, designed to investigate the prevalence of FASD in the Yukon corrections population. Over the course of these early discussions, the high prevalence of mental health and substance abuse problems found concurrently in individuals with FASD, as well as more generally in the justice system, was also highlighted. Thus, the present study also sought to evaluate rates of these additional challenges in offenders in Yukon.

Methodological Development

Development of the current study methodology was initiated with a Diagnostic Experts Meeting, held on May 10, 2010, in Vancouver, British Columbia. Attendees included local and national experts and stakeholders. Items discussed at this meeting were carefully considered in developing this research approach. A key theme that emerged during this meeting was the complexity and labour-intensive nature of undertaking a clinical diagnostic study in the Yukon justice system. The final methodology and research approach reflected a synthesis of information learned at this meeting, as well as extensive information gathered during meetings assessing Yukon correctional and clinical landscapes. While not without limitations, our research approach was thought to reflect a careful balance between achieving clinically useful diagnostic information that would benefit individual participants, the Yukon Department of Justice, and broader research interests at the local and national levels, while executing a methodologically sound, efficient, and feasible research design.

Guiding Principles

A series of guiding principles informed this research. Importantly, this research program was developed with the intention of sharing resources in other similar correctional jurisdictions. Replication and adaptation of the research protocol is encouraged to suit the differing needs and diverse offender populations in Canada.

Prevalence Partnership Board. A Prevalence Partnership Board was developed in 2010 to provide community, expert, and stakeholder oversight and guidance during the development, implementation, interpretation, and dissemination stages of this research. An early search by the Yukon Department of Justice identified key stakeholders, knowledge users, and contributors to this research, including: Yukon Government Departments of Justice and Health and Social Services; Yukon College Northern Institute of Social Justice and Yukon Research Centre; Fetal Alcohol Syndrome Society of Yukon; Yukon First Nations Health and Social Development Commission; Justice Canada; Correctional Service Canada, Canadian Centre on Substance Abuse, the Canadian Bar Association (Yukon Branch). This board oversaw all stages of this research, and provided final review and approval for this report.

Local Stakeholder Consultation and Engagement. Early discussions held during the planning stages of this research underscored the importance of developing collaborative relationships with the individuals, service agencies, professionals, justice personnel, First Nations partners, medical and psychological experts, and other prevalence researchers who would either be impacted by the implementation of the current study, or have key information to contribute to the methodological development. Consultations were held both in-person in Whitehorse, as well as via teleconference, both at the outset of this project, and during the interpretation phase of the research. More than 60 meetings and presentations were undertaken during this period, resulting in a high degree of stakeholder engagement and knowledge translation of study findings detailed in this report.

Representative of Yukon Justice and Corrections Landscape. In making decisions about whom to involve in the study as participants, it was deemed critical to ensure that the results would generalize to the Yukon correctional jurisdiction. This involved balancing several demands, including ecological validity, feasibility, cost, and efficiency. Adherence to this guiding principle increased the likelihood that results from this research will be useful in informing future policy and programming decisions in the territory.

Capacity Development. This research was conducted in parallel to a second project stream led by the Yukon Health and Social Services aimed at increasing service capacity for individuals with FASD. Primary objectives of this project included ascertaining the presence of current service capacity, developing local diagnostic and case management expertise for FASD, and helping already existing service networks to operate more efficiently. Decisions about how to undertake the prevalence study were

made, wherever possible, with the goal of contributing to the development of local Yukon capacity and expertise.

Clinical Utility for Participants and Service Providers. A key theme that emerged throughout early stakeholder consultation focused on ensuring that participants who became involved in this research received support and benefitted from their participation throughout the study. This proved particularly important, given the potential labeling and stigmatization that can arise when considering a diagnosis of FASD, coupled with limited services for individuals with the disability in Yukon. Simply “counting” individuals who met the criteria for an FASD diagnosis was seen as insufficient and ethically inappropriate, particularly in light of the extensive needs of many individuals qualifying for such a diagnosis. Thus, an important outcome of this research involved developing an approach that would ensure individuals received meaningful feedback and supports with respect to their participation.

Cultural Considerations

Yukon represents a unique tapestry of culture relative to the rest of Canada, as there is a much higher proportion of First Nations residents (23.1%) within Yukon’s population, compared to the overall Canadian population (4.3%) (Statistics Canada, 2011). Research has long established the overrepresentation of Indigenous persons in correctional settings across Canada (Royal Commission on Aboriginal Peoples, 1996; Tait, 2003; Waldram, Herring, & Young, 2006). This is also the case in Yukon, where between two-thirds and three-quarters of adults incarcerated at the Whitehorse Correctional Centre, and approximately half of probation admissions in the territory, are identified as First Nations/Indigenous. This, coupled with previously high rates of FASD identified in northern First Nations communities in Canada, suggested that Yukon First Nations would be disproportionately impacted by this research.

Early work examining the prevalence of FASD in northern Yukon and BC identified high rates of prenatal alcohol exposure (PAE) and FASD in select, isolated, rural First Nation communities. Indigenous persons have also been overrepresented in research on FASD in Canada. Often, these findings have been presented without a contextualized discussion surrounding factors that are associated with high rates of FASD, leading to the further stigmatization of already marginalized communities, and perpetuation of stereotypes and myths about cultural factors contributing to the use of alcohol during pregnancy, and resulting “susceptibility” toward FASD. These factors were acknowledged at the outset of this research, with the aim of ensuring that the study was carried out in a culturally sensitive manner. Further, we sought to ensure that findings would be communicated with attention to the Yukon socio-historical context in which PAE occurs, and the social determinants of health that influence both women’s health, and the health of individuals with FASD.

Research involving Métis, First Nation, and Inuit Peoples in Canada is governed by Chapter Nine of the 2014 Tri-Council Policy Statement: Ethical Conduct for Research

Involving Humans (TCPS-2). These Guidelines provide a framework for the ethical conduct of research involving Métis, First Nation, and Inuit persons and emphasize the development of respectful relationships, collaboration, and engagement between researchers, participants, and communities. This research was conducted following these recommendations and in the spirit of the TCPS-2.

The study Prevalence Partners Board included representation from the Yukon First Nations Health and Social Development Commission (YFNHSDC). Regular engagement with the YFNHSDC Health Directors, and their guidance, ensured that this research was conducted in the best possible way. Engagement occurred from the initial stages in formulating the goals and aspirations of this project, throughout the development of an appropriate research methodology, all stages of data collection, interpretation, and critically, in the process of interpreting and reporting findings from the study. This guidance proved invaluable, and helped to ensure that all aspects of the research were culturally-informed and sensitive to the diverse needs and values of participants, their families, and communities. Importantly, the YFNHSDC wanted to ensure that study participants and their families were protected and that they received appropriate support both during, and after their involvement in this research. The First Nations Principles of OCAP (ownership, control, access, and possession) must also be taken into consideration when planning research that impact First Nation individuals and communities. Thanks to the guidance offered by YFNHSDC, this study was conducted in a manner designed to ensure that as many principles as appropriate and relevant were respected in planning and carrying out this research.

Because an important objective of this research involved determining the needs of justice-involved individuals with FASD, we felt that it was important to understand the cultural heritage of the sample, and to report this information. In order to address the needs of offenders with First Nations background, culturally-informed programming has been advocated as an important avenue (Mullet, Fletcher, & Hume, 2010; Tait, 2003). Research assessing the prevalence of FASD in Métis, First Nation, and Inuit communities has not traditionally been communicated with attention to the fact that higher rates do not translate into an “ethnic” susceptibility to the condition (Tait, 2003). Indeed, FASD is found at higher rates in the context of poor social determinants of health (e.g., substance abuse, poverty, and poor access to prenatal care), irrespective of the ethnicity of community members (Johnston, 2000; Tait, 2003). This is particularly true for many of Canada’s Métis, First Nation, and Inuit communities, who continue to grapple with the aftermath of targeted colonialist efforts at assimilation (Mullet et al., 2010; Tait, 2003). For these reasons, findings from this research were reviewed with leaders at YFNHSDC, who supported the principle investigator in ensuring that this information was communicated in a manner that was respectful, rooted in history and context, and useful for current and future generations of knowledge users. We are grateful for this engagement and guidance.

Introduction to FASD

Fetal Alcohol Spectrum Disorder is a broad umbrella term used to denote the range of effects that can result from PAE (Chudley et al., 2005; Hoyme et al., 2016). The effects of PAE can be wide ranging and include deficits in neurocognitive functioning, emotion and behaviour regulation, and in a smaller proportion of cases, sentinel dysmorphic facial features and problems related to growth (Astley, 2010; Chudley et al., 2005; Cook et al., 2015). The term *fetal alcohol syndrome* (FAS) first appeared in the clinical literature in the 1970s following the publication of a series of articles describing a small number of case reports and a retrospective analysis of data linking what appeared to be shared alcohol-related birth defects (ARBD) resulting from the teratogenicity of alcohol (Calhoun & Warren, 2007; Clarren & Smith, 1978; Jones & Smith, 1973). Since that time research has continued to confirm the substantial teratogenic impact of PAE on the developing fetus, frequently resulting in lifelong adverse developmental impacts. As the field has moved toward the development of objective and empirically grounded approaches to the assessment and diagnosis of FASD, several classification systems and commonly used terms have emerged. These include fetal alcohol syndrome (FAS), partial fetal alcohol syndrome (pFAS), fetal alcohol effects (FAE), alcohol-related neurodevelopmental disorder (ARND). FASD is the preferred term referenced by diagnostic guidelines, advocacy groups, and federal agencies, and is generally used as an umbrella term to cover the full range of difficulties experienced by individuals varying levels of PAE (Chudley et al., 2005; Sokol, Delaney-Black, & Nordstrom, 2003).

Individuals with FASD experience a range of neurocognitive deficits that include problems with overall cognition, attention, academic functioning, executive functioning, memory, communication and language. Though, individual profiles of deficits and strengths vary between affected persons (Kodituwakku & Kodituwakku, 2014; Mattson, Crocker, & Nguyen, 2011). Difficulties related to the regulation of behaviour and emotion are also frequently observed, including challenges related to adaptive functioning (Chudley et al., 2005). Comorbid mental health problems occur at high rates, with estimates ranging as high as 90% in some samples (Pei, Denys, Hughes, & Rasmussen, 2011). Further compounding these difficulties, individuals with FASD experience additional pre and postnatal adversity at exceptionally high rates, including other pregnancy related complications such as prematurity and substance exposure (McLachlan, Andrew, Pei, & Rasmussen, 2015). Later as children, frequent disruptions in caregiver placements, foster care system involvement, school failure, and criminal justice system involvement are among the myriad of adversities documented at high rates in this population (Astley, 2010; McLachlan et al., 2016; Streissguth et al., 2004). While research focusing on the experiences and outcomes of adults with FASD is limited, research suggests that individuals with the disability also experience problems in employment and independent living (Streissguth et al., 2004).

FASD Prevalence, Diagnosis, and Economic Impact

Canadian FASD prevalence rates remain unclear owing to limited population-level research (Cook et al., 2015; Popova, Lange, Probst, Gmel, & Rehm, 2017). The Public Health Agency of Canada (PHAC) estimates that the prevalence of FASD in the general population is approximately 1% (or, 9 in 1,000) (2005). However, estimates from the United States range from 2% to 5% (May et al., 2009, 2014), and worldwide, estimates vary widely. Small-scale studies have shown substantially higher rates in rural and northern Indigenous communities (Popova et al., 2017), however, these communities also tend to be marked by a lack of resources and multiple adverse social determinants of health. Generalizations about any ethnic or cultural susceptibility with respect FASD are not empirically defensible. Higher rates have also been shown in other vulnerable populations, including both juvenile and adult criminal justice settings (subsequently discussed in more detail).

Current FASD prevalence estimates are thought to underrepresent true rates of the disability for several reasons. Many individuals with FASD present without observable physical features and develop compensatory skills that may mask underlying neurocognitive deficits (Astley, 2010; Cook et al., 2015). FASD has been coined an “invisible” disability for these reasons. There is currently limited capacity and expertise among clinicians and other professionals to recognize, screen, and undertake assessments and/or diagnosis for FASD (Clarren, Lutke, & Sherbuck, 2011; Fast & Conry, 2009; Institute of Health Economics, 2013). Traditionally, mothers have not been asked about their alcohol use during prenatal care or delivery, and confirmation of PAE can be difficult to ascertain due to informants’ reluctance to report alcohol use in pregnancy (e.g., Caprara, Nash, Greenbaum, Rovet, & Koren, 2007; Ernhart, Morrow-Tlucak, Sokol, & Martier, 1988). In addition, the current “gold standard” approach to diagnosis is expensive, with limited opportunities for publicly-funded evaluations, particularly in adults (Clarren & Lutke, 2008). Finally, there has been a historical reluctance on the part of clinicians to diagnose FASD owing to the associated stigma associated with the condition, coupled with the increasing clinical complexity presented by adults who were not diagnosed in childhood or adolescence.

Recent health economic analyses have suggested that FASD costs in Canada are high. A 2009 study reported the adjusted individual lifetime cost of FASD from birth to age 53 years to be \$21,642 [95% CI: \$19,842-24,041], translating to an annual total Canadian cost of \$5.3 billion [95% CI: \$4.1-\$6.4B] (Stade et al., 2009). A recent Canadian cost-of-illness study on FASD estimated that the national cost of FASD in 2013 ranged from \$1.3 to \$2.3 billion dollars (Popova, Lange, Burd, & Rehm, 2015). The three highest drivers of cost included: Productivity loss linked with high morbidity and premature mortality (\$532 million to \$1.2 billion), criminal justice system involvement (\$378.3 million), and health care utilization (\$128.5 to 226.3 million) (Popova et al., 2015). These costs are likely underestimates, given the lack of comprehensive FASD surveillance in Canada, and limited research on a variety of additional cost drivers, particularly in the adult and aging FASD population.

FASD in the Criminal Justice System

Among the numerous adverse outcomes experienced by individuals with FASD, overrepresentation in the criminal justice system is likely the most costly and impactful for individuals and society. Despite this, few studies have directly examined prevalence in correctional and forensic settings. In one of the earliest studies, Fast, Conry, and Looch (1999) found that 23.3% of adolescents admitted to a forensic inpatient assessment unit over a one-year period in British Columbia met diagnostic criteria for FASD. MacPherson, Chudley, and Grant (2011) reported that 10% of newly sentenced federal adult male offenders in a single institution over an 18-month period met diagnostic criteria for FASD. A further 15% met some of the diagnostic criteria, but were missing information critical to making a diagnosis. Most recently, Forrester and colleagues (2015) reported that 17% of federally incarcerated adult women in a single institution likely met diagnostic criteria for FASD, with a further 22% considered “uncertain” as a result of missing information required to make a diagnosis. However, this study was limited by a small sample size. Due to limited diagnostic availability and lack of expertise in both community and correctional settings, these estimates are thought to underestimate the true rates of FASD across legal settings (Burd, Fast, Conry, & Williams, 2010; Clarren et al., 2011; Fast et al., 1999). Indeed, Burd, Selfridge, Klug, and Juelson (2003) surveyed Canadian correctional institutions and found evidence of significant under-diagnosis and lack of screening capacity for FASD. Thus, understanding how many offenders in the correctional system have FASD remains an important question that will be critical in informing how to best address their needs.

In Yukon, there is limited empirical information to inform rates of FASD in adults, but in particular, among those involved in the criminal justice system. During the methodological development stage of this project, Fraser (2011) undertook a Yukon Corrections file review to ascertain the characteristics of offenders currently under legal supervision (both in custody and in the community serving territorial sentences of two years less one day). Findings indicated that only 2% ($n = 4$) of the sample had been diagnosed with FASD, while an additional 5% ($n = 8$) were suspected of having FASD. Data also indicated substantial rates of substance abuse (current and historical) but appeared to under identify the presence of mental health problems. Using an FASD screening tool to rank “risk” of having FASD based on correctional file data alone, Fraser (2011) concluded, conservatively, that as many as 22% of offenders were considered “at risk” for FASD. Findings suggested significant under recognition of FASD in this sample, and underscored the need for a structured evaluation of prevalence in this population.

In addition to FASD, rates of neurocognitive deficits and intellectual disability have been shown to be higher in offenders compared to the general population. Broadly, the international literature shows prevalence rates ranging from 10% to 30%, comprising offenders with a spectrum of severity of intellectual disability (Crocker, Cote, Toupin, & St-Onge, 2007; Hellenbach, Karatzias, & Brown, 2016; Lindsay, Haut, & Steptoe, 2011). Recently, the Correctional Service of Canada completed a study demonstrating that 25% of incoming male offenders to federal corrections presented

with cognitive deficits based on computerized screening (Stewart, Wilton, & Sapers, 2016). Research indicates that offenders with intellectual disability face increased risk with respect to recidivism and victimization, as well as higher and more complex physical and health needs (Hellenbach et al., 2016). It remains unclear whether research and practice guidance concerning offenders with intellectual disability can appropriately address the needs of offenders with FASD. Thus, while identifying the rate of FASD in Yukon Corrections is critical, it is equally important to identify the rate of offenders with neurocognitive deficits in the absence of PAE or a confirmed FASD diagnosis.

FASD Screening and Diagnosis in Correctional Settings

Identification of individuals with FASD in the criminal justice system is important for several reasons. First, offenders with FASD are thought to be significantly overrepresented in correctional and forensic settings. Second, the complex cognitive, emotional, and behavioural challenges experienced by many individuals with FASD may interfere with their ability to benefit from traditional correctional management and intervention approaches. This is further complicated by high rates of early life adversity and trauma, co-occurring mental health and substance abuse problems, and limited academic and vocational skills and/or success in independent living. Though empirical evidence is scarce, reports from clinicians and legal professionals suggest that offenders with FASD have difficulty complying with legal supervision orders, experience poor treatment response, and manifest higher recidivism rates, in part resulting from a failure to identify cognitive deficits and clinical needs, leading to a revolving door phenomenon in the criminal justice system (Fast & Conry, 2009; Gagnier, Moore, & Green, 2010; McLachlan, 2012; Roach & Bailey, 2009). However, at this juncture, there is insufficient evidence to inform how the treatment and management needs of offenders with FASD may differ from the general offending population. Understanding how many people in the Yukon criminal justice system may have FASD, along with characteristics about their cognitive and mental health functioning, will form an important first step in answering these critical questions.

Given the high resources and costs associated with comprehensive assessment, diagnosis, intervention, and management resources, it is necessary to first determine which offenders may benefit from a comprehensive assessment. FASD screening represents a critical first step in identifying individuals at risk, particularly given the challenges involved in undertaking an FASD assessment in the correctional environment. FASD screening has been identified as an important yet lacking service in the criminal justice system (Burd, Martsolf, & Juelson, 2004; Goh et al., 2008; Institute of Health Economics, 2013). Currently, no validated FASD screening tool exists for use in either general clinical or correctional settings. However, two instruments demonstrate promise, including the Asante FASD Screening and Referral Tool for Youth Probation Officers (AST, Conry & Asante, 2010), and the Brief Screening Checklist, a tool developed by the Correctional Service of Canada for use with adult offenders (BSC, MacPherson et al., 2011). Given the critical nature of FASD screening in correctional

settings, the current study sought to evaluate the validity and utility of these tools in a cohort of adult offenders in Yukon using a prospective design.

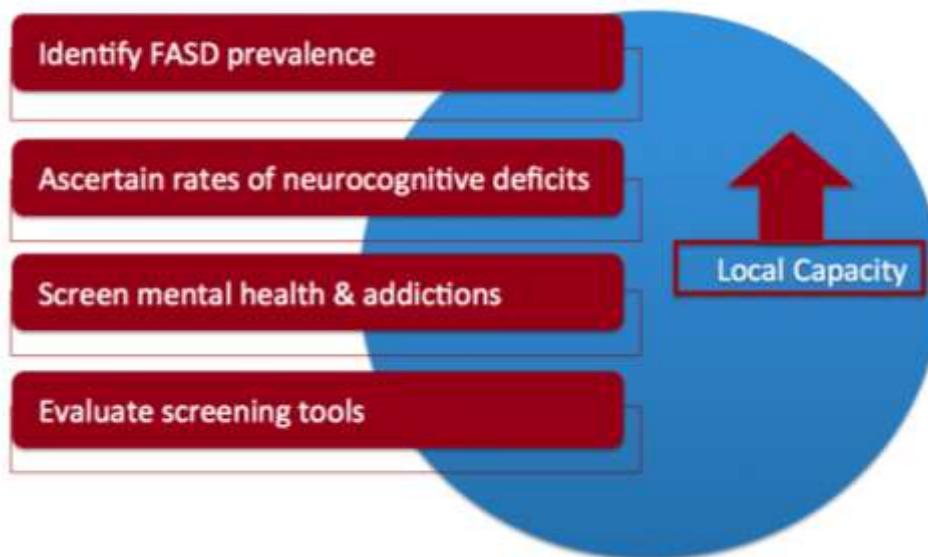
Mental Health and Substance Abuse Problems in Corrections

Growing evidence supports the high rate of mental health and substance use disorders in Canadian offenders (Beaudette, Power, & Stewart, 2015; Sapers, 2016). A substantial increase in the number of offenders with mental health problems has been observed over the past decade. The Correctional Service of Canada (2015) most recently reported that 27.6% of federally sentenced offenders had mental health needs (defined as having at least one mental health treatment-oriented service or stay in a treatment centre during the previous six months) and as many as 80% were identified to have substance use related problems. Recommendations made by Howard Sapers, the Federal Correctional Investigator, in his annual report (2016) continue to underscore the need for improved access to mental health care in Canadian Federal prisons. The same report encouraged Federal correctional administrators to develop best practices for the identification, diagnosis, treatment, and support of offenders with FASD. Further complicating matters, evidence highlights substantial overlap between FASD and other mental health problems, with rates of comorbidity as high as 90% (Famy, Streissguth, & Unis, 1998; O'Connor et al., 2002; Pei et al., 2011; Streissguth, Barr, Kogan, & Bookstein, 1996). Thus, the current study sought to examine rates of mental health problems and substance use problems reported in Yukon corrections.

The Current Study: Objectives and Aims

The overarching objective of this research was to estimate the prevalence of FASD, neurocognitive deficits, and mental health and substance use problems in the Yukon adult correctional population. The overall goal of this work was to better understand the prevalence and needs of adults with FASD and other health challenges to inform future service provision in the correctional context. In addition, we sought to assess the utility of FASD screening tools in the justice context in order to inform future service referral. We also intended to develop a research approach that could be adapted and implemented in other correctional jurisdictions in Canada. Lastly, it was critical that the resources used in this project also contributed to the development of increased local clinical and research capacity related to FASD in Yukon.

Figure 1. Research Objectives and Aims



Three specific research questions were investigated:

1. What is the prevalence of FASD among adult offenders in Yukon?
2. What are the rates of neurocognitive deficits, mental health, and substance abuse problems among offenders in the Yukon justice system?
3. Can FASD screening tools be used to identify offenders at risk of having FASD in Yukon corrections?

It was anticipated that findings from this research would provide critical information about the estimated prevalence of FASD in adult offenders in Yukon, as well as rates of

neurocognitive and health-related needs in both offenders with FASD, and in the broad offender population. In turn, this information can be used to develop appropriate policy responses and management plans to support the rehabilitation and needs of individuals with complex needs who are involved in the Yukon criminal justice system.

Method

Study Design

This study used a modified prospective case ascertainment design. As described, we sought to estimate rates of FASD in the correctional population in Yukon. In addition, we planned to assess the validity of FASD screening measures using a prospective design. Thus, we screened all individuals who consented to participate in the study, per specific eligibility and exclusion criteria. We subsequently undertook comprehensive clinical evaluations for neurocognitive functioning and FASD, and screened for mental health and substance use problems. The clinical team was blind to screening outcomes. The study took place over a 17-month period (May 2014 to September 2015) followed by six months of post-study support. Various features of the study design are outlined in detail in the section that follows.

Eligibility and Exclusion Criteria

Several eligibility and exclusion criteria were established for the present study. Criteria were chosen to ensure that findings would be both generalizable and relevant to the Yukon correctional jurisdiction, while also ensuring methodological rigor. Criteria were as follows:

Age. Individuals aged 18 to 40 years were eligible to participate. An upper age restriction was made for several reasons, and consistent with previous similar studies (Forrester et al., 2015; MacPherson et al., 2011). It is often more difficult to confirm PAE in older individuals. Mothers and relatives are often missing or deceased, and information tends to not be routinely recorded in medical records, particularly in older adults. Differential diagnosis¹ of older offenders can be complex, owing to the degree of competing neurological insults (e.g., excessive substance abuse, head injuries, etc.) observed in many older offenders (Chudley, Kilgour, Cranston, & Edwards, 2007). We estimated that the selected age band represented approximately two-thirds of the correctional population in Yukon based on an analysis of statistics for the five-year period leading up to data collection. While the decision to exclude older offenders represents a limitation to the generalizability of findings, it was considered necessary to maximize limited diagnostic resources and obtain reliable information about PAE.

Gender. Female offenders represent approximately 20% of the offending population in Yukon. Research examining the needs of female offenders has long established the need for gender specific study and programming owing to the unique needs of women in the justice system. Evidence also suggests that women's mental

¹ Differential diagnosis refers to the process of eliminating competition candidate conditions that could mimic or account for the physical and neurobehavioral deficits associated with prenatal alcohol exposure. Multiple syndromes have signs that overlap with diagnostic indicators of FASD, including genetic conditions. Additionally, mental health disorders and other insults to the brain (including head injuries and effects of long term alcohol and drug abuse) can also produce a neurobehavioral pattern of impairment that can complicate an FASD diagnosis.

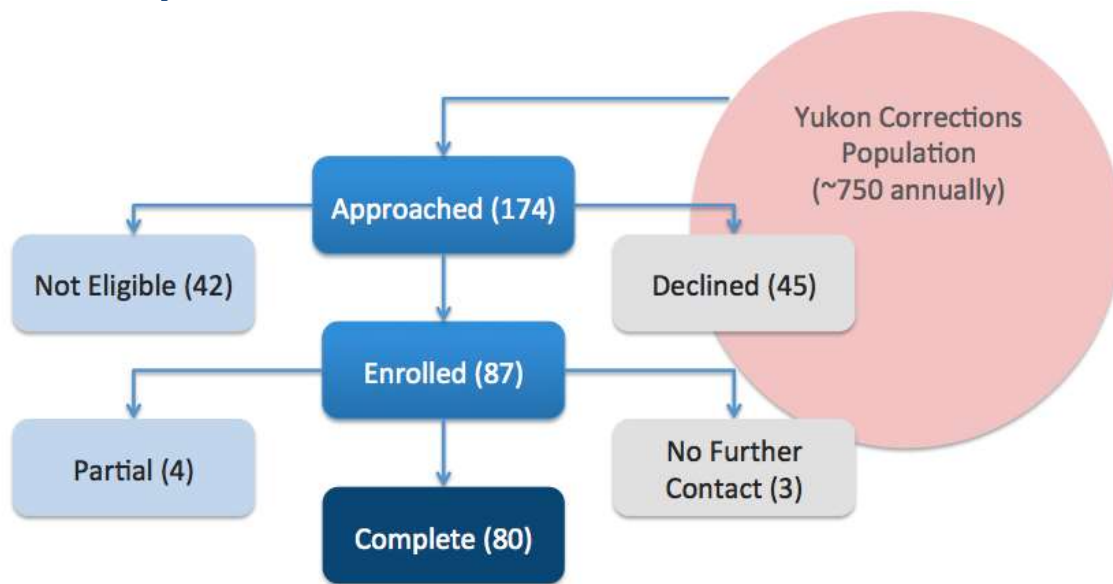
health needs differ from those of men (Derkzen, Booth, McConnell, & Taylor, 2012). Women were included in the current study in order to acquire descriptive information about their needs, despite statistical limitations inherent in a small subgroup.

Legal Status. Participants were required to be serving one of the following correctional supervision terms: bail, probation, or community wellness order; those in custody on either a remand order or as a result of sentencing. Legal supervision terms (e.g., bail, probation) were required to be at least 30 days to ensure participants were available to complete all aspects of the study. Offenders serving legal orders for other jurisdictions (e.g., other provinces or Federal terms) were not eligible, nor were offenders under the supervision of the Yukon Review Board (i.e., those found Not Criminally Responsible on Account of Mental Disorder or Unfit to Stand Trial). Individuals detained at WCC who were deemed psychiatrically or medically unstable, or, who posed a risk to the safety of the research team, were not eligible to participate.

Recruitment

Detailed information about study recruitment procedures follows in the Procedures section. In brief, participants were recruited from both community (e.g., Yukon Community Corrections) and correctional (e.g., WCC) settings. Figure 2 shows the number of participants approached and enrolled in the study. In total, the research team approached 174 prospective participants. From these, 42 individuals (24%) were deemed ineligible (primarily because they were over age 40), and 45 individuals (26%) declined. The primary reasons participants reported declining included: lack of interest, being released from custody, wanting a higher incentive for participation, and being unsure about their decision. A total of 87 participants were initially enrolled in the study, resulting in a 66% enrollment rate (based on eligible, approached prospective participants). This is consistent with several FASD-related studies conducted with offenders (e.g., MacPherson et al., 2011; McLachlan, Roesch, Viljoen, & Douglas, 2014). Of these, three individuals (3%) had no further contact following enrollment, and four (5%) did not complete enough assessment components to be evaluated for a diagnosis. Both subsets were excluded, resulting in a final sample of 80 individuals, and a 92% retention rate. A review of census data provided by the Yukon Department of Justice indicated that between 650 and 750 unique individuals were actively under the supervision of Yukon Corrections during the study recruitment period. As noted, roughly two-thirds (e.g., between 429 and 495) between the ages of 18 and 40. Based on these figures, we estimated that our final sample ($N = 80$) represented between 16% and 19% of the eligible annual correctional population.

Figure 2. Study Recruitment Procedures



Study Procedures

FASD Orientation Strategies

Staff Training. Staff training sessions were held with justice and corrections staff prior to study implementation, including probation officers, correctional officers, and case managers. Sessions were designed to increase staff awareness about FASD, including how to work more effectively with those diagnosed with the disability, and to provide an orientation to the study, including goals, procedures, and recruitment strategies. Sessions were held at intervals across participant recruitment to orient new staff and prevent drift with respect to recruitment guidelines. In keeping with the objective of increasing local FASD capacity, these sessions provided training and support to a range of justice personnel engaged in the daily care and support of offenders.

FASD Awareness Sessions. Multiple FASD awareness sessions were held for individuals both in the community and at WCC. The purpose of these sessions was two-fold. First, we provided general information about FASD in order to help prospective participants better understand the disorder and reduce stigma. Second, we provided an overview about the study in order to understand why they receiving an invitation to hear more about the research. Sessions were open for voluntary attendance.

Recruitment Plan

Recruitment strategies used for both community and custody settings were parallel and designed to ensure that all eligible prospective participants learned about the study, while protecting individual rights to confidentiality and anonymity.

Recruitment. All prospective participants who met eligibility criteria were invited to participate in the study. At WCC the study was advertised in several ways, including open invitation FASD Awareness Sessions; posting of recruitment flyers; or, being approached by a WCC staff member for permission to be contacted by the study team to protect confidentiality. Prospective participants at WCC were not approached about the research within the first two weeks of admission in order to ensure that they had sufficient time to stabilize (e.g., free from substances) and that they had adjusted to institutional routines. Similarly, at the community probation office, individuals attending for a meeting with a bail or probation officer had the opportunity to attend FASD Awareness Sessions; view recruitment flyers; and/or be approached by a staff member for permission to be contacted by the study team.

Attrition Reduction Strategies. Recognizing the challenges often faced by individuals with FASD, several support strategies were put into place to assist participants in attending scheduled study meetings. These included working with the individual's support team to schedule appointments, providing transportation reimbursement and assistance scheduling transit options to and from meetings, and making frequent reminder phone calls. Participants were offered snacks, drinks, and/or a meal to ensure that they could comfortably engage in study visits. Participants were contacted between study appointments with reminders about upcoming visits. Frequent breaks were offered during study sessions, and multiple short sessions were offered for individuals who had difficulty participating in longer meetings. Participant contact information was reviewed frequently to prevent attrition via loss of contact.

Ethical Considerations

All study procedures were reviewed and approved by the Clinical Research Ethics Board at the University of British Columbia, and were consistent with prevailing standards and guidelines.

Informed Consent. Prospective participants met with a research assistant during an initial meeting to review key aspects of the study and elements of informed consent. Given the known burden of neurocognitive deficits present for individuals with FASD, several procedures were developed to support optimal understanding and appreciation of the informed consent process. Prospective participants were offered an opportunity to consult with a trusted advocate or Elder prior to agreeing to participate in the research, or to have a support person attend the initial study enrolment meeting. They were provided with a written copy of study consent forms, and the research assistant read the consent form verbatim. The study information sheet, informed

consent sheet, and study information and consent script were written in accessible language, and divided into sections to reduce cognitive and reading burden.

Study personnel were trained to review each element of the informed consent process in one section at a time, item by item, to maximize participant understanding. They checked for comprehension frequently, and asked prospective participants to paraphrase key informed consent elements to gauge understanding. Where understanding appeared unclear, further explanation was provided, and then comprehension was reassessed. This process was repeated for each element of the informed consent process, until optimal understanding was reached. Participants were offered an opportunity to ask questions throughout the informed consent procedure to maximize understanding. This resulted, at times, in lengthy informed consent sessions, and it was not unusual to complete only this portion of the study during a meeting.

Participants at WCC were informed that owing to the characteristics of a correctional institution, Correctional Officers and other staff members may be aware of scheduled visits by the research team, thereby leading to a loss of anonymity/freedom from being identified as a participant in research. Those who consented to participate agreed to this limitation and completed a modified consent form outlining this caveat.

Potential Benefits and Harms. Benefits and potential harms that could result from participation in the study were clearly explained to participants during the study enrolment session and informed consent procedure. Possible benefits of their participation included contributing to the body of knowledge and prevalence rates of FASD in justice settings, as well as the health needs of offenders in Yukon. Participants received individualized clinical feedback (both verbal and written) about their current functioning (cognitive, mental health, substance use), including a diagnosis of FASD where appropriate. They were advised that they could choose to share this information with current and future service providers, and given the opportunity to place their final assessment report on file with the Yukon Corrections Branch to support their supervision.

Risks of participating in the current study included the possibility of emotional distress resulting from talking about past adverse experiences or the possibility of an FASD diagnosis, and possible harm to familial relationships as a result of learning about PAE for the first time. The possibility that a prospective participant may feel labeled or experience stigma following a diagnosis of FASD was also communicated. The research team spent time explaining the meaning of an FASD diagnosis, and the importance of considering functional strengths in addition to limitations, to assist in mitigating these feelings. Study personnel were available to assist participants in accessing necessary supports in instances where they felt that it would be helpful to have another person to speak with about their participation in the study (e.g., Elders, family members, case workers, or mental health staff through Yukon Justice).

Release of Records. Participants provided consent to access several types of records for the purposes of obtaining information about PAE, including correctional records, medical records from birth, child welfare records, education records in cases where an individual was assessed for FASD or other developmental difficulties in the school system, and records from any additional assessments undertaken to evaluate mental health or developmental conditions (such as a previous psychological or cognitive assessment). In circumstances where records contained third party information, potentially identifying information was redacted. In circumstances where a participant's birth mother engaged in the research as a collateral informant, she was asked to consent to the release of maternal records potentially related to the participant's PAE status (e.g., birth records, maternal delivery records, etc.).

Maintenance of Study Records and Confidential Data. Several record keeping protocols governed the maintenance and storage of confidential study records. Data was immediately stripped of identifying information and coded with a unique participant identification number. Study data was stored separately from identifying records (e.g., consent forms). Records were stored in a secure cabinet in a secure office within the Yukon Department of Justice during the data collection phase of the study. Training and procedures were put into place to ensure that only members of the research team would be able to access this information. Following completion of each assessment, de-identified study data was securely couriered to the University of British Columbia where it was stored in a secured cabinet within a secured office. Raw data will be maintained for five years following dissemination of the study results in keeping with ethical guidelines. De-identified data was entered into a secure database and maintained on a secure server at the University of British Columbia.

Research and Clinical Team Training

As outlined, it was considered an important study objective to recruit and train local Yukon clinicians to increase local FASD capacity. In keeping with the Canadian FASD Diagnostic Guidelines (Chudley et al., 2005) and best practice standards for FASD assessment and diagnosis, the clinical team included a physician, psychologist, and a clinical coordinator. All medical evaluations were undertaken by a single physician. A team comprising registered psychologists and psychology learners completed the psychological assessments under supervision and with oversight. Clinical coordinators provided support to the diagnostic team, undertaking medical interviews with participants, as well as collateral interviews with birth mothers and collateral informants. All members of the clinical team underwent substantial training prior to beginning the study. This included a multi-day workshop led by interdisciplinary experts in FASD clinical practice and research, overseen by the principle investigator. They each completed training online provided by the University of Washington focused on FASD assessment and the four-digit diagnostic code. All clinical study personnel also underwent extensive training in key research principles (e.g., confidentiality, data recording, etc.) and on all elements of the research protocol. In order to ensure the psychological assessment portion of the diagnostic process was conducted in keeping with study psychological procedures, an expert clinical neuropsychologist in the area of

FASD provided supervision and oversight for the duration of the study. In addition, two physician-researchers and an expert clinical neuropsychologist with significant expertise in FASD assessment and diagnosis among adults, including those involved in the justice system, participated in early diagnostic case conferences to provide clinical guidance to the newly formed assessment team. They were subsequently available for consultation when challenging clinical issues arose with respect to FASD diagnosis.

Participant Assessment Procedures

Following consent and study enrolment, participants underwent a series of assessment procedures, consistent with the Canadian FASD Diagnostic Guidelines (Chudley et al., 2005). For a review of measures comprising each stage of the assessment process, please refer to the Measures section of this report.

Figure 3. Study Design



FASD Screening. FASD screening tools were completed by participants during their initial study visit (BSC), as well as by a probation office or WCC case manager (AST). The AST was completed for participants following the informed consent procedure, which included advising each participant that either their probation officer or WCC case manager would be asked to rate the tools. The clinical team was kept blind to FASD screening outcomes for the duration of the study.

Medical and Psychosocial Assessment. After completing the BSC, the Clinical Coordinator completed a structured medical history interview. Pertinent medical and psychological records were also requested with participant consent during this meeting, and participants were asked to provide contact information for their birth mother and/or collateral informants for the purposes of confirming or ruling out PAE. The clinical coordinator took three digital photographs of the participant's face to measure aspects

of the FASD facial phenotype (palpebral fissure lengths; philtrum depth, lip fullness). Next, the study physician completed a physical exam comprising measurement of growth indicators (height, weight, head circumference), basic testing of neurological functioning (fine and gross motor, reflexes, etc.), and general physical health. In the case where medical or mental health concerns arose (e.g., dental or vision problems) the physician made appropriate referrals for follow-up evaluation and/or treatment, as appropriate.

Neurocognitive and Psychological Assessment. Following the medical evaluation, participants underwent a comprehensive standardized battery of neurocognitive and psychological tests. Participants completed the test battery, on average, across between two and four sessions, lasting 8 to 12 hours in total. Prior to test administration, the psychologist conducted a brief structured interview to build rapport and evaluate factors that could impact test interpretation. To ensure that participants provided their best effort during testing, they were offered frequent breaks, and the option to switch tasks when necessary. Academic skills were evaluated prior to questionnaire completion to ensure that participants held the necessary reading skills to understand and answer questions. Where necessary, audiotaped versions of the questionnaires were used to support valid administration.

Following testing, the psychologist scored and interpreted all test findings, and rated each of eight brain areas assessed, in accordance with the Canadian Diagnostic Guidelines (Chudley et al., 2005). Brain areas were assessed by providing an overall clinical ranking: zero = no evidence of impairment; one = evidence of mild to moderate impairment; two = evidence of significant impairment. The Canadian Diagnostic Guidelines specify that a ranking of two can be given in each of the following cases: (a) Scores are 2 standard deviations or more below the mean; (b) There is a discrepancy of at least 1 standard deviation between subdomains; (c) there is a discrepancy of at least 1.5– to 2 standard deviations among subtests on a measure, taking into account the reliability of the specific measure and normal variability in the population.

Table 1. Brain Areas Assessed during FASD Evaluation

2005 Canadian Diagnostic Guidelines: CNS Areas Assessed	
Hard and Soft Neurologic Signs	Brain Structure
Cognition	Communication
Academic Achievement	Attention Deficit/Hyperactivity
Executive Functioning/Abstract Reasoning	Adaptive behaviour, social skills, social communication
Memory	

CNS: Central Nervous System

The study psychologist used a similar impairment rating scale to summarize the presence of problems related to mental health or substance use, with “0” indicating low risk (within average range/normal limits on test findings and no/limited history of problems; “1” indicating mild/moderate risk for problems (scores fall between 1-2 standard deviations above normal limits on instruments and there is some indication of

past/current problems evident from interview and file review), and “2” indicating serious risk for mental health or substance abuse problems (scores on instruments fall at or above 2 standard deviations above normal limits and/or there is indication of serious problems during interview/file review). When concerns regarding a participant’s mental health or substance use emerged, appropriate referrals were made.

Maternal and Collateral Interviews. Following enrolment, participants were asked for consent to contact their birth mother, if possible (e.g., if she was alive, in contact with the participant with known whereabouts). Prior to obtaining consent, participants were directed to contact their mother and discuss in advance his or her participation in the study, as well as to ask for her permission to be contacted by a member of the research team. In cases where the birth mother declined to be contacted, this aspect of the study was not pursued and alternative measures were used to confirm/rule out PAE. In cases where mothers agreed to be contacted a research assistant followed up by telephone with an invitation to participate. Mothers who provided consent completed a 30-minute interview with the clinical coordinator about child behavior, history, and exposure to substances prenatally, including alcohol.

The maternal interview protocol followed guidelines developed by the Correctional Service of Canada following extensive research and focus groups with mothers aimed at producing a sensitive approach to eliciting this information from women. Broadly, the approach included the development of a semi-structured interview (Maternal Interview Guide), and the maternal version of the BSC using a women-centred approach. This included the use of a flexible and self-directed format, and principles of motivational interviewing. Efforts to ensure that interviews were conducted in an environment in which mothers felt secure and supported were undertaken. This included offering women choice with respect to where and how they preferred to complete the interview (e.g., by phone, choice of location), or scheduling the interview for a time when a support person was available to be present. Provisions were made to ensure that the Study Coordinator could assist mothers in connecting with local resources if she indicated any distress as a result of her study participation. All mothers had the option of receiving an FASD resource kit sent to them following their participation. Mothers were also offered a \$10 gift card for a local service such as a coffee shop to thank them for their participation in the research.

Procedures parallel to those described from birth mothers were followed in instances where collateral informants were available to be interviewed about PAE. Following informed consent, collateral informants were invited to complete the BSC (collateral version) either in person or by telephone with the study coordinator. Collateral informants were offered a \$10 gift card to thank them for their participation, and offered the option to receive an FASD resource kit in the mail.

FASD Diagnosis. This study adhered to diagnostic guidelines established in 2005 for Canada (Chudley et al., 2005). Diagnoses under the FASD umbrella are summarized in Table 2 (e.g., FASD, pFAS, ARND). In addition, the Washington FAS DPN four-digit code (Astley, 2004) was used to rate the severity of diagnostic features

associated with FASD, including growth restriction, dysmorphic facial features, impaired central nervous system (CNS) functioning, and PAE. Rankings were made on a four-point Likert scale ranging from absent to severe. Diagnostic tools and assessment measures selected for the present study were supported by both the Canadian Guidelines (Chudley et al., 2005) and the consensus guidelines on the use of psychometric tools for evaluating individuals with FASD (Canada Northwest Research Network, 2007). Diagnostic decisions were made following an interdisciplinary case conference wherein each member of the clinical team summarized information collected over the course of the study. During this time, the study team made a decision about the participant's diagnostic status with regard to FASD, as well as any relevant recommendations.

Diagnostic Feedback & Debriefing. Each participant received a summary report detailing findings from the clinical evaluation, including any FASD diagnosis, with a focus on identifying individual strengths and difficulties, and related recommendations. The report was prepared by all members of the clinical team, and written in lay language accessible to participants. Feedback sessions were offered to each participant, wherein a study psychologist provided clinical feedback during individual meetings. The study physician also attended when a diagnosis of FASD was given, or when follow-up regarding outstanding medical concerns was required. Participants were given a list of local resources, including FASD services in Yukon, and were invited to connect with the Post Study Coordinator should they wish to receive further assistance following their participation.

Table 2. Canadian Diagnostic Guidelines for FASD

	Growth	Face	CNS	PAE
FAS	At least one: - Birth weight/length $\leq 10^{\text{th}}$ % for GA - Height/weight $\leq 10^{\text{th}}$ % for age - Disproportionately low weight-height ratio (= 10^{th} %)	Simultaneous presentation of 3: - Short palpebral fissures (≥ 2 SD below mean) - Smooth philtrum (rank 4 or 5) - Thin upper lip (rank 4 or 5)	Impairment in ≥ 3 CNS domains	Confirmed or unconfirmed PAE
pFAS	-	Simultaneous presentation of 2 features	Impairment in ≥ 3 CNS domains	Confirmed PAE
ARND	-	-	Impairment in ≥ 3 CNS domains	Confirmed PAE

FAS: Fetal Alcohol Syndrome; pFAS: partial Fetal Alcohol Syndrome; ARND: Alcohol Related Neurodevelopmental Disability; GA: Gestational Age

Post Study Support. Feedback from stakeholders throughout the planning stage of this research echoed the need for additional supports for participants who

received a diagnosis of FASD through the study. Yukon is a jurisdiction with unique service needs owing to the sometimes-scarce availability of treatment resources and high levels of morbidity and mortality (Goldner, 2006). As such, a Post Study Coordinator, who was a member of the study research team, was available to all participants during their involvement in the research. The Post Study Coordinator remained available to all participants for six months following the completion of data collection. The Post Study Coordinator did not provide direct service, but was available to assist individuals who had completed the study who needed further supports connecting with recommended resources, wished to obtain another copy of their report, or asked for clarification about their diagnostic findings (e.g., system navigation).

Study Measures

FASD Screening Tools

Asante FASD Screening and Referral Form (AST, Conry, & Asante, 2010). The Asante FASD Screening Tool (AST) was developed for use by probation officers as a screening and referral tool to help identify offenders who may benefit from an FASD assessment. The AST is a brief checklist consisting of five social factors and five personal factors that are rated as “present” or “absent.” The tool also comprises a decision tree that indicates when evaluatees should be referred for diagnostic assessments. The screening tool requires between 10 to 15 minutes to complete. The AST has not been prospectively validated for youth or adult offenders. However, preliminary evaluation of the tool using a one-day snapshot and retrospective methods indicated promising sensitivity and specificity (Conry & Lane, 2009). The AST was also recognized as a promising screening instrument by the Canadian Association of Pediatric Health Centres. In the current study, the AST was completed for each participant by either a probation officer or case manager following study enrolment. Respondents completed a full day training session offered by a member of the AST development team and the Principal Investigator, and were provided support throughout the study.

Brief Screening Checklist. The Brief Screening Checklist (BSC, MacPherson et al., 2011) is a screening tool developed to identify adult offenders in correctional settings who may be at risk for FASD. Three versions were developed, including one for the individual undergoing screening (BSC-Participant Version), a second for birth mothers along (BSC-Maternal Version), and a third for additional collateral informants (BSC-Collateral). In the original version, the BSC included 48 items across three sections: 28 Behavioral Indicators, 9 Historical Indicators, and 11 Maternal Indicators gauging exposure to alcohol and other substances prenatally. Behavioral items were rated on a five point Likert scale from 1 (strongly disagree) to 5 (strongly agree). Psychometric evaluation of the BSC during validation suggested that there may be merit in reducing the total number of Historical items from 28 to 26, and, collapsing response options from a 5-point Likert scale to a “present/absent” dichotomous rating format. In the current study, the original 48-item version of the BSC was administered to confirm psychometric properties of both the original and modified versions. Research evaluating

the psychometric properties of the BSC during the development stage indicated good classification accuracy (86.0%) using pre-determined cut-offs on each of the scales. Sensitivity (78%), specificity (85%), positive predictive (41%) and negative predictive (97%) values were all strong (MacPherson et al., 2011).

Medical and Physiological Assessments

Medical Intake Interview. The Correctional Service of Canada (MacPherson et al., 2011; Forrester et al., 2015) developed a medical intake interview for use in FASD research during studies conducted in federal institutions with male and female offenders. The interview includes questions about general physical and mental health, and family/social history, pertinent to an FASD assessment. The Medical Intake Interview was used in this study, with minor modifications. On average, it required between 15 and 20 minutes to complete.

FAS Facial Photographic Analysis Software (Astley, 2012). This software is designed to measure the magnitude of expression of the three key diagnostic facial features of FAS (short palpebral fissure lengths, smooth philtrum, and thin upper lip) and rank these following the 4-Digit Diagnostic Code. Three digital photographs (frontal view, 3/4 view, and lateral view) were taken and uploaded into the software program. Users then measured the three facial features using image analysis tools and documented the presence of other facial anomalies. From this information, the software automatically computed the 4-Digit Facial ABC-Score, and the 4-Digit Facial Rank. The software stored all photo analysis information in an ACCESS database. Facial photographic analysis required approximately 10 minutes to complete and features were analyzed using Canadian normative data. Studies comparing traditional manual measurement approaches and the FAS Facial Photographic Analysis software have demonstrated that the photographic technique yields either comparable or higher accuracy (Astley, 2004, 2012; Astley & Clarren, 2001; Astley, Stachowiak, Clarren, & Clausen, 2002).

Neurocognitive and Psychological Measures

Several criteria were used to select neurocognitive and psychological measures (see Appendix A), with a prioritization on sound psychometric properties, the availability of Canadian normative data, consensus guidelines on use of psychometric tools for evaluating individuals with FASD, and the Canadian diagnostic guidelines (Chudley et al., 2005). Where possible, we also selected measures that would facilitate comparison between samples from previous FASD correctional research.

Wechsler Adult Intelligence Scale – Fourth Edition (WAIS-IV, Wechsler, 2008). The WAIS-IV is a measure of general cognitive ability for adults (ages 16-69) comprising ten core and five supplementary subtests. The WAIS-IV yields four index scores: Verbal Comprehension, Working Memory, Perceptual Reasoning, and Processing Speed, providing clinicians with an assessment of broad abilities in each area. Canadian norms were used in the current study. Average administration time for

the ten core subtests was approximately one hour. Additional subtests were administered for cases requiring substitution.

Wechsler Memory Scale – Fourth Edition (WMS-IV, Wechsler, 2009). The WMS-IV is a measure of verbal learning and memory for older adolescents and adults (Ages 16 - 90). Four WMS-IV subtests were administered: Logical Memory (I and II) measures short and delayed verbal memory in a semantic context. Designs (I and II) measures short and delayed visual memory. Subtest administration occurred over a 40-minute span, though other measures were completed during delay intervals. Canadian norms were used.

Wide Range Test of Achievement – Fourth Edition (WRAT-4, Wilkinson & Robertson, 2006). The WRAT-4 is a brief measure of academic skill, including math computation, reading comprehension, and spelling. It can be administered with individuals ages 5 to 94 years and required 35 to 45 minutes to administer.

California Verbal Learning Test – Second edition (CVLT-II, Delis, Kramer, Kaplan, & Ober, 2000). The CVLT-II is an individually administered measure of strategies and processes involved in learning and remembering verbal information. It can be used with examinees ages 16 to 89 years. The instrument consists of five immediate free recall trials, short delay free and cued recall trials, and long delay free, cued recall, recognition, and forced-choice recognition trials. The instrument was administered over approximately 45 minutes comprising delay intervals.

Rey Osterrieth Complex Figure Test (RCFT, Meyers & Meyers, 1995). The RCFT is a measure of constructional abilities and nonverbal memory assessed over both short and delayed recall intervals. Administration occurred over approximately 45 minutes.

Delis Kaplan Executive Function System (DKEFS, Delis, Kaplan, & Kramer, 2001). The DKEFS is a battery of measures designed to assess aspects of executive functioning. Five subtests were administered: The Trail Making test assesses flexibility of thinking on a visuo-motor task, including visual scanning, number sequencing, letter sequencing, number-letter switching, and motor speed; the Verbal Fluency test assesses fluent productivity in the verbal domain; the Design Fluency test assesses fluent productivity in the spatial domain; the Color-Word Interference test assesses verbal inhibition; and the Sorting test assesses problem solving, verbal and spatial concept formation, and flexibility of thinking on a conceptual task. Administration time for selected subtests ranged from 25 to 50 minutes.

Conners' Continuous Performance Test – II (CPT-II, Conners, 2004). The CPT-II is a computerized assessment tool used to assess sustained auditory attention. Examinees press the space bar or click the mouse button when any letter except the target letter 'X' appears. White letters appear on a black screen at varying Inter-Stimulus Intervals (ISIs) of 1, 2, and 4 seconds with a display time of 250 milliseconds. There are

six blocks, with three sub-blocks, each containing 20-letter presentations. The order of ISIs presentation varies between blocks. The CPT-II took 14 minutes to complete.

Adaptive Behavior Assessment System – Second Edition (ABAS-II, Harrison & Oakland, 2003). The ABAS-II is a norm-referenced measure of adaptive behavior for assessing individuals from infancy to age 89. Respondents rate the behavioral frequency of various skills, using a 4-point scale, grouped together into skill areas and domains. Scores include the General Adaptive Composite (GAC), three domain scores (Conceptual, Social, and Practical), and scores for nine skill areas. Each skill area contains at least 20 items. Participants completed the self-report version of the ABAS-II, assessing their own perceptions regarding day-to-day functioning. Administration time ranged from 15 to 20 minutes.

Adolescent/Adult Sensory Profile (ASP, Brown & Dunn, 2002). The ASP is a 60-item self-report inventory that aids in the self-assessment of behavioral responses to everyday sensory experiences. Scores are provided for four functional quadrants across six major areas: taste/smell; movement; visual; touch; activity level; and auditory processing. Administration time ranged from 10 to 15 minutes.

Advanced Clinical Solutions for WAIS-IV and WMS-IV (ACS, Pearson Assessment, 2009). The ACS is an individually administered array of tasks and procedures that enhance the clinical utility of the WAIS-IV and the WMS-IV. Specifically, the ACS consists of several tasks, procedures, and scores that yield additional information on the processes underlying performance on the two measures including effort. The Word-Choice subtest, administered during this study, took approximately five minutes to administer and provides information on chance performance by an examinee.

Word Memory Test. The Word Memory Test (WMT, Green, 2003) is a computerized test that assesses effort and simulation in the context of verbal and nonverbal memory testing. Participants were asked to remember a list of words and reproduce those words across several recall contexts. Completion time ranged from 10 to 15 minutes.

Mental Health and Substance Abuse Screening Measures

Jail Screening Assessment Tool (JSAT, Nicholls, Roesch, R, Olley, & Hemphill, 2005). The JSAT is a semi-structured interview guide intended to aid in the identification of mental disorder and risk for suicide, self-harm, violence, and victimization, among individuals during admission to jails and pretrial facilities. The interview canvasses demographics, current charges/legal status, criminal history, social circumstances (e.g., family support, housing, finances), past and present substance use and treatment, past and present mental health status/treatment, suicide, violence, history of self-harm, and current suicidal ideation and intent. Current mental state is also evaluated using the Brief Psychiatric Rating Scale-Expanded (BPRS-E; Lukoff, Nuechterlein, & Ventura, 1986, see below). On the basis of a file review and a 10 to 20-

minute interview, the mental health screener uses structured professional judgment to identify inmates who require a referral for mental health services and/or specialized placement.

Brief Psychiatric Rating Scale –Expanded (BPRS-E; Lukoff et al., 1986). The BPRS is a rating scale designed to assess the severity of specific psychopathological symptoms. The BPRS-E consists of 24 symptoms and uses a 7-point rating scale (1 = the absence of symptoms, 2 to 3 = a non-pathological intensity of symptoms, 4-7 = pathology). Items 1 to 10 and 19-22 are rated based on self-report based on the last two weeks. Items 11-18, 23, and 24 are rated based on observed behavior and speech during the interview.

Personality Assessment Inventory (PAI, Morey, 2007). The PAI is a 344-item, multi-scale, self-administered inventory of adult personality and psychopathology. Although not developed specifically for use with offender populations, the PAI has a low required reading level (i.e., fourth grade) and is relatively brief, making it a useful tool in this population. Administration time ranged from 50 to 60 minutes, with some cases using the standardized audio recording. The PAI consists of 22 non-overlapping scales.

Substance Abuse Subtle Screening Inventory-3 (SASSI-3, Miller & Lazowski, 1999). The SASSI-3 is a self-report measure designed to assist in the identification of substance use disorder risk. The tool comprises both face valid and indirect items related to alcohol and drug use. Items are rated using a four-point Likert scale, and a dichotomous “true/false” format. In the current study, participants were asked to report on the past six months. Administration time was approximately 15 minutes.

Analytic Approach

Descriptive characteristics are presented by group (FASD, Deferred, Not Diagnosed) except in cases where low cell counts could compromise participant confidentiality. Between-group comparisons on descriptive characteristics, including diagnostic findings, were analyzed using chi-square analyses (for categorical data across diagnostic groups), independent sample *t*-tests for continuous data in two-group comparisons (e.g., exploratory gender analyses), and ANOVA for continuous dependent variables. Effect sizes were calculated for all inferential analyses, including Cohen’s *d* for *t*-tests, the phi coefficient (ϕ) for chi-square analyses, partial eta squared (η^2_p) for the F-statistic. An effect size provides a measure of the magnitude of differences between groups. Cohen’s *d* values range from .2 (small), to .5 (medium), to .8 and above (large). Phi values range from .1 (small) to .3 (medium) to .5 and above (large). Partial eta squared values range from .02 (small) to .13 (medium) to .26 and above (large) (Cohen, 1988). Analyses were conducted using IBM SPSS version 24.0 for Mac.

Receiver operating characteristic (ROC) analyses were conducted to assess the psychometric properties of the BSC (Hanley & McNeil, 1982; Mossman, 1994; Rice & Harris, 2005). ROC analyses yield an area under the curve (AUC) value. AUC values range from 0 to 1, with a value of .5 indicating a probability at chance. Thus, in

estimating the predictive accuracy of the BSC in correctly classifying participants in either the FASD or Not Diagnosed groups, an AUC value above .5 would indicate classification accuracy greater than chance, with a value of .99 indicating near perfect accuracy (Conroy & Murrie, 2007; Mossman, 1994; Rice & Harris, 1995). By convention, AUC values of .56, .64, and .71 correspond with small, medium, and large effect sizes, respectively (Rice & Harris, 2005). Additional indicators of screening tool accuracy were calculated, including sensitivity (probability that a test result will be positive when the disease is present, true positive), specificity (probability that a test result will be negative when the disease is not present, true negative), positive predictive value (PPV, probability that the disease is present when the test is positive), and negative predictive value (NPV, probability that the disease is not present when the test is negative). Statistical analyses for these indicators were calculated using MedCalc Version 15.1 for Windows.

Sample Size. Power calculations were undertaken to identify optimal sampling ranges for the current study. Previous research identifying prevalence rates for FASD in justice contexts ranged from 10 to 23%, but could have been higher with confirmation of prenatal alcohol exposure in more cases (Fast et al., 1999; Forrester et al., 2015; MacPherson et al., 2011). Several studies conducted in rural communities in northern British Columbia and Yukon identified higher rates of FASD in small samples, with estimates ranging from 25 per 1,000 to 46 per 1,000 (Asante & Nelms-Maztke, 1985; Popova et al., 2017; Robinson, Conry, & Conry, 1987). In Whitehorse, pediatric clinics evaluating preschool and school-aged children for FASD have diagnosed between 27% to 43% of referred children, however, the referral process inevitably biases these estimates. Anecdotal estimates gathered from local stakeholders ranged widely (20% to 80%). Fraser's (2011) retrospective file review in Yukon Corrections suggested that 22% of individuals were considered "at risk" of having FASD using the AST. Taking these figures into consideration, we made a conservative *a priori* estimate of approximately 20% prevalence to inform power calculations.

Power calculations² using traditionally conservative parameters for precision (.5) and power (.95) in a finite population of approximately 500 individuals with an estimated prevalence of .20 suggests a sample size of 166 individuals would be required (Daniel, 1999; Naing, Winn, & Rusli, 2006). However, practical limitations, including timeline, funding, and access to diagnostic personnel rendered this sample size impractical. Adjusting the desired precision from .5 to .8 resulted in a target sample size of approximately 81 individuals, using a finite population correction (95% confidence interval). This target sample size was thought to reflect a balance between practical limitations of conducting diagnostic research in the real world, and maintaining the statistical rigor required to obtain a sufficiently reliable prevalence estimate in the current population.

² Formula used to calculate desired sample size (see Daniel, 1999; Naing et al., 2006).

$$n' = \frac{NZ^2P(1-P)}{d^2(N-1) + Z^2P(1-P)}$$

Results

Diagnostic Assessments, Feedback Reports, and Participant Support

In total, 80 participants completed the complete diagnostic process (assessment and diagnostic case conferences). Participants were invited to return for a feedback session and were offered an individualized feedback report. In total, 80% of the sample ($n = 60$) opted to participate in feedback sessions. As reported, 30% of the sample ($n = 24$) opted to engage in post-study support. Activities included assisting participants with system navigation and study related services, such as additional follow-up meetings regarding study participation and feedback, provision of additional copies of the study report, facilitating referrals for medical or mental health support services, and connecting participants with various local agencies responsible for housing and employment supports. Several participants required assistance with more than one form of support. Participants were also afforded an opportunity to share their report, with their consent, with a staff person at Yukon Corrections (e.g., probation officer or WCC case manager). In total 29% of participants opted to do so ($n = 22$).

Participant Characteristics

Characteristics of the final sample ($n = 80$) are described in Table 3. Descriptive characteristics are presented for the entire sample, with subsequent analyses focusing on group differences. Most the sample was initially recruited at WCC. However, there is a high level of mobility between custodial and community-supervised settings (e.g., most WCC stays are relatively brief). Several participants began the study while at WCC or on a probation order in the community, but transitioned from or to WCC during their participation in the research. Given the high number of incarcerated offenders comprising the sample, findings likely best generalize to individuals who have been, or may become, incarcerated in Yukon. The average age of the sample was approximately 30 years. The sample was 85% male and 77.5% of participants identified as Indigenous. The current sample was considered representative with respect to the overall correctional population at WCC over an 18-month period that overlapped the study recruitment period (Table 3). All participants identified English as their first and preferred language, and all reported being educated in the English language.

Table 3. Participant Characteristics

	<i>n</i> (%)	WCC % (range)
Age (19-40, <i>M</i> , <i>SD</i>)	29.38 (5.34)	
19-26	26 (32.5%)	54% (19-24)
27-34	42 (52.5%)	
35-40	12 (15.0%)	32% (25-49)
Gender (% male)	68 (85.0%)	85%
Ethnicity		
Indigenous	62 (77.5%)	71%
Caucasian	18 (22.5%)	29%
ESL (% yes)	0 (0.0%)	
Marital Status (% single)	53 (66.3%)	
Recruitment Status		
Custody	70 (87.5%)	
Community	10 (12.5%)	
Legal Status		
Pre-adjudication	51 (63.7%)	
Post-adjudication	29 (36.3%)	

WCC: Whitehorse Correctional Centre; ESL: English as a Second Language

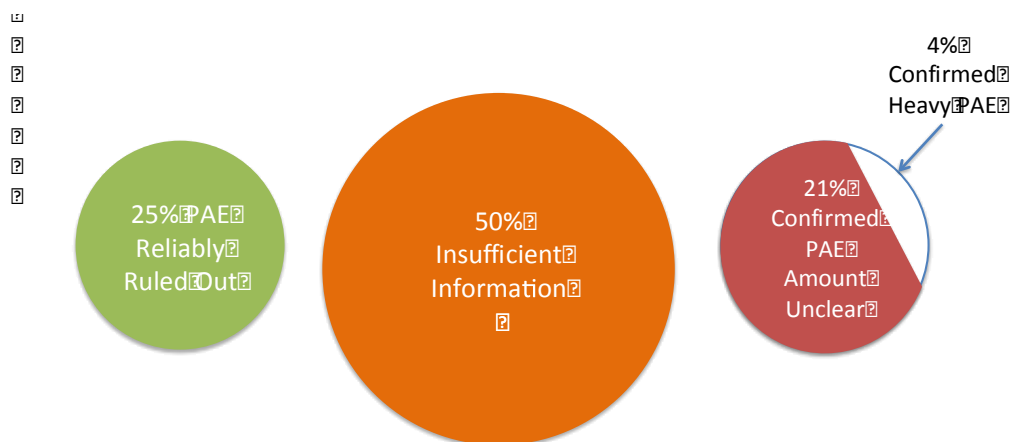
Note. Participants were classified as “pre-adjudication” if they had any open/unresolved criminal legal matter before the courts. Indigenous participants included those who reported their cultural or ethnic identity as First Nation, Métis, or Inuit.

Confirmation of Prenatal Alcohol Exposure

As described, the clinical team used a variety of methods to obtain information about possible PAE, including record review, collateral interviews, and participant self-report. Findings are outlined in Figure 4. In total, the clinical team determined that sufficiently reliable information about PAE was available for half of the sample ($n = 40$, 50.0%). More than 300 unique records were requested, and between 50% and 60% of records requested were received. The greatest barrier to obtaining records involved obtaining those from Health and Social Services (child welfare records) owing to concerns about third party information and risk of privacy breaches (e.g., to individuals other than the participant potentially identified in records). Maternal interviews were conducted with 34 birth mothers (40.0% of the sample) and collateral interviews were conducted with 11 individuals (13.8% of the sample). PAE was reliably confirmed (report from mother, collateral, or clear information documented in records) for 20 participants (25.0%), with unclear, or low to moderate exposure for 17 individuals (21.2%), and confirmed heavy exposure in one case (3.8%). In many cases, multiple sources were available to confirm PAE (e.g., maternal interview and records). PAE was reliably ruled out for a further 20 participants (25.0%). For the remaining 40 participants, or half the sample (50.0%), there was insufficient information to rule PAE in or out with reliability. This finding was expected given the challenges associated with obtaining

information about PAE in adults. In most cases, detailed information about the nature, timing, and dose of PAE was not available, either because birth mothers had difficulty remembering specific details with respect to drinking during the pregnancy, or because the information was not recorded in records. In the 40% of cases where a birth mother was interviewed ($n = 34$) to provide information concerning PAE, seven (17.5%) confirmed use during their pregnancy.

Figure 4. Confirmation of PAE



Diagnostic Findings

Results from the FASD assessment are summarized in Table 4. Overall, 14 participants (17.5%) received an FASD diagnosis. ARND was most frequently diagnosed ($n = 12$, 15.0%) with only two cases of pFAS ($n = 2$, 2.5%), and no cases of FAS. Approximately 14% of the sample ($n = 11$) was clinically deferred. The clinical team used the *Deferred* category when there was insufficient information available to reliably diagnose, or rule out, FASD. Typically, this was related to a lack of information about PAE ($n = 10$, 12.5%), with only one case in the Deferred category presenting with PAE reliably excluded (1.2%). In the Deferred group, 10 participants (12.5%) presented with significant evidence of impairment in brain functioning (e.g., CNS³ ranking of ‘3’ using the Washington FAS four-digit ranking system). These findings suggest that the overall number of diagnosed cases could have been as high as 30% (e.g., if all participants who received a diagnostic deferral were found to have confirmed PAE).

Diagnostic findings from this study are compared with data reported by MacPherson et al. (2011) and Forrester et al. (2015) for Canadian federally sentenced incarcerated men and women. In both studies, alternative classifications were used to characterize those participants who did not receive a diagnosis. The term “Uncertain” was applied when participants were identified as having “some” characteristics of FASD, but did not meet all criteria established in the (2005) Canadian Diagnostic Guidelines (e.g., CNS deficits of rank 2 or 3, and unclear PAE). A second group,

³ CNS: Central Nervous System. A term used to refer to areas of brain functioning, in this case, potentially adversely impacted by PAE.

classified as “CNS Deficit,” comprised individuals who presented with neurocognitive deficits considered unrelated to FASD (e.g., PAE ruled out, or a clinical decision from the diagnostic team indicating that other factors likely accounted for the deficits). FASD rates in the current sample were consistent with those reported for “probably FASD” by Forrester et al. (2015) and for FASD by MacPherson et al. (2011). Substantially fewer participants in the current sample were rated as being free of neurocognitive deficits relative to the other samples (6.2% vs. 29.7% and 39%, respectively).

Table 4. Diagnostic Results by Group

	Current Sample (<i>N</i> = 80) <i>n</i> (%) ^b	MacPherson et al. (2011) (<i>N</i> = 91) <i>n</i> (%)	Forrester et al. (2015) ^a (<i>N</i> = 23) <i>n</i> (%)
FASD	14 (17.5%)	9 (10.0%)	4 (17%)
FAS	0 (0.0%)	0 (0.0%)	0 (0%)
pFAS	2 (2.5%)	1 (1.2%)	1 (4%)
ARND	12 (15.0%)	8 (8.8%)	3 (13%)
Deferred	11 (13.8%)	-	-
Not Diagnosed	55 (68.8%)	-	-
CSC Categories			
Uncertain	45 (56.3%)	14 (15.4%)	5 (22%)
AU CNS = 2	25 (31.3%)	-	-
AU CNS = 3	14 (17.5%)	7 (7.7%)	-
AC CNS = 2	6 (7.5%)	7 (7.7%)	-
CNS Deficit	16 (20.0%)	41 (45.1%)	5 (22%)
CNS = 2	13 (16.3%)	-	-
CNS = 3	3 (3.8%)	-	-
No Deficit	5 (6.2%)	27 (29.7%)	9 (39%)

FASD: Fetal Alcohol Spectrum Disorder; FAS: Fetal Alcohol Syndrome; pFAS: Partial Fetal Alcohol Syndrome; ARND: Alcohol Related Neurodevelopmental Disorder; CNS: Central Nervous System; AU: Alcohol Unknown; AC: Alcohol confirmed.

Note. ^a Due to limitations in the availability of reliable and valid information stemming from neuropsychological assessment and confirmation of PAE, Forrester et al. (2015) provided “probable” diagnostic classifications instead of “confirmed” diagnoses. ^b Counts in the current study sample column reflect overlapping characterizations to draw comparisons with the additional study samples and should not be summed.

The clinical team assigned a four-digit diagnostic code using the Washington Diagnostic and Prevention Network guidelines. Findings are presented in Table 5. Growth was considered typical (e.g., within normal limits) in most participants (*n* = 77, 96.2%), with only three individuals classified as “Mild to Moderately impaired” (rank 2 or 3). Facial characteristics in the Mild to Moderate range (rank 2 or 3) were identified for 14 participants (17.5%). Though there was limited correspondence between the presence of mild to moderate facial features and diagnosed cases. Among participants with identified facial features, two were diagnosed (pFAS, 14.3%), five were Deferred (35.7%), and FASD was ruled out in the remaining 50.0% of cases.

Table 5. Four-Digit Code Rankings

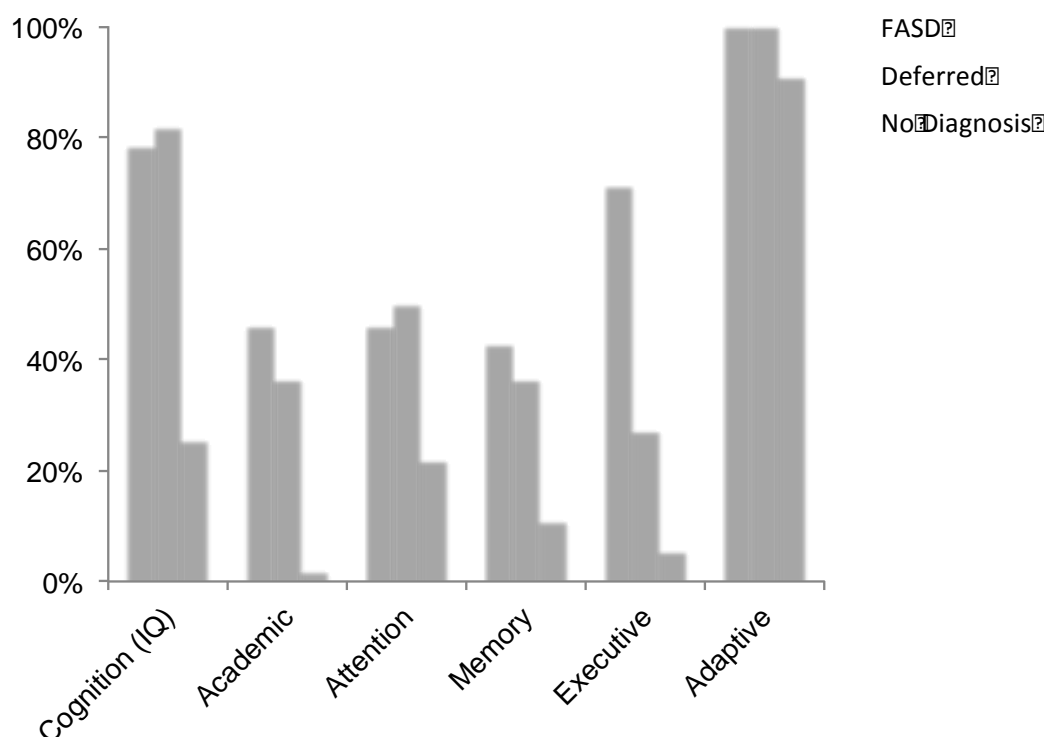
	1 (n) %	2 (n) %	3 (n) %	4 (n) %
Growth	77 (96.2%)	2 (2.5%)	1 (1.2%)	0 (0.0%)
Face	66 (82.5%)	13 (16.2%)	1 (1.3%)	0 (0.0%)
CNS	5 (6.2%)	44 (55.0%)	31 (38.8%)	0 (0.0%)
PAE	20 (25.0%)	40 (50.0%)	17 (21.2%)	3 (3.8%)

CNS: Central Nervous System; PAE: Prenatal Alcohol Exposure

CNS deficits were present in most participants, with only five individuals ranked as having no impairment (rank = 1). Slightly more than half the sample ($n = 44$, 55.0%) fell in the “Possible” range (Rank = 2) and 31 individuals (38.7%) fell in the “Probable” range (Rank = 3). Across the nine brain domains assessed, findings from seven were coded into the following categories: “0” (no impairment), “1” (mild to moderate impairment) and “2” (significant impairment). Coded domains included: brain structure, cognition, academic achievement, memory, executive functioning, and adaptive functioning. Two domains were excluded from these analyses (communication and hard and soft neurological signs) owing to the lack of formalized language and motor testing.

Figure 5 summarizes the percentage of participants in each of the three diagnostic groups who were considered significantly impaired (rank 2). Mean impairment scores for participants in the FASD ($M = 3.79$; $SD = .22$) and Deferred groups ($M = 3.27$, $SD = .25$) were significantly higher compared to the Not Diagnosed group ($M = 1.56$, $SD = .11$), $F = 49.93$, $p < .001$, $\eta^2_p = .57$. This ranged from zero to five domains impaired at a level considered indicative of substantial impairment. In almost all domains, substantially more participants in both the FASD and Deferred groups were coded as having “significant impairment” compared to the Not Diagnosed group. The exception was Adaptive Functioning, where no group differences emerged. Notably, a higher proportion of participants in the FASD group were coded as having significant impairment in the executive functioning domain ($n = 10$, 71.4%) compared to both the Deferred ($n = 3$, 27.3%) and Not Diagnosed groups ($n = 3$, 5.5%), suggesting that this domain may be a more sensitive indicator of ultimate diagnosis based on neurocognitive testing.

Figure 5. Brain Domains Considered Significantly Impaired by Group



Neurocognitive Test Performance

Measures of Effort

Clinicians were asked to rate perceived effort across each testing session to inform decisions about the validity of psychological test completion. One participant provided clear suboptimal effort, but was excluded from the final sample because of incomplete test data. Among the final 80 participants, six (7.5%) were considered to have provided “fair” effort on at least one session, and the remainder were judged to have provided “good” to “excellent” effort. For participants rated as providing only fair effort, breaks and rescheduled sessions were offered to manage the potential influence of fatigue or inadequate engagement on tasks. Importantly, in judging the validity of a given individual’s effort and the validity of psychological test findings, the psychologist considered the totality of each individual’s test data and presentation. Thus, while average test scores for effort measures are presented across study groups, clinicians factored multiple indicators into consideration when determining the validity of neurocognitive test data for each participant. Further, these considerations were factored into diagnostic decision making at case conferences.

Looking at WMT effort scores (Table 6), in general, more participants in the FASD and Deferred groups failed individual indicators, including Immediate Recognition, Delayed Recognition (only the FASD group), Consistency, and Paired

Associates (*NS*). Looking at the percentage of participants in each group who failed any single WMT indicator also suggested no significant group differences. More than one-third of the sample ($n = 25$, 32.9%) failed at least one effort indicator, suggesting the need for further study concerning use of the WMT in similar study populations.

Table 6. Effort Measure Results by Group

	FASD <i>n</i> (%)	Deferred <i>n</i> (%)	Not FASD <i>n</i> (%)	χ^2 (ϕ)
Word Memory Test (WMT, % fail)				
Immediate Recognition	3 (23.1%)	3 (27.3%)	3 (5.7%)	6.09 (.28)*
Delayed Recognition	3 (25.0%)	1 (9.1%)	1 (1.9%)	8.64 (.34)*
Consistency	4 (33.3%)	4 (36.4%)	5 (9.4%)	7.31 (.31)*
Multiple Choice	4 (30.8%)	3 (27.3%)	15 (28.8%)	.04 (.02)
Paired Associates	4 (33.3%)	3 (30.0%)	4 (7.7%)	7.16 (.31)*
Failed any WMT	5 (41.7%)	4 (36.4%)	16 (30.2%)	.65 (.09)
Advanced Clinical Solutions				
Reliable Digit Span (≤ 7)	1 (7.1%)	2 (22.2%)	1 (2.3%)	5.34 (.28)
LM Recognition ($<TG$)	4 (28.6%)	1 (9.1%)	1 (1.9%)	11.35 (.38)**
Word Choice ($<TG$)	0 (0.0%)	0 (0.0%)	0 (0.0%)	-

TG: Theoretical Guess Score, calculated by assessing the threshold at which a score falling below that point would be consistent with guessing (below chance); LM: Logical Memory (WMS-IV); Reliable Digit Span: A score of ≤ 7 signifies a base rate at $\leq 25\%$ of the clinical normative sample.

Note. Sample sizes vary due to missing data across indicators. Percentages are adjusted to reflect sample size differences. * $<.05$; ** $<.01$

Additional embedded and external validity measures were administered over the course of neurocognitive testing, including Reliable Digit Span from the WAIS-IV and Logical Memory (Recognition) from the WMS-IV. A third external measure, the Word Choice subtest from the Advanced Clinical Solutions addendum to the WAIS-IV and WMS-IV test batteries, was also administered. Few participants were flagged as having potentially problematic effort on the either Word Choice (scoring lower than a subject would score based on theoretical guess rates) or Reliable Digit Span (a span of ≤ 7 based on $\leq 25\%$ of the overall clinical normative sample) subtests. Four participants in the FASD group (28.6%) scored below the theoretical guess rate on a visual memory recognition task (Logical Memory – Recognition) compared to only one participant in each of the Deferred ($n = 9.1\%$) and Not Diagnosed groups (1.9%). Visual examination of the distribution of “flagged” response patterns across effort indicators revealed dispersion throughout the overall sample. Put another way, many participants were “flagged” on at least one effort indicator, but the same individuals were rarely flagged on multiple indicators. This finding underscores the importance of carrying out a careful and individualized review of effort during cognitive assessment for individuals who may present with impairment.

Neurocognitive Test Findings

Participants in the FASD group, and often both the FASD and Deferred groups, generally earned scores indicating significantly greater impairment relative to those who were not diagnosed (Table 7) and below normative means. However, participants who were not diagnosed also showed impairment across measures, with average scores falling between half and 1.5 standard deviations below normative means. Greater variability in scores was observed on tasks of executive functioning. Figure 6 highlights key neurocognitive test findings using Z-scores to improve interpretability across measures.

Cognition and Academic Achievement

In the cognitive domain, the FASD group scored below the Not Diagnosed group on all indicators, with large effect sizes evident for the Verbal Comprehension Index (VCI), Working Memory Index (WMI), and overall full-scale IQ (FSIQ). Mean Full Scale IQ scores were significantly lower in both the FASD ($M = 65.38$, $SD = 5.38$) and Deferred groups ($M = 68.55$, $SD = 4.67$) relative to those who were Not Diagnosed ($M = 83.08$, $SD = 12.29$), $F = 19.40$, $p < .001$, $\eta^2_p = .34$. Mean scores for the FASD and Deferred groups were not significantly different. In the general population, average IQ scores fall at 100, with a standard deviation of 15 points, indicating that participants in the FASD and Deferred groups presented with full scale IQ scores more than two standard deviations below the population mean.

In the overall sample, 35% ($n = 27$) of participants had a Full-Scale IQ score below 70, a common clinical cut-off point for making a diagnosis of intellectual disability. Roughly three-quarters of participants in the FASD ($n = 10$, 76.9%) and Deferred ($n = 7$, 70.0%) groups had full scale IQ scores below 70, whereas significantly fewer of those Not Diagnosed had IQ scores below that level ($n = 10$, 18.9%). With respect to Index scores on the WAIS-IV, the WMI proved a particularly sensitive indicator in the FASD group.

Turning to academic achievement, on the WRAT-4, large effect sizes differentiated the FASD group from the Not Diagnosed group, with similar performance between the FASD and Deferred groups. Participants in the FASD and Deferred groups were estimated to fall between three and five grade levels below the Not Diagnosed group across skill areas assessed, with the lowest overall scores in Arithmetic for individuals in the FASD group. This finding is in keeping with research showing impaired math skills in children with FASD (e.g., Rasmussen & Bisanz, 2009).

Table 7. Neurocognitive Test Scores

	FASD		Deferred		Not FASD		
	<i>M</i> (SD)		<i>n</i> (%)		<i>n</i> (%)		<i>F</i> (η^2_p)
Cognition (IQ)							
WAIS-IV							
Verbal Comprehension	66.45	(7.03)	61.81	(6.35)	80.98	(13.40)	16.85 (.31)***
Perceptual Reasoning	75.23	(6.41)	86.27	(8.06)	91.00	(14.29)	8.24 (.18)**
Working Memory	65.00	(3.61)	71.64	(6.34)	85.70	(12.08)	24.57 (.40)***
Processing Speed	78.62	(13.29)	76.09	(9.62)	89.62	(12.33)	8.39 (.18)**
Full Scale IQ	65.38	(5.38)	68.55	(4.68)	83.07	(12.29)	19.40 (.34)***
Academic Achievement							
WRAT-4							
Sentence Comprehension	75.46	(8.90)	70.36	(6.47)	89.23	(11.16)	20.92 (.36)***
Grade Equivalent	6.55	(2.48)	5.25	(1.53)	9.83	(2.54)	22.04 (.37)***
Word Reading	72.92	(11.78)	71.72	(10.19)	90.41	(10.70)	23.14 (.38)***
Grade Equivalent	5.18	(3.11)	4.60	(1.72)	9.70	(2.94)	23.75 (.38)***
Spelling	71.62	(13.17)	70.55	(8.82)	90.31	(10.79)	25.42 (.40)***
Grade Equivalent	4.50	(3.67)	4.05	(1.87)	9.53	(3.24)	22.67 (.38)***
Mathematical Operations	68.46	(7.77)	70.72	(9.17)	83.89	(11.86)	14.43 (.28)***
Grade Equivalent	3.91	(1.07)	4.28	(1.24)	6.98	(2.99)	10.46 (.22)***
Attention							
CPT-II							
Overall Hit RT	62.21	(10.74)	52.42	(9.16)	54.15	(10.88)	3.41 (.09)*
Overall Hit RT SE	62.64	(9.87)	57.90	(12.88)	53.28	(12.20)	3.44 (.09)*
WAIS-IV Digit Span	4.07	(1.14)	5.27	(1.27)	7.48	(2.10)	21.29 (.38)***
Memory							
WMS-IV							
Logical Memory I	4.14	(2.32)	4.45	(2.62)	6.60	(3.00)	5.73 (.13)**
Logical Memory II	4.57	(2.68)	4.91	(2.47)	6.51	(2.87)	3.57 (.08)*
Designs I	5.69	(2.87)	6.91	(2.34)	9.78	(8.76)	1.92 (.05)
Designs II	6.69	(2.39)	7.54	(1.44)	9.21	(2.88)	5.61 (.13)**
CVLT-II							
Trial 1	-1.32	(.93)	-1.55	(.82)	-1.14	(.80)	1.23 (.03)
Trial 5	-1.89	(1.04)	-1.91	(.87)	-.96	(1.06)	7.04 (.15)**
Learning Slope	-.79	(1.25)	-.55	(.65)	-.01	(1.10)	3.47 (.08)*
Short Delay Free Recall	-1.86	(1.10)	-1.68	(1.11)	-.81	(.91)	8.69 (.18)***
Short Delay Cued Recall	-1.89	(1.21)	-1.50	(1.07)	-.93	(.98)	5.46 (.12)**
Long Delay Free Recall	-1.75	(1.17)	-1.73	(1.08)	-.90	(.89)	6.46 (.14)**
Long Delay Cued Recall	-1.89	(1.16)	-1.73	(.98)	-.92	(.92)	7.45 (.16)**
RCFT							
Immediate Recall	31.23	(10.13)	27.60 (12.13)		37.68	(13.01)	3.56 (.09)*

Delayed Recall	25.86 (8.33)	25.55 (6.87)	31.05 (3.65)	8.81 (.19)***
Executive Functioning				
DKEFS				
Trails Composite	8.30 (3.66)	9.60 (2.17)	11.44 (2.92)	6.56 (.15)**
Verbal Fluency Letters	5.79 (2.72)	7.09 (2.66)	9.38 (3.00)	9.88 (.20)***
Verbal Fluency Categories	9.00 (4.80)	9.72 (2.87)	10.51 (3.34)	1.08 (.03)
Colour-Word Composite	6.50 (2.79)	7.70 (1.83)	9.95 (2.26)	14.27 (.27)***
Sorting Free Correct	5.31 (2.39)	6.81 (2.68)	8.31 (2.74)	7.15 (.16)**
Sorting Free Description	4.77 (2.62)	5.91 (2.51)	7.73 (2.55)	8.19 (.18)**
Sorting Recognition Correct	3.58 (2.47)	5.18 (3.06)	6.80 (3.04)	6.38 (.14)**
Adaptive Functioning				
ABAS-II				
General Adaptive	84.43 (16.96)	93.18 (11.50)	91.78 (16.78)	1.29 (.03)
Conceptual	81.57 (16.42)	89.27 (13.26)	91.15 (17.09)	1.87 (.05)
Social	86.85 (16.90)	92.09 (11.78)	91.67 (15.93)	.57 (.01)
Practical	88.93 (17.38)	96.36 (11.72)	94.25 (17.43)	.73 (.02)

FASD: Fetal alcohol spectrum disorder; GE: Grade Equivalent; SE: Standard Error; Hit RT: scores are scaled such that slow reaction times produce higher T-scores; Overall mean Hit RT = Hit Reaction Time (the average speed of correct responses for the entire test)

Note: Composite scores (WAIS-IV, WRAT-4, ABAS) have a mean of 100 and standard deviation of 10. The mean for T-scores (CPT-II, RCFT) is 50 with a standard deviation of 10. Scaled scores (WMS-IV, WAIS-IV Digit Span, DKEFS) have a mean of 10 and a standard deviation of three. Z-scores have a mean of zero and a standard deviation of one.

Attention

Subtests from both the Conners' Continuous Performance Test – II (CPT-II) and the WAIS-IV (Digit Span) were considered for this domain. The CPT-II is a measure of sustained auditory attention. A review of CPT-II scores showed few significant differences between the groups. Between one-third and half of participants in each of the diagnostic groups demonstrated performance comparable to clinical reference group of individuals with attention deficit hyperactivity disorder (ADHD) (FASD: $n = 7$, 53.8%; Deferred: $n = 4$, 40%; Not Diagnosed: $n = 16$, 30.2%). A further 23.1% ($n = 3$) of the FASD group, 60.0% ($n = 6$) of the Deferred group, and 35.8% ($n = 19$) of the Not Diagnosed group had inconclusive results, suggesting possible clinical impairments in attention. Though rates of attention problems were high across the sample, few clear differences emerged between the groups. In examining specific CPT-II indicators, the FASD group produced slower reaction times (Overall Hit RT) and showed greater variability in reaction time (Hit RT SE) compared to both the Deferred and Not Diagnosed groups.

Memory and Executive Functioning

Verbal and visual memory were assessed over both short and delayed recall intervals. Participants in the FASD and Deferred groups had significantly lower scores compared to those who were not diagnosed on all tasks, though effect sizes were

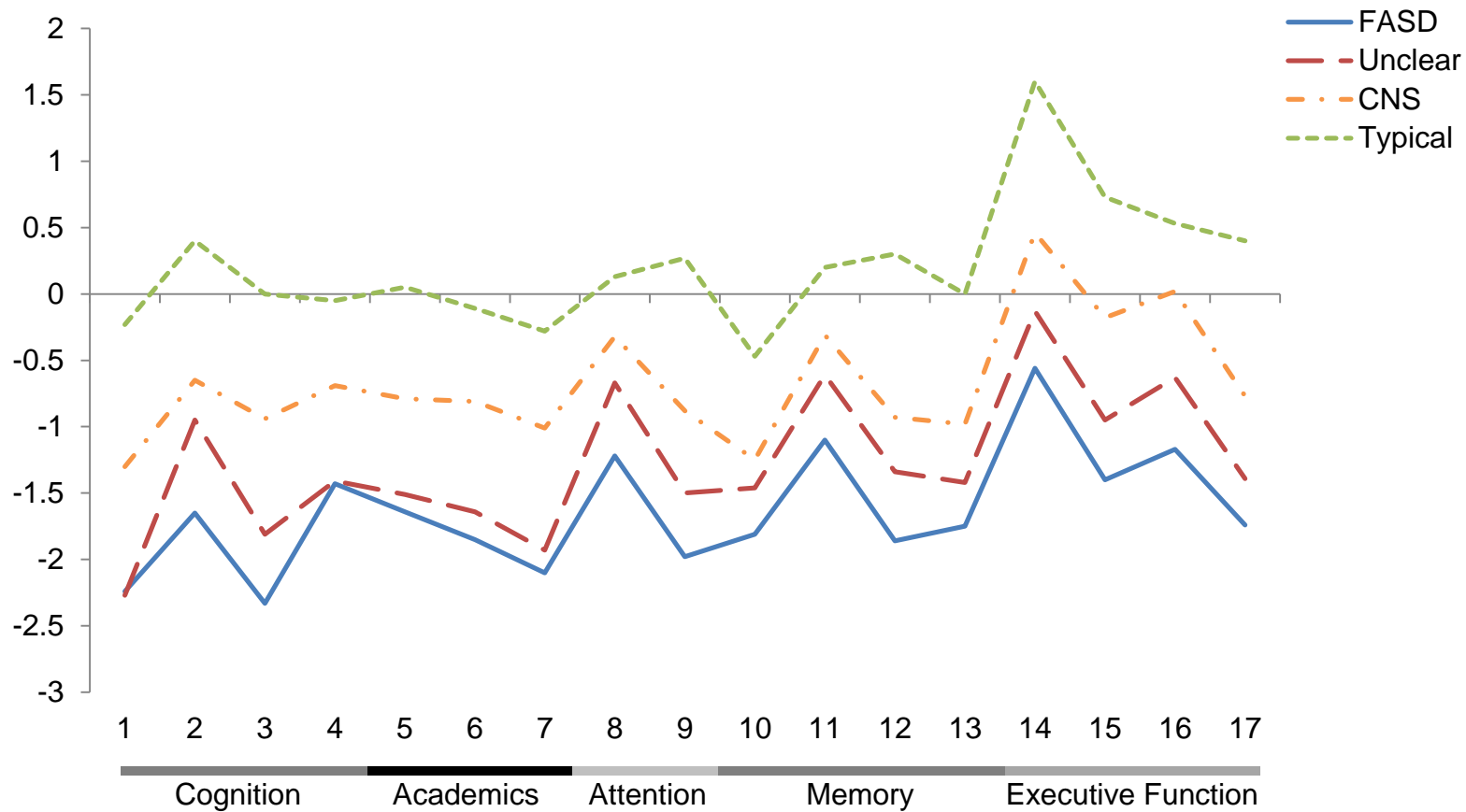
conservative and ranged from small to medium. Notably, participants in the FASD and Deferred groups fared better on tasks tapping short term or immediate recall (e.g., the first recall trial on a word list learning task, or the immediate recall trial on a visual figure drawing task) compared to those comprising longer delay intervals. With respect to tasks assessing executive functioning, participants in the FASD and Deferred groups again scored significantly below the Not Diagnosed group across most measures. Several subtests appeared more sensitive in distinguishing the FASD and Deferred groups, including Trails, Verbal Fluency (letters) and Sorting (correct free sorts). This finding is in keeping with evidence indicating that executive functions are sensitively impacted by PAE in children with FASD.

Adaptive Functioning

Participant ratings on the ABAS-II were considered in conjunction with other clinical observations regarding daily living skills for participants. Scores on the ABAS-II were not significantly different across the groups, with average scores across practical, social, and conceptual domains falling, on average, approximately 10 to 15 standard points (.75 to 1.0 standard deviations) below normative means. Scores in the FASD group were lower than the Deferred and Not Diagnosed groups, but not significantly so. Overall, participants rated themselves as having greater success in areas pertaining to practical skills. Notably, participants appeared to rate themselves as having fewer problems in daily living related to adaptive functioning, relative to clinical judgments from the assessment team. Further, given the high rates of difficulty in adaptive functioning commonly observed in adolescents with FASD, findings from this sample bring into question the appropriateness of using self-report measures to evaluate this domain. On the one hand, it is possible that individuals over-estimated their skills in this area. An alternative explanation, however, could be that adults with FASD, over time and with supports, may develop additional skills of daily living. This issue warrants further evaluation, given the importance of this domain in both FASD diagnosis, but also frequently in assessments for disability support funding for adults on other jurisdictions. Notably, participants with IQ scores below 70 (a common clinical cut-off point required for a diagnosis of Intellectual Disability) had lower average ABAS-II composite scores ($n = 27$) $M = 85.11$, $SD = 14.33$) compared to those with an IQ of 70 or higher ($n = 50$, $M = 93.16$, $SD = 16.68$), $F = 4.49$, $p = .04$, $\eta^2_p = .06$.

Figure 6 provides a comparison of key neurocognitive test indicators by participant groupings used by both MacPherson et al. (2011) and Forrester et al. (2015). This approach allows for the disentanglement of individuals with neurocognitive deficits related to FASD, from those with neurocognitive deficits not related to FASD. Analyses are exploratory given uneven sample sizes, but suggest a linear pattern, whereby participants with FASD consistently earn scores below both the “unclear” group, and those with identified CNS deficits not related to FASD. Group differences were generally not significant, though, findings suggest the importance of recognizing that individuals with FASD may represent the most neurocognitively impacted offenders as a group in correctional environments.

Figure 6. Neurocognitive Test Scores by CSC Research Categories



FASD: Fetal alcohol spectrum disorder

CNS: Central nervous system

Note: Displayed values are Z-scores, transformed to facilitate comparisons between measures using different normative scales. 1. WAIS-IV Verbal Comprehension. 2. WAIS-IV Perceptual Reasoning. 3. WAIS-IV Working Memory. 4. WAIS-IV Processing Speed. 5. WRAT-IV Spelling. 6. WRAT-IV Reading. 7. WRAT-IV Arithmetic. 8. CPT-II Hit RT (scores are reversed to facilitate interpretation). 9. WAIS-IV Digit Span. 10. WMS-IV Logical Memory II. 11. WMS-IV Designs II. 12. CVLT-II Short Delay Free Recall. 13. CVLT-II Long Delay Free Recall. 14. DKEFS Trails Composite. 15. DKEFS Verbal Fluency Letter. 16. DKEFS Color-Word Composite. 17. DKEFS Free Sort Correct.

FASD Screening Tools

Brief Screening Checklist (BSC) Results

Participants completed the BSC during their initial study visit. Few Maternal ($n = 34$) and Collateral ($n = 13$) informants completed the BSC-C or BSC-M, and as such, psychometric analyses of the BSC are focused on the participant version.

Behavioural Indicator. Table 8 summarizes mean scores and standard deviations for the 28-item Likert version of the BSC Behavioural Indicator. Recoded dichotomous responses are presented in Table 9 (ratings of 1, 2, or 3 = disagree; 4 or 5 = agree). A review of item-total correlations proved consistent with findings reported by MacPherson et al. (2011), and resulted in items 20 (is strongly opinionated) and 27 (is stubborn) being discarded because of low item-total correlations (.27 and .39 respectively). Remaining item-total correlations ranged from .40 to .75. Subsequent analyses were conducted using the remaining 26-item version of the BSC. Given the ordinal nature of the five-point Likert scale response options for the BSC Behavioural items, nonparametric analyses (Independent Samples Kruskal-Wallis Test) were used to compare mean scores across groups. At the item level, three items pertaining to academic difficulties distinguished the groups: problem with spelling; problem with arithmetic; problem with reading. A review of mean scores indicated higher average scores on these items in both the FASD and Deferred groups, compared to the Not Diagnosed group. Item 10 (problem budgeting or handling money) also distinguished the groups, but in this case, the FASD group had substantially higher mean scores compared to both the Deferred and Not Diagnosed groups. Item patterns differed considerably in this sample from the data reported by MacPherson et al. (2011), and the weighted total score did not differentiate the groups.

Table 8. BSC Behavioural Indicator Results

	FASD <i>M</i> (SD)	Deferred <i>M</i> (SD)	Not FASD <i>M</i> (SD)	K-W <i>p</i>
Acts Impulsively	3.31 (0.95)	3.09 (1.22)	3.29 (1.22)	.91
Trouble following directions	3.00 (1.18)	3.09 (1.04)	2.65 (1.11)	.35
Is restless	2.77 (1.36)	2.91 (1.30)	3.11 (1.17)	.62
Problem with spelling	3.57 (1.28)	3.91 (0.70)	2.31 (1.22)	<.001
Poor judgment	2.71 (1.20)	3.09 (1.04)	2.56 (1.09)	.34
Easily distracted	3.36 (1.08)	3.27 (1.35)	3.38 (1.05)	.96
Temper tantrums	2.29 (1.07)	3.27 (1.19)	2.47 (1.09)	.07
Strong mood swings	2.85 (1.46)	2.82 (1.25)	2.85 (1.25)	.99
Hyperactive	2.54 (0.90)	2.91 (1.14)	2.65 (1.08)	.67
Problem budgeting/money	4.31 (0.86)	3.00 (1.41)	3.15 (1.43)	.02
Unaware consequences	2.75 (1.22)	2.73 (1.01)	2.30 (0.99)	.27
Problem arithmetic	3.64 (1.15)	3.09 (1.30)	2.51 (1.20)	.008
Interrupts conversations	2.62 (0.96)	3.09 (1.38)	2.69 (1.18)	.64
Agitated	3.14 (0.77)	2.82 (1.08)	2.82 (1.07)	.54

Very forgetful	2.92 (1.26)	2.73 (1.10)	2.87 (1.35)	.93
Talks a lot but says little	2.62 (1.04)	3.09 (1.22)	2.45 (1.03)	.23
Poor memory	2.86 (1.29)	3.09 (1.30)	2.78 (1.18)	.75
Problem with reading	3.14 (1.17)	3.45 (1.13)	2.09 (1.12)	<.001
Easily victimized	2.69 (1.38)	2.64 (1.50)	2.35 (1.04)	.73
Strongly opinionated	3.23 (0.93)	3.45 (1.13)	3.47 (1.09)	.76
Trouble completing tasks	2.69 (1.11)	2.82 (1.47)	2.59 (1.16)	.92
Poor attention span	2.69 (1.03)	3.18 (1.17)	2.89 (1.15)	.56
Few friends	2.14 (1.10)	2.09 (1.37)	2.33 (1.26)	.72
Easily manipulated	2.62 (1.26)	3.00 (1.48)	2.22 (1.17)	.19
Disorganized	2.29 (0.91)	2.18 (1.25)	2.09 (1.04)	.70
Trouble staying on topic	2.93 (0.98)	3.00 (1.18)	2.65 (1.09)	.50
Stubborn	3.21 (1.12)	3.18 (1.47)	3.42 (1.18)	.77
Poor social skills	2.57 (1.02)	2.82 (0.98)	2.11 (0.98)	.05
Weighted Behaviour Total ^a	2.95 (0.55)	2.99 (0.69)	2.68 (0.59)	.29

FASD: Fetal Alcohol Spectrum Disorder

Note: $N = 78$. Results were adjusted to account for three participants who completed BSC's with 4 or more Behavioural items missing. ^a = The Weighted Behaviour Total score was calculated by summing individual Behavioural indicators, and then dividing them by the number of items answered to account for incomplete items.

Analyses for predictive accuracy were conducted comparing the FASD and Not Diagnosed groups. The Deferred group was excluded from these analyses owing to a lack of diagnostic clarity. MacPherson et al. (2011) found that a cut-off of 10 on the BSC Behavioural scale resulted in optimal sensitivity⁴ (.78), specificity (.81), positive predictive value (PPV, .35) and negative predictive value (NPV, .96). An Area under the Curve (AUC) score was calculated for the dichotomized BSC Behavioural weighted total score (26-item version) from Receiver Operating Characteristic (ROC) curve analyses using the cut-off score of ten or more items. The AUC is a metric used to determine the probability that a randomly selected individual with FASD has a higher test value than someone who does not have FASD. A test that does no better than chance alone will have an AUC of .50. In the current sample, comparing the FASD group to the Not Diagnosed group, yielded an AUC of .57, or, close to chance detection, suggesting poor accuracy in correctly distinguishing the groups. In the FASD group, seven participants (63.6%) were correctly identified, and 34 participants (64.1%) from the undiagnosed group were correctly identified. Put another way, more than 50% of individuals with FASD were not detected, and 19 individuals from the Not Diagnosed group incorrectly screened "positive" for risk of FASD. Resulting sensitivity was 53.9% (95% CI⁵: 25.1% –

⁴ *Sensitivity* refers to the proportion of true positives correctly identified as such (true positive rate). *Specificity* refers to the proportion of true negatives correctly identified as such (true negative rate). *Positive Predictive Value* (PPV) and *Negative Predictive Value* (NPV) are the proportions of positive and negative results that are true positive and true negative results, respectively. High values can be interpreted as indicative of the accuracy of a screening measure or diagnostic test. PPV and NPV depend on prevalence.

⁵ *Confidence Interval* (CI) is a type of interval estimate of a population parameter, based on sampling method. CIs are calculated to describe the degree of uncertainty associated with a sample estimate of a

80.8%), specificity was 64.1% (95% CI: 49.8% - 76.9%), PPV was 19.7% (95% CI: 10.9% - 31.3%) and NPV was 26.9% (95% CI: 16.6% - 40.6%). The current findings suggest that the Behavioural indicator, as previously developed and using established cut-offs, did not accurately classify many participants, and highlights the importance of inter-sample variation.

Exploratory analyses. In an effort to optimize the predictive accuracy of the BSC Behavioural Indicator, the most sensitive items (4, 10, 12, and 18) were summed using dichotomous responses (e.g., present, absent) to create a continuous score ranging from 0 to 4. A screening cut-off of ≥ 2 items resulted in optimal sensitivity and specificity. Comparing only the Diagnosed and Not Diagnosed groups, 12 of 14 (85.7%) participants with FASD were correctly identified, while only 16 of 54 (29.6%) of participants in the Not Diagnosed group screened positive. The resulting AUC was .78 (SE = .07). Sensitivity was 85.7% (95% CI: 59.2% – 98.2%), specificity was 70.4% (95% CI: 56.4% – 82.0%), PPV was 42.9% (95% CI: = 32.1% – 54.4%), and NPV was 95.0% (95% CI: = 83.9% – 98.6%). The sample-optimized four-item BSC Behavioural Indicator may provide promise in screening for FASD in Yukon corrections. This may also present an expedited preliminary approach to screening with fewer items, and would assist in the identification of practical academic skill deficits. Of note, correlations between BSC Behavioural items pertaining to academic difficulties were considered large in magnitude (ranging from $r = -.51$ to $r = -.74$), suggesting good correspondence between psychometric test scores and participant self-report in this area.

Table 9. BSC Behavioural Indicator Results (Dichotomous Coding)

	FASD <i>n</i> (%)	Deferred <i>n</i> (%)	Not FASD <i>n</i> (%)	χ^2 (ϕ)
Acts Impulsively	6 (46.2%)	6 (54.5%)	27 (50.9%)	.79 (.10)
Trouble following directions	6 (46.2%)	4 (36.4%)	14 (26.4%)	2.06 (.16)
Is restless	5 (38.5%)	4 (36.4%)	24 (45.3%)	.42 (.07)
Problem with spelling	10 (76.9%)	8 (72.7%)	12 (22.6%)	19.08 (.50)***
Poor judgment	5 (38.5%)	4 (36.4%)	10 (18.9%)	3.10 (.20)
Easily distracted	8 (57.1%)	5 (45.5%)	31 (58.5%)	.65 (.09)
Temper tantrums	2 (15.4%)	5 (45.5%)	11 (20.0%)	4.15 (.23)
Strong mood swings	5 (38.5%)	4 (36.4%)	20 (37.7%)	.01 (.01)
Hyperactive	4 (30.8%)	5 (45.5%)	14 (26.4%)	1.58 (.04)
Problem budgeting/money	11 (84.6%)	4 (36.4%)	26 (49.1%)	6.77 (.30)*
Unaware consequences	5 (38.5%)	2 (18.2%)	8 (15.1%)	3.65 (.22)
Problem arithmetic	8 (61.5%)	4 (36.4%)	11 (20.8%)	8.55 (.33)*
Interrupts conversations	3 (23.1%)	5 (45.5%)	15 (28.3%)	1.62 (.14)
Agitated	4 (30.8%)	4 (36.4%)	18 (34.0%)	.09 (.03)
Very forgetful	4 (30.8%)	3 (27.3%)	19 (35.8%)	.36 (.07)
Talks a lot but says little	4 (30.8%)	5 (45.5%)	10 (19.2%)	3.61 (.22)

population parameter. A CI measures the probability that a population parameter will fall between two sets of values (in this case, at 95% probability).

Poor memory	5 (38.5%)	4 (36.4%)	14 (26.4%)	.79 (.10)
Problem with reading	7 (53.8%)	6 (54.5%)	8 (15.1%)	12.72 (.41)**
Easily victimized	5 (38.5%)	3 (27.3%)	10 (18.9%)	2.35 (.18)
Strongly opinionated	7 (53.8%)	6 (54.5%)	27 (50.9%)	.07 (.03)
Trouble completing tasks	5 (38.5%)	4 (36.4%)	11 (20.8%)	2.71 (.19)
Poor attention span	4 (30.8%)	5 (45.5%)	18 (43.0%)	.66 (.09)
Few friends	3 (23.1%)	2 (18.2%)	13 (24.5%)	.21 (.05)
Easily manipulated	4 (30.8%)	6 (54.5%)	11 (20.8%)	5.34 (.26)
Disorganized	2 (15.4%)	2 (18.2%)	6 (11.3%)	.46 (.08)
Trouble staying on topic	4 (30.8%)	4 (36.4%)	13 (24.5%)	.74 (.10)
Stubborn	6 (46.2%)	6 (54.5%)	31 (58.5%)	.65 (.09)
Poor social skills	3 (23.1%)	3 (27.3%)	5 (9.4%)	3.36 (.21)
Screening Outcomes				
Weighted Behaviour Total ^a	.40 (.25) ^b	.40 (.28) ^b	.30 (.19) ^b	1.92 (.05) ^c
Positive Screens ≥10	6 (42.9%)	4 (36.4%)	15 (27.8%)	1.30 (.13)
Optimized Behaviour Total ^d	2.71 (1.07) ^b	2.00 (1.61) ^b	1.07 (1.04) ^b	12.80 (.25)***^c
Positive Screens ≥ 2	12 (85.7%)	7 (63.6%)	16 (29.6%)	16.11 (.45)***

FASD = Fetal alcohol spectrum disorder.

Note: *N* = 77. Results were adjusted to account for three participants who completed BSC's with 4 or more Behavioural items missing. ^a = The Weighted Behaviour Total score was calculated by summing individual Behavioural indicators, and then dividing them by the number of items answered to account for incomplete items. ^b = *M* (*SD*). ^c = *F* Statistic for ANOVA and (Partial Eta Square). ^d = Optimized Behavioural Total Score was calculated by summing responses for items 4, 10, 12, and 18. * *p* < .05 ** *p* < .01 *** *p* < .001

BSC Historical Items. Frequency ratings for the BSC Historical Indicator are presented in Table 10. Two items significantly differentiated the groups. All participants in the FASD group, and eight from the Deferred group (72.7%) endorsed a history of problems in school from an early age. Despite low endorsement rates, the item pertaining to having been previously told about an FASD diagnosis also differentiated the groups. A total score was calculated by summing positive endorsements across the nine historical items. While the average score was higher for participants in the FASD group relative to the Deferred and Not Diagnosed groups, the difference was not statistically different. A second total score was calculated to mirror analyses conducted by MacPherson et al. (2011) wherein items pertaining to history of an FASD diagnosis in the participant or a sibling were omitted (there was significant missing data for these items in their analyses). Again, this score did not significantly differentiate the groups.

Turning to ROC analyses, we first evaluated the unadjusted BSC Historical total score (9-items). Using a cut-off of score of ≥ 2, roughly half of the FASD participants were correctly identified (57.1%) whereas 42.6% (*n* = 23) of the undiagnosed group also screened positive. This resulted in an AUC of .57 (SE = .09), or close to chance, with sensitivity = 57.1% (95% CI: 28.9% - 82.3%), specificity = 54.5% (95% CI: 40.5% - 68.0%), PPV = 24.2% (95% CI: 15.7% - 35.4%), NPV = 83.3% (95% CI: 72.3% - 90.6%). Values for the BSC Historical total scale with items omitted to mirror CSC analyses did not change findings meaningfully and they are therefore not reproduced here. Alternatively, MacPherson et al. (2011) found that a cut-off of ≥ 2 on the BSC

Historical scale (7 items) resulted in optimal sensitivity (78%), specificity (76%), PPV (30%) and NPV (96%).

Exploratory Analyses. An evaluation of effect sizes across Historical items revealed that those pertaining early problems in school and foster care showed the largest effect sizes in distinguishing the groups. An optimized total score was calculated by summing these items. Cut points of both ≥ 1 and 2 were evaluated. Using a cut-off of ≥ 1 , all participants in the FASD group ($n = 14$, 100.0%) were correctly screened in, though nearly two-thirds of the Not Diagnosed group also screened positive ($n = 35$, 64.8%). Comparing the FASD and undiagnosed groups yielded an AUC of .68 (SE = .07), with perfect sensitivity (100.0%) (95% CI: 76.8% - 100.0%), specificity at 64.8% (95% CI: 50.6% - 77.3%), PPV of 42.4% (95% CI: 33.9% - 51.4%), and NPV of 100%. Shifting the cut-off to 2 yielded slightly lower classification accuracy for the FASD group to 57.1% ($n = 8$), but improved accuracy for the undiagnosed group ($n = 13$, 23.6%). Comparing the FASD and undiagnosed groups, this resulted in an AUC of .66 (SE = .09), with a reduction in sensitivity (57.1%) (95% CI: 28.9% - 82.3%), improved specificity at 74.1% (95% CI: 60.4% - 85.0%), PPV of 36.4% (95% CI: 23.1% - 52.0%), and NPV of 87.0% (95% CI: 78.1% - 92.6%).

Table 10. BSC Historical Indicator Results (Dichotomous Coding)

	FASD <i>n</i> (%)	Deferred <i>n</i> (%)	Not FASD <i>n</i> (%)	χ^2 (ϕ)
Adopted ⁱ	1 (7.1%)	1 (10.0%)	5 (9.3%)	-
Foster care	8 (57.1%)	6 (54.5%)	19 (34.5%)	3.28 (.20)
Foster care ≥ 3 times ⁱⁱ	5 (35.7%)	1 (10.0%)	11 (21.2%)	2.36 (.18)
Early problems in school	14 (100.0%)	8 (72.7%)	31 (56.4%)	9.74 (.35)**
Treatment for mental health ≥ 3 times	2 (14.3%) 0 (0.0%)	2 (18.2%) 0 (0.0%)	9 (16.4%) 1 (0.0%)	.07 (.10) -
Developmental disability dx	3 (21.4%)	2 (18.2%)	5 (9.1%)	1.93 (.16)
Sibling dx with FASD	3 (21.4%)	0 (0.0%)	4 (7.3%)	-
Told has FASD	2 (14.3%)	3 (27.3%)	2 (3.6%)	-
Screening Outcomes				
Historical Total ^a	2.71 (2.02) ^c	2.09 (1.70) ^c	1.58 (1.55) ^c	7.53 (.07) ^d
Positive screen (≥ 2)	8 (57.1%)	6 (54.5%)	23 (41.8%)	1.41 (.13)
Historical Total (CSC) ^b	2.35 (1.45)	1.81 (1.40)	1.47 (1.40)	2.27 (.06)
Positive screen (≥ 2)	8 (57.1%)	4 (36.3%)	24 (43.6%)	1.21 (.12)
Optimized Historical (≥ 1)	14 (100.0%)	9 (81.8%)	36 (65.5%)	7.31 (.30)*
Optimized Historical (≥ 2) ^e	8 (57.1%)	5 (45.4%)	13 (23.6%)	6.69 (.29)*

FASD: Fetal alcohol spectrum disorder; Dx: Diagnosed

Note. ⁱ = Two participants omitted for missing data. ⁱⁱ = Four participants omitted for missing data. ^a = Historical total is the sum of all positively endorsed Historical Items. ^b = Historical Total (CSC) excludes two items, consistent with analyses conducted by MacPherson et al. (2011). ^c = *M*, (SD). ^d = *F* Statistic for ANOVA and Partial Eta Square. ^e = Optimized Historical was calculated by summing positive endorsements for history of school problems and history of foster care, with a cut point of ≥ 1 * $p < .05$ ** $p < .01$.

BSC Maternal Indicator. Participant responses the BSC Maternal Indicator are provided in Table 11. Overall, 12.5% of participants ($n = 10$) reported that their mother had consumed alcohol during the index pregnancy, though, they were largely unable to provide specific information with respect to the timing, frequency, and amount of alcohol consumed. In reviewing information provided by biological mothers on parallel items, a further seven cases resulted in confirmation of PAE, where participants had responses “unknown” or felt that there had been no PAE. Among those participants who reported PAE, only one corroborative Maternal interview was conducted. In this case, the participant endorsed PAE while the mother indicated that there was not PAE. Collateral informants confirmed PAE for only two participants. In one case, the collateral provided information that was consistent with the participant’s information (e.g., both confirmed PAE). In the other, the collateral denied or was unaware of PAE, while the participant had endorsed PAE. These findings highlight the importance of using multiple sources of information to confirm PAE, particularly for adults. Two-thirds of the sample endorsed maternal alcohol use while they were young ($n = 54$, 67.5%), though again, participants were largely unable to provide detailed information concerning patterns of use. There were no significant differences across the groups. BSC Maternal items also canvass maternal use of additional illicit substances and cigarette smoking during pregnancy, but findings are not reported due to the level of “unknown” responses.

In their original report, MacPherson et al. (2011) reported developing screening criteria by combining data across dichotomous variables (e.g., “did mother drink during pregnancy”) with frequency or severity ratings (e.g., more than five drinks per occasion). Due to the degree of “unknown” responses regarding patterns of alcohol consumption in pregnancy or childhood, these analyses were not replicated. Instead, we opted to use only the dichotomous variables as screening markers for maternal alcohol use in pregnancy. Taking a positive endorsement of alcohol use during either childhood or pregnancy yielded an AUC of .51 (SE = .08). Using a cut-off of one item endorsed resulted in 78.6% of the FASD group being correct classified ($n = 11$), however, nearly three-quarters of those in the Not Diagnosed group were also positively identified ($n = 39$, 72.2%). Sensitivity was (78.6%) (95% CI: 49.2% - 95.3%), specificity was very low (27.8%, 95% CI: 16.5% - 41.6%), PPV was 22.0% (95% CI: 17.0% - 28.0%), and NPV was 83.3% (95% CI: 62.7% - 93.7%).

Increasing the required number of items from one to two did little to improve accuracy (AUC = .51, SE = .09), and resulted in only one participant with FASD being screened in (7.1%) despite the majority of individuals Not Diagnosed being correctly screened out ($n = 51$, 94.4%). Despite low predictive accuracy, there appears to be merit in asking these questions from a screening perspective, given the potentially increased risk of FASD following either PAE, or heavy maternal drinking in childhood, as a possible proxy for PAE. As such, both items were included in the final exploratory or optimized BSC.

Table 11. BSC Maternal Indicator Results

	FASD <i>n</i> (%)	Deferred <i>n</i> (%)	Not FASD <i>n</i> (%)	χ^2 (ϕ)
Drank alcohol when young	10 (71.4%)	6 (54.5%)	38 (69.1%)	1.00 (.11)
Drank alcohol during pregnancy	4 (28.6%)	1 (9.1%)	5 (9.1%)	4.01 (.22)
Screening Outcomes				
Optimized Maternal ^a ,	2.71 (2.02) ^c	2.09 (1.70) ^c	1.58 (1.55) ^c	7.53 (.07) ^d
Positive screen (≥ 1)	8 (57.1%)	6 (54.5%)	23 (41.8%)	1.41 (.13)

FASD: Fetal alcohol spectrum disorder

Note. Optimized Maternal Total Score was calculated by summing dichotomous scores (1 = yes) for two items: Did mother drink when young; and, Did mother drink during pregnancy. A positive screen was defined as having a score of ≥ 1 on the Optimized Maternal Total Score (e.g., either item was positively endorsed by participants).

Final Optimized BSC. A final, abbreviated and sample-optimized version of the BSC was evaluated using the entire study sample. In ideal circumstances, this could have been developed using half the sample, and validated on the remaining participants. However, this option was not feasible given the conservative final sample size. Optimized items from the BSC Behavioural, Historical, and Maternal Indicators were compiled, resulting in an eight-item final screening measure (Table 12). Comparing the FASD and Not Diagnosed groups, screening accuracy was excellent (AUC = .82, SE = .06). In the FASD group, 13 participants were accurately screened in (92.9%) while only 16 participants Not Diagnosed (29.6%) were screened in. Sensitivity was 92.3% (95% CI: 66.1% - 99.8%), specificity was improved (70.4%, 95% CI: 56.4% - 82.0%), PPV was 44.8% (95% CI: 34.4% - 55.7%), and NPV was 97.4% (95% CI: 85.1% - 99.6%). Exploratory analyses also revealed that participants who “screened positive” using the final optimized BSC had significantly more impairment on an array of neurocognitive test scores, compared to those who “screened negative,” suggesting that further exploration of the secondary utility of using these items to also identify individuals at risk of having neurocognitive deficits may be warranted. In ideal circumstances, individuals who “falsely” screen positive for FASD may nonetheless benefit from comprehensive neurocognitive testing to identify possible serious deficits that may impact functioning and success in desisting from offending.

Given that most participants in the Deferred group resembled participants in the FASD group across neurocognitive tasks, a final set of analyses was conducted wherein the FASD and Deferred groups were combined and compared to the Not Diagnosed group, using the sample-optimized BSC with a cut-off of ≥ 4 . The resulting AUC was .75 (SE = .06). In total, 20 of 25 participants in the FASD+Deferred group screened positive (80.0%) while only 16 participants of 53 screened positive in the Not Diagnosed Group (30.2%). This results in a sensitivity of 80.0% (95% CI: 59.3% - 93.2%), specificity remained good (70.4%, 95% CI: 56.4% - 82.0%), PPV was 55.6% (95% CI: 44.2% - 66.3%), and NPV was 88.4% (95% CI: 77.3% - 94.4%). Findings suggested that the sample-optimized BSC may function equally well in screening in participants considered to be “at risk” of FASD in the Deferred group.

Table 12. Sample-optimized BSC: Behavioural, Historical, and Maternal Indicators

	FASD <i>n</i> (%)	Deferred <i>n</i> (%)	Not FASD <i>n</i> (%)	$\chi^2 (\phi)$ $F(\eta^2_p)$
Behavioural Indicators				
Problem with spelling	10 (76.9%)	8 (72.7%)	12 (22.6%)	19.08 (.50)***
Problem budgeting/money	11 (84.6%)	4 (36.4%)	26 (49.1%)	6.77 (.30)*
Problem arithmetic	8 (61.5%)	4 (36.4%)	11 (20.8%)	8.55 (.33)*
Problem with reading	7 (53.8%)	6 (54.5%)	8 (15.1%)	12.72 (.41)**
Optimized Total	2.71 (1.07)	2.00 (1.61)	1.07 (1.04)	12.80 (.25)***
Positive Screens ≥ 2	12 (85.7%)	7 (63.6%)	16 (29.6%)	16.11 (.45)***
Historical Indicators				
Early problems in school	14 (100.0%)	8 (72.7%)	31 (56.4%)	9.74 (.35)**
Foster care	8 (57.5%)	6 (54.5%)	19 (34.5%)	3.28 (.20)
Optimized Historical (≥ 1)	14 (100.0%)	9 (81.8%)	36 (65.5%)	7.31 (.30)*
Maternal Indicators				
Drank alcohol when young	10 (71.4%)	6 (54.5%)	38 (69.1%)	1.00 (.11)
Drank alcohol in pregnancy	4 (28.6%)	1 (9.1%)	5 (9.1%)	4.01 (.22)
Positive screen (≥ 1)	8 (57.1%)	6 (54.5%)	23 (41.8%)	1.41 (.13)
Screening Outcome				
Final Optimized BSC ^a	5.14 (1.35)	3.91 (2.16)	2.76 (1.62)	12.00 (.24)
≥ 4 items ^a	13 (92.9%)	7 (63.6%)	16 (29.6%)	19.08 (.50)***

FASD: Fetal alcohol spectrum disorder.

Note. ^a The final sample included $n = 53$ in the Not Diagnosed group as a result of missing data on the BSC ($N = 78$). * $p < .05$ ** $p < .01$ *** $p < .001$.

Asante Probation Officer Screening Tool Results

Probation officers and WCC case managers received training and implementation support prior to the study administration, and during data collection. However, implementation challenges were encountered. Respondents felt they had insufficient knowledge or information to accurately complete the tool in many cases, particularly for participants in custody, or only on a bail order, and therefore less well known to corrections. Completed screening forms were only available for 41 participants (51.2% of the total sample). The AST was originally developed for youth probation officers who would arguably have access to more thorough and proximal information about youth under their supervision. In contrast, adult probation officers and case managers felt that they did not have sufficient developmental and mental health information about clients to accurately rate the AST. This outcome highlights the importance of ensuring that screening tool selection corresponds with the availability of information and resources in a given jurisdiction.

Findings from the 41 completed ASTs are outlined in Table 13. Very few social or personal risk factors were endorsed for participants across the groups. Though notably, respondents marked “positive” approximately 26.8% for the PAE/maternal alcohol

problems item. In keeping with findings from the BSC implementation, a history of learning difficulties in school significantly differentiated the groups, despite low endorsement rates overall. Given the low number of items endorsed, general lack of group differences, and limited number of participants screened positive, no further statistical analyses were undertaken. Lessons from an implementation perspective may include focusing the use of a tool like the AST at a stage wherein developmental and clinical histories are being collected, either at the youth justice stage, or, during a more comprehensive presentence or intake evaluation. Coupled with more intensive training and implementation support, this may increase the natural availability of information necessary for the evaluation of the psychometric properties and potential screening utility of the AST and other similar measures in this setting.

Table 13. AST Screening Results

	FASD <i>n</i> (%)	Deferred <i>n</i> (%)	Not FASD <i>n</i> (%)	χ^2 (ϕ)
A. Social Factors				
Maternal Alcohol/Known PAE	4 (40.0%)	1 (33.3%)	7 (25.0%)	.83 (.14)
Adopted	0 (0.0%)	0 (0.0%)	0 (0.0%)	-
Previous foster care/CPS	3 (30.0%)	0 (0.0%)	3 (10.7%)	2.75 (.26)
Sibling with FASD	0 (0.0%)	0 (0.0%)	0 (0.0%)	-
Documented FASD suspected	2 (20.0%)	0 (0.0%)	1 (3.5%)	3.19 (.28)
B. Personal Factors				
Childhood delay	1 (10.0%)	0 (0.0%)	0 (0.0%)	3.18 (.28)
School learning difficulties	2 (20.0%)	3 (100.0%)	2 (7.1%)	16.58 (.64)*
Growth deficiency	0 (0.0%)	0 (0.0%)	1 (3.5%)	.48 (.11)
ADHD Diagnosis	1 (10.0%)	0 (0.0%)	1 (3.5%)	.82 (.14)
Mental Health Diagnosis	0 (0.0%)	1 (33.3%)	3 (10.7%)	1.50 (.19)
Screening Criteria				
Criteria A	1 (10.0%)	0 (0.0%)	1 (3.5%)	.82 (.14)
Criteria B	1 (10.0%)	0 (0.0%)	0 (0.0%)	3.18 (.28)
Any positive screen	1 (10.0%)	0 (0.0%)	1 (3.5%)	.82 (.14)

FASD: Fetal alcohol spectrum disorder; PAE: Prenatal Alcohol Exposure; CPS: Child Protective Services; ADHD: Attention deficit hyperactivity disorder.

Note. $n^{\text{FASD}} = 10$, $n^{\text{Deferred}} = 3$, $n^{\text{Not FASD}} = 28$. Data are described for 41 completed screens (51% of total sample). *n* and % describe “positive” item endorsement (e.g., ‘yes’ vs. “unknown” and “no”). * = $p < .05$.

Mental Health Concerns

Participants provided information about mental health during semi-structured interviews, and via self-report questionnaires (Table 14). Participants were asked to report whether they had been previously diagnosed with a range of mental health disorders, however, it was not possible to confirm whether they had officially received a diagnosis in any given area, or if they had experienced symptoms in that area without receiving a diagnosis. Thus, the following data are summarized as indicators of mental health problems in various symptom areas. Mental health concerns were high across

the sample, with few significant group differences. Rates of difficulties related to depression, anxiety, and post traumatic stress disorder (PTSD) were particularly high, and consistent with the high rates of mental health difficulties reported in other samples of adult offenders in Canada.

In the current sample, rates of learning related problems were also high, and significantly higher in the FASD group relative to those who did not receive a diagnosis. Notably, rates of self-harm and previous suicide attempts were high across the groups, with nearly three-quarters of participants in the FASD group ($n = 10$, 71.4%) endorsing previous self-harm, relative to only a quarter of the Deferred group ($n = 3$, 27.3%) and 40% ($n = 22$) of those who were Not Diagnosed (this trended toward significance). More than half the overall sample endorsed a history of problems related to suicidal ideation, raising concerns about the risk of self-harm and suicide in this sample.

Table 14. Participant Reported Mental Health Concerns

	FASD n (%)	Deferred n (%)	Not FASD n (%)	χ^2 (ϕ)
Depression	9 (64.3%)	5 (45.5%)	37 (67.3%)	1.89 (.15)
Anxiety	6 (42.9%)	5 (45.5%)	32 (58.2%)	1.41 (.13)
PTSD	4 (28.6%)	3 (27.3%)	17 (30.9%)	.74 (.03)
Schizophrenia	0 (0.0%)	0 (0.0%)	1 (1.8%)	.46 (.08)
Psychosis	0 (0.0%)	0 (0.0%)	6 (10.9%)	2.95 (.19)
Bipolar Disorder	1 (7.1%)	2 (18.2%)	4 (7.3%)	1.42 (.13)
OCD	1 (7.1%)	3 (27.3%)	11 (20.0%)	1.82 (.15)
Eating Disorder	0 (0.0%)	1 (10.0%)	2 (3.6%)	1.61 (.14)
ADHD	1 (7.7%)	3 (27.3%)	14 (25.5%)	2.03 (.16)
Other (PD, ODD)	0 (0.0%)	2 (18.2%)	4 (18.2%)	2.49 (.19)
Learning Problems	13 (92.9%)	9 (81.8%)	31 (56.4%)	8.03 (.32)*
Learning Disability	4 (28.6%)	5 (45.5%)	7 (12.7%)	6.92 (.29)*
Self-Harm	10 (71.4%)	3 (27.3%)	22 (40.0%)	5.89 (.27)
Suicidal Thoughts	8 (57.1%)	5 (45.5%)	33 (60.0%)	.79 (.10)
Suicide Attempts	6 (42.9%)	5 (45.5%)	22 (40.0%)	.13 (.04)

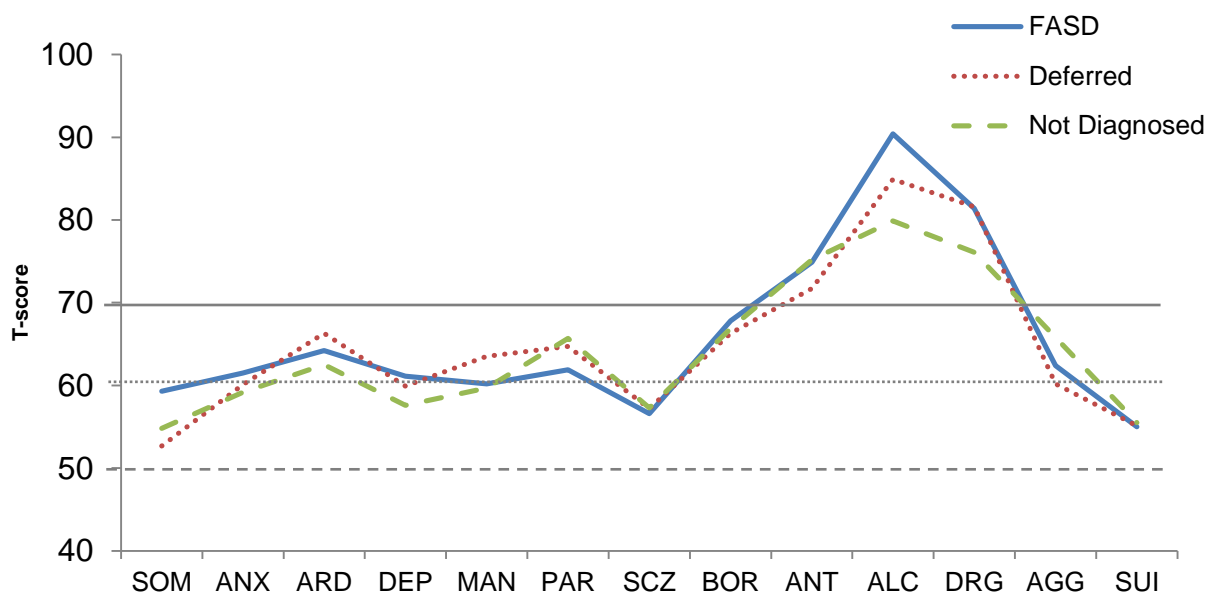
PTSD: Post traumatic stress disorder; ADHD: Attention deficit hyperactivity disorder; OCD: Obsessive Compulsive Disorder; PD: Personality Disorder; ODD: Oppositional Defiant Disorder.

Note. * $p < .05$

Participants completed the Personality Assessment Inventory, a self-report measure designed to assess psychopathology and personality characteristics in adults. Figure 7 displays average PAI scores across the three groups. The PAI provides T-scores, which reflect an index of problem severity for each subscale. A T-score of 50 corresponds with average scores in the Normative sample. Scores \geq T-60 are considered one standard deviation above the normative mean and can be interpreted clinically (84% of respondents will have a score below T-60). Scores \geq T-70 signify

potentially serious clinical concerns (two standard deviations above the mean, 98% of respondents will have scores below T-70). Few group differences across PAI subscales were apparent. Participants with FASD had higher mean scores on the ALC subscale, a scale that screens for problems related to alcohol use (NS). The highest overall sample elevations were found on subscales related to antisocial behaviour, alcohol problems, and drug use problems. Comparing the proportion of participants who scored above T-70 on each subscale (signifying possible clinical concerns), by group, revealed high scores across the overall sample.

Figure 7. PAI T-scores by Group



Note: SOM: Somatic Concerns; ANX: Anxiety; DEP: Depression; MAN: Mania; PAR: Paranoia; SCZ: Schizophrenia; BOR: Borderline features; ANT: Antisocial features; ALC: Alcohol problems; DRG: Drug problems; AGG: Aggression; SUI: Suicidal ideation. T-scores have a mean of T = 50 (long-dashed line) and standard deviation of 10 points. The short-dashed line indicates ≥ 1 standard deviation above the mean. The solid grey line indicates ≥ 2 standard deviations above the mean.

The JSAT is a semi-structured screening interview that includes questions about participants' current mental health and mental health history. Table 15 summarizes mental health data from the JSAT. Most participants reported previously engaging in mental health treatment, and approximately one-third had undergone a previous mental health assessment. A subset of these was reportedly court-ordered. Between one-third and half of participants reported engaging in mental health treatment while in a correctional facility, as well as in the community. Between 7.1% (FASD group) and 18.2% (Deferred group) of participants reported a previous inpatient hospitalization for psychiatric reasons, and between 9.1% (Deferred group) and 27.8% (Not Diagnosed group) had been treated previously with psychiatric medications. Across mental health history variables canvassed by the JSAT, no significant group differences emerged.

Table 15. JSAT Mental Health History

	FASD <i>n</i> (%)	Deferred <i>n</i> (%)	Not FASD <i>n</i> (%)	χ^2 (ϕ)
Treatment	10 (76.9%)	9 (81.8%)	37 (75.5%)	.20 (.05)
Court Ordered	1 (7.1%)	3 (27.3%)	2 (3.7%)	-
Assessment	4 (30.8%)	4 (36.4%)	22 (44.9%)	-
Court Ordered	2 (15.4%)	3 (27.3%)	12 (24.5%)	2.91 (.19)
Correctional Treatment	7 (50.0%)	4 (36.4%)	17 (31.5%)	1.89 (.15)
Past Month	3 (21.4%)	3 (27.3%)	16 (29.6%)	.15 (.76)
Community Treatment	8 (57.1%)	6 (54.5%)	24 (44.4%)	2.38 (.17)
Past Month	0 (0.0%)	0 (0.0%)	5 (9.3%)	-
Inpatient Hospitalization	1 (7.1%)	2 (18.2%)	7 (13.0%)	2.25 (.17)
Past Month	0 (0.0%)	0 (0.0%)	0 (0.0%)	-
Psychiatric Medications	3 (21.4%)	1 (9.1%)	15 (27.8%)	3.04 (.20)
Past Month	1 (7.1%)	1 (9.1%)	10 (18.9%)	2.98 (.20)

FASD: Fetal alcohol spectrum disorder; JSAT: Jail Screening Assessment Tool

Note. *N* = 73 due to missing data for some participants. Percentages are adjusted to reflect *n* for each group.

Participants were also rated by the study psychologist using the BPRS while completing the JSAT. BPRS ratings were completed on a seven-point Likert-scale, ranging from 1 ('not present') to 7 ('extremely severe'). Results are shown in Table 16. Few severe overt mental health symptoms were observed, on average, across symptom areas canvassed. The highest ratings were made on items pertaining to anxiety and depression, with mean ratings ranging from 2 ('very mild') to 3 ('mild'), and no differences between groups. Group differences emerged on two variables. The FASD group was rated higher, on average, on Conceptual Disorganization compared to the Deferred and Not Diagnosed groups. The FASD and Deferred groups were also rated significantly higher in blunted affect compared to the Not Diagnosed group. However, mean ratings for both items fell below 'very mild,' suggesting a low magnitude of symptom expression.

Table 16. BPRS Results by Group

	FASD <i>n</i> (%)	Deferred <i>n</i> (%)	Not FASD <i>n</i> (%)	χ^2 (ϕ)
Somatic Concerns	1.64 (1.04)	1.73 (.79)	1.60 (1.12)	.07 (.002)
Anxiety	3.07 (1.64)	3.64 (1.12)	3.56 (2.08)	.41 (.01)
Depression	2.93 (1.86)	2.36 (1.12)	2.64 (1.93)	.30 (.008)
Suicidality	1.36 (.93)	1.36 (.81)	1.09 (.55)	1.40 (.04)
Guilt	2.29 (.99)	2.45 (1.04)	2.20 (1.08)	.27 (.007)
Hostility	2.36 (1.82)	1.82 (.98)	2.11 (1.26)	.50 (.01)
Elated Mood	1.00 (.00)	1.00 (.00)	1.04 (.19)	.45 (.64)
Grandiosity	1.00 (.00)	1.00 (.00)	1.07 (.38)	.45 (.01)
Suspiciousness	1.50 (.76)	1.19 (.60)	1.45 (.79)	.67 (.02)
Hallucinations	1.07 (.27)	1.00 (.00)	1.05 (.23)	.36 (.009)
Unusual Thoughts	1.07 (.27)	1.00 (.00)	1.09 (.44)	.25 (.007)
Bizarre Behaviour	1.00 (.00)	1.00 (.00)	1.05 (.30)	.41 (.01)
Self-Neglect	1.21 (.58)	1.09 (.30)	1.13 (.51)	.22 (.006)
Disorientation	1.00 (.00)	1.00 (.00)	1.00 (.00)	-
Conceptual Disorg.	1.29 (.47)	1.09 (.30)	1.00 (.00)	9.42 (.20)***
Blunted Affect	1.93 (1.38)	1.91 (1.22)	1.27 (.71)	4.16 (.10)*
Emotional Withdraw	1.21 (.58)	1.00 (.00)	1.22 (.81)	.44 (.01)
Uncooperativeness	1.21 (.58)	1.00 (.00)	1.09 (.55)	.55 (.01)
Excitement	1.21 (.80)	1.00 (.00)	1.25 (.89)	.45 (.01)
Distractibility	1.21 (.58)	1.36 (.67)	1.25 (.70)	.16 (.004)
Mannerisms/Posturing	1.14 (.53)	1.00 (.00)	1.05 (.30)	.62 (.02)

Disorg: Disorganization; BPRS: Brief Psychiatric Rating Scale

Note. * $p < .05$ *** $p < .001$

Finally, the psychologist was asked to consider the totality of the information collected and observed with respect to mental health functioning, and to provide a rating for concerns regarding mental health, ranging from 0 ('no concerns') through 1 ('mild to moderate risk') to 2 ('significant risk'). Across the groups, 10 participants in the FASD group (79.2%), 5 participants in the deferred group (35.7%), and 42 participants (80.8%) in the Not Diagnosed group were rated 'significant risk.' A range of referrals for mental health supports was made during the course of this research. Findings suggest high rates of mental health problems and needs in the current sample. It should be noted that individuals incarcerated at WCC who were experiencing active, overt psychiatric symptoms may have been excluded from participating in the study if their mental status suggested risk to either themselves or the study team. As a result, estimated rates of major mood and psychotic symptoms and disorders (e.g., Schizophrenia) may be lower.

Substance Abuse Concerns

Participants responded to interview questions and standardized self-report measures designed to screen for substance abuse problems (Table 17). As described,

results from the PAI indicated high rates of problems related to both alcohol and drug use across study groups. Participants endorsed high rates of problems related to alcohol use, with the FASD group reported substantially higher rates of problems in this area. Most of the sample reported having previously experienced alcohol-reported “blackouts,” though few reported experiencing alcohol-related seizures. Most of the sample reported a history of problematic drug use, and between 7.7% (FASD group) and 24.5% (Not Diagnosed group) had experienced a prior drug-related overdose. Participant responses on the JSAT concerning substance abuse reinforced high rates of problematic and long-term alcohol abuse, in addition to problems with marijuana and cocaine abuse. Nearly the entire sample screened “high-risk” for substance related problems including abuse or dependency using the SASSI-3, a substance abuse screening inventory. In keeping with high rates of problematic substance use, nearly all participants endorsed having previously engaged in substance use treatment.

The psychologist was also asked to rate concerns with respect to substance use concerns (drugs and alcohol) taking into consideration the totality of the information collected during the course of the study. Ratings were made ranging from 0 (‘no concerns’) through 1 (‘mild to moderate risk’) to 2 (‘significant risk’). Rates of substance use concerns were uniformly high across participants, with “significant risk ratings” made for all participants in the FASD and Deferred groups ($n = 24$; one rating was missing in the FASD group, though that individual received an “at risk” rating on the SASSI and expressed significant substance use patterns), and 50 participants in the Not Diagnosed group (91%). Four participants in the Not Diagnosed group were considered to mild to moderate risk (7%), with only one participant in the overall sample rated with no concerns.

Table 17. Substance Use Problems by Group

	FASD <i>n</i> (%)	Deferred <i>n</i> (%)	Not FASD <i>n</i> (%)	χ^2 (ϕ)
Self-Report^a				
Alcohol abuse	13 (100.0%)	4 (57.1%)	40 (81.6%)	5.92 (.29)
Drinking to blackout	11 (84.6%)	7 (100.0%)	43 (87.8%)	1.12 (.13)
Alcohol related seizures	2 (15.4%)	0 (0.0%)	3 (6.1%)	1.92 (.17)
Drug abuse	13 (100.0%)	7 (100.0%)	41 (83.7%)	3.69 (.23)
Overdose	1 (7.7%)	1 (14.3%)	12 (24.5%)	1.97 (.17)
JSAT^b				
Ever Substance Use	13 (100.0%)	11 (100.0%)	49 (97.9%)	.49 (.08)
Ever Treatment	12 (92.3%)	9 (81.8%)	37 (68.5%)	3.48 (.21)
Alcohol Abuse				
Long-term Severe Abuse	10 (76.9%)	5 (45.5%)	21 (43.7%)	-
Marijuana Abuse				
Long-term Severe Abuse	3 (23.1%)	2 (18.2%)	11 (22.4%)	-
Cocaine				
Long-term Severe Abuse	2 (20.0%)	1 (10.0%)	14 (29.8%)	-
SASSI-3^c				
Screened 'high risk'	13 (100.0%)	11 (100.0%)	53 (96.2%)	.95 (.11)

FASD: Fetal alcohol spectrum disorder; Hx: History; Tx: Treatment

Note: ^a *N* = 69 (Data was missing for 11 participants due to an administration error) ^b *N* varies due to variable missing JSAT data on substance abuse related items (*n* = 59 to *n* = 74). Percentages are adjusted by variable to account for differing sample sizes. ^c *N* = 77, 3 participants provided incomplete data on the SASSI-3.

Adversity, Victimization, and Adverse Outcomes

Participants were asked to report on a range of early life adversities and adverse outcomes (Tables 18 and 19). In keeping with high rates of adversity and victimization experienced by both individuals with FASD, and offenders, participants in the current study reported exceptionally high rates of previous trauma, with no significant differences between the groups. Rates of previous sexual abuse were particularly concerning, and though not significantly different, were higher on visual inspection in the FASD (50.0%) and Deferred (63.6%) groups compared to those who were not diagnosed (35.4%). Three participants reported attending residential schools.

Table 18. Participant Reported Adversity & Victimization

	FASD <i>n</i> (%)	Deferred <i>n</i> (%)	Not FASD <i>n</i> (%)	χ^2 (ϕ)
Physical Abuse	8 (57.1%)	5 (45.5%)	35 (63.6%)	1.32 (.13)
Emotional Abuse	11 (78.6%)	7 (63.6%)	33 (60.0%)	1.66 (.14)
Sexual Abuse	7 (50.0%)	7 (63.6%)	20 (36.4%)	3.18 (.20)
Domestic Violence	11 (78.6%)	6 (54.5%)	30 (54.5%)	2.75 (.19)
Bullying	1 (7.1%)	2 (18.2%)	4 (7.3%)	1.42 (.13)
Foster Care	8 (57.1%)	6 (54.5%)	20 (36.4%)	2.73 (.18)

FASD: Fetal alcohol spectrum disorder.

With respect to adverse outcomes beyond criminal justice system involvement, most of the sample endorsed previous receipt of social assistance or employment insurance. Less than a quarter of participants were employed at study enrolment, and approximately half endorsed problems maintaining stable employment in the past. With respect to education, approximately half the sample endorsed a history of grade failure or repetition, the majority endorsed previous suspensions or expulsions, and the most had not completed high school or a GED. More than half the sample endorsed previous difficulties related to homelessness. While no significant differences emerged between the groups, high rates of current housing instability were evident across participants, with more than one-quarter of participants in the FASD group reporting unstable or current homelessness. Findings underscore high rates of difficulties achieving healthy and independent living among participants, irrespective of diagnostic outcome, and a need for support in these areas.

Table 19. Participant Reported Adverse Outcomes

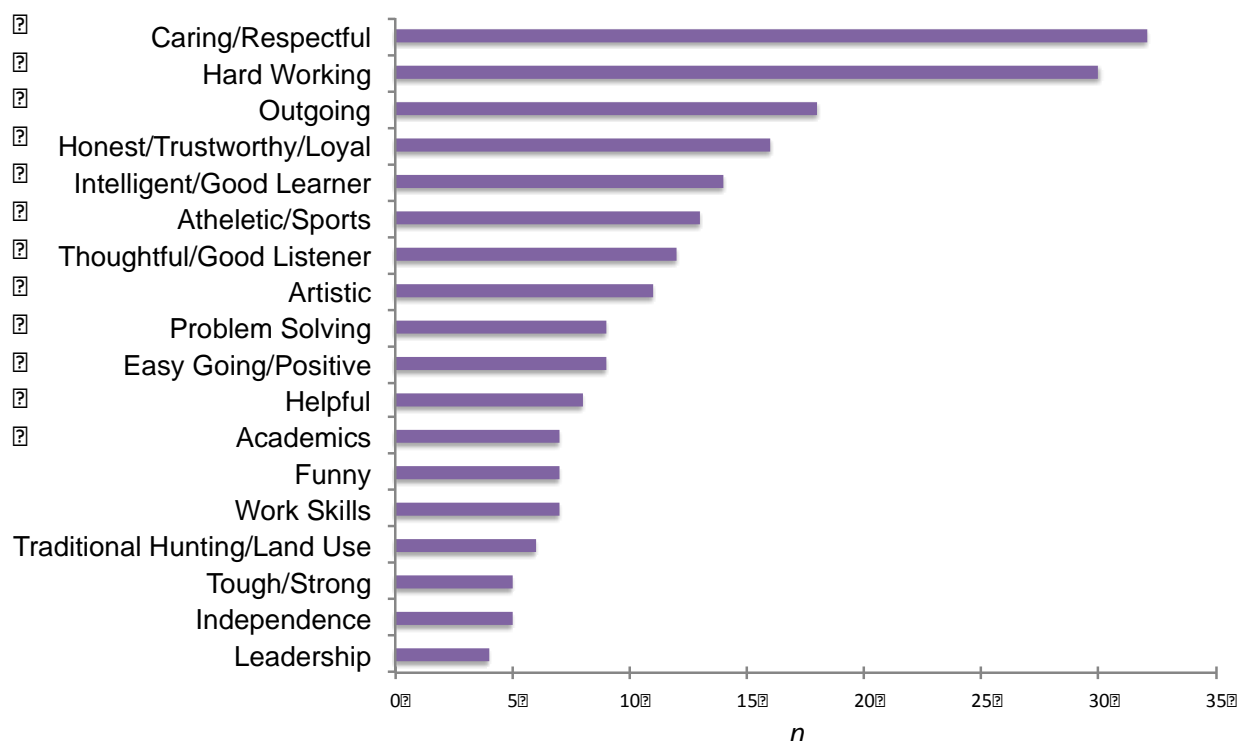
	FASD <i>n</i> (%)	Deferred <i>n</i> (%)	Not FASD <i>n</i> (%)	χ^2 (ϕ)
Employment				
Problems staying employed	7 (50.0%)	3 (27.3%)	30 (54.5%)	2.72 (.19)
Currently employed	3 (21.4%)	5 (45.5%)	8 (14.8%)	5.32 (.26)
Previous SA/EI	12 (92.3%)	9 (100.0%)	41 (77.4%)	3.77 (.22)
Education				
Fail or Repeat Grades	7 (50.0%)	6 (54.5%)	22 (40.0%)	1.06 (.11)
Suspensions or Expulsions	13 (92.9%)	9 (81.8%)	43 (78.2%)	1.58 (.14)
Completed Grade 12/GED	2 (14.3%)	1 (9.1%)	16 (29.1%)	2.86 (.19)
Ever Homeless	9 (64.3%)	6 (54.5%)	32 (58.2%)	.26 (.06)
Current Housing				
Independent/Stable	6 (42.9%)	7 (63.6%)	28 (54.9%)	
With Family	4 (28.6%)	2 (18.2%)	13 (25.5%)	1.27 (.13)
Unstable/homeless	4 (28.6%)	2 (18.2%)	10 (19.6%)	

FASD: Fetal alcohol spectrum disorder; SA: Social Assistance; EI: Employment Insurance

Participant Strengths

Participants were asked to report on their personal strengths using an open-ended response format to capture the full range of possible areas in which they felt they excelled. Responses were coded into categories in an effort to understand key areas of strength across the sample. Group differences did not emerge. The most frequently reported strengths are summarized in Figure 8. Participants emphasized caring and respect for others, and qualities such as being hard working, outgoingness, or extroverted. Responses highlighted the fact that many participants recognized that their best attributes or strengths were present in the absence of substance abuse (e.g., “I’m a caring person when I am sober”). Every participant in the sample was able to identify at least one personal strength, and many emphasized several areas. Though not explicitly evaluated from an empirical perspective, a review of clinical feedback reports highlighted that all participants had areas of relative personal neurocognitive strength. Research has demonstrated the importance of strengths and protective factors in buffering negative outcomes for individuals with FASD (e.g., Rogers, McLachlan, & Roesch, 2013; Streissguth et al., 2004) and the value in taking a resilience or strength-focused approach to intervention. Findings from the current study highlight the importance of carefully assessing a variety of personal strengths for these reasons, and identifying strength-based approaches to supporting individuals with FASD and neurocognitive deficits.

Figure 8. Participant Strengths



Supplementary Gender Analyses

While the proportion of female and male participants in the current sample was consistent with gender representation in the Yukon correctional population, the absolute number of female participants in the current study was low ($n = 12$, 15.0%). This is a challenge commonly faced in correctional research, and by history, has led to women being excluded from research. Given the identified importance of understanding the unique needs of female offenders, we undertook exploratory gender analyses, despite conservative and disproportionate sample size. To preserve confidentiality, analyses are not reported by study group. Briefly, exploratory analyses based on gender were undertaken across a range of study variables, in parallel with those presented in this report. Few significant differences by gender emerged on neurocognitive tests, and these results are not summarized. Table 20 summarizes a range of key findings based on differences between male and female participants on additional variables. Female participants in the current sample experienced significantly higher rates of abuse of all forms except for emotional abuse. Particularly concerning was the exceptionally high rate of sexual abuse experienced by female participants ($n = 10$, 83.3%). Similarly, most women in this study had experienced previous domestic violence ($n = 11$, 91.7%). These findings suggest that trauma may be an important issue to evaluate and consider in the context of correctional supervision for all offenders, but in particular, among women incarcerated at WCC.

In keeping with findings demonstrating higher rates of mental health problems in female offenders compared to males, women in the current study reported significantly higher rates of mental health concerns. The entire sample of women reported concerns related to anxiety and depression, half endorsed difficulties related to PTSD, and three-quarters reported a previous suicide attempt. Women endorsed higher rates of mental health problems relative to men in virtually all areas, except for symptoms related to psychotic disorders (e.g., paranoia, psychosis). Again, findings from this study highlight the importance of mental health screening for all offenders, but in particular, for incarcerated women. Though not significantly different from the high rates of substance abuse problems reported by males in this sample, it bears noting that females reported similarly high rates of problems related to substance use, including high rates of alcohol abuse. Given that the sample comprised women of childbearing age, this finding suggests the need for screening of female offenders who may be at risk of having an alcohol-exposed pregnancy, coupled with clinical plans for how to support women who are identified as being at risk in this regard, to prevent future alcohol exposed pregnancies and support female offenders.

Table 20. Supplemental Analyses by Gender

	Female <i>n</i> (%) <i>M</i> (SD)	Male <i>n</i> (%) <i>M</i> (SD)	χ^2 (ϕ) <i>t</i> (<i>d</i>)
Adversity/Victimization			
Physical Abuse	11 (91.7%)	37 (54.4%)	5.90 (.27)*
Emotional Abuse	10 (83.3%)	41 (60.3%)	2.34 (.17)
Sexual Abuse	10 (83.3%)	24 (35.3%)	9.63 (.35)**
Domestic Violence	11 (91.7%)	36 (52.9%)	6.31 (.28)*
Adverse Outcomes			
Current Employment	0 (0.0%)	16 (23.9%)	3.59 (.21)
Ever Social Assistance/EI	11 (91.7%)	51 (81.0%)	.81 (.10)
Education (\geq HS/GED)	2 (16.7%)	17 (25.0%)	.39 (.53)
# Mental Health Concerns	3.58 (1.68)	1.93 (1.70)	-3.11 (.98)**
Depression	12 (100.0%)	39 (57.4%)	8.03 (.32)**
Anxiety	12 (100.0%)	31 (45.6%)	12.15 (.39)***
PTSD	7 (58.3%)	17 (25.0%)	5.40 (.26)*
Bipolar	3 (25.0%)	4 (5.9%)	4.67 (.24)*
Suicide Attempts	9 (75.0%)	24 (35.3%)	6.64 (.29)*
Suicidal Ideation	8 (66.7%)	38 (55.9%)	.49 (.08)
Personality Assessment Inventory			
SOM	62.58 (10.78)	53.82 (8.93)	-3.03 (.88)**
ANX	67.25 (13.75)	58.41 (10.75)	-2.51 (.72)*
DEP	64.83 (9.92)	57.45 (9.57)	-2.81 (.76)**
ARD	72.33 (12.95)	61.73 (11.89)	-2.45 (.85)*
BOR	73.17 (11.75)	65.87 (10.60)	-2.16 (.65)*
Substance Abuse Concerns			
SR Alcohol Abuse ^a	9 (75.0%)	3 (25.0%)	.59 (.09)
SR Drug Abuse ^a	11 (91.7%)	50 (87.7%)	.15 (.05)
PAI ALC	81.17 (12.60)	82.66 (15.78)	.31 (.10)
PAI DRG	84.00 (17.27)	76.69 (16.58)	-1.40 (.43)
SASSI Screen Positive %	12 (100.0%)	62 (96.9%)	.39 (.53)

EI: Employment Insurance; HS: High school; GED: General Education Development; PTSD: Post traumatic stress disorder; SOM: Somatic Concerns; ANX: Anxiety; DEP: Depression; ARD: Anxiety related disorders; BOR: Borderline features; SR: Self-Report; PAI: Personality Assessment Inventory; ALC: Alcohol problems; DRG: Drug problems; SASSI: Substance Abuse Subtle Screening Inventory.
Note. ^a *n* = 57 for males due to missing data resulting from administration error. * < .05 ** < .01 *** < .001

Summary and Discussion

This study sought to estimate the prevalence of FASD in the Yukon Correctional population. In addition, we evaluated rates of neurocognitive deficits, and mental health and substance use needs, in the offending population. This research represents one of very few studies to examine these issues, and contributes to an important and growing body of evidence highlighting the overrepresentation of adults with FASD in the criminal justice system. Findings from this study were consistent with previous FASD prevalence estimates in corrections. Based on findings from the current study, the estimated rate of FASD in Yukon corrections is 17.5%. However, this could extend as high as 30% with reliable information concerning PAE. This compares to an estimated 1% prevalence in the Canadian general population, and 2-5% in the United States.

The finding that most offenders had identified neurocognitive deficits also warrants attention. The number of individuals who presented with significant intellectual deficits (e.g., IQ <70) was high (34%). While consistent with findings from other correctional populations, the presence of neurocognitive deficits ranging from mild/moderate to severe in the current sample proved nearly uniform. Efforts to identify offenders with pronounced neurocognitive deficits, including those with FASD, will continue to prove important in the context of understanding how those individuals respond to programming and services “as usual” over the course of their contact with the criminal justice system. In keeping with research in other correctional jurisdictions in Canada and internationally, rates of mental health and substance abuse problems were also very high in this sample, particularly in female offenders. Continued efforts to identify individuals at risk of mental health and substance abuse problems, and to connect them with necessary interventions and support services, will prove important in preventing adverse outcomes and improving quality of life.

Another important focus of this research involved prospectively evaluating FASD screening tools developed for correctional populations. Implementation challenges encountered in using the AST in Yukon corrections highlighted the importance of selecting appropriate tools for specific jurisdictions. While the BSC did not yield effective screening outcomes using established criteria, an optimized and abbreviated series of BSC items yielded excellent sensitivity and specificity in identifying both individuals who went on to receive a diagnosis of FASD, as well as those cases where an ultimate diagnostic decision was deferred. Importantly, even individuals who were not diagnosed with FASD, but screened positive using this approach, had higher rates of neurocognitive impairment, suggesting that the optimized BSC may prove a useful tool in identifying individuals with neurocognitive deficits broadly. Further research using this version of the tool will prove important to ensure the reliability and replication of these findings. In addition, screening results indicated that many individuals would “screen positive” and trigger the need for more extensive evaluation.

Given the limited resources that often define the justice-context, future research focused on “secondary screening” that can identify offenders at risk of having more substantial neurocognitive deficits, thus being in most need of high-cost resources, may

prove useful. Access to psychologists able to undertake comprehensive neurocognitive assessments or interdisciplinary FASD assessment teams is typically limited, and should be reserved for those in greatest need of services. While service expansion is also an important focus, efforts to identify a two-stage approach to screening that does not rely on the limited availability of professional service providers may prove helpful in triaging service needs.

Lastly, it is critical to return to one of the earliest points emphasized in this research. Indigenous offenders were overrepresented in our sample, consistent with the overrepresentation of Indigenous offenders in Yukon, and Canadian corrections broadly. By virtue of this overrepresentation, Indigenous offenders were also overrepresented among those who went on to receive an FASD diagnosis and/or clinical Deferral in this study. FASD occurs at high rates in the context of inequitable social determinants of health, and it is important to recognize that there is no cultural or ethnic vulnerability to the disability. Findings from this research emphasize the high degree and complexity of clinical needs inherent not only in offenders with FASD, but in the justice-involved population broadly, including Indigenous persons. Results from this study can be used to inform “next steps” required to identifying appropriate and effective ways to support their needs. Effective responses should be inter-sectoral and focus on the full range of needs presented by individuals with FASD and complex neurocognitive deficits, extending beyond the context of the criminal justice system.

Limitations. This study was conducted using a prospective design and collected a rich array of data in a sample of offenders with FASD that was considered representative of Yukon corrections, and in particular, the population at WCC. However, this research was not without limitations. On the one hand, the conservative nature of our sample size prohibited more sophisticated inferential analyses. It also bears emphasis that our results are best interpreted as estimates, versus absolute prevalence values. However, given the very high rates of key variables of interest across the sample, we believe that confidence can be placed in the generalizability of our findings. Challenges associated with confirming PAE were anticipated, and indeed, this proved difficult over the course of this research. Our ultimate prevalence estimate may prove conservative, given the high number of participants “Deferred” owing to a lack of reliable information about PAE. To the extent that alternative neurobiological markers of PAE and/or FASD can be established, the reliance on confirmation of PAE in adult offenders may be reduced, thereby permitting more precise prevalence estimates. Finally, revised Canadian Guidelines for FASD Diagnosis were published during the course of this research (Cook et al., 2015). These Guidelines use updated diagnostic terminology and criteria, and as such, our findings do not map directly onto the new framework for identifying FASD. Future research and diagnostic efforts in Yukon should incorporate these changes into practice.

Recommendations. This study has demonstrated that offenders with FASD are overrepresented in the Yukon correctional context. In keeping with previous prevalence studies, findings suggest that offenders with FASD present, as a group, with a high degree of cognitive impairment. Few participants in this sample had been previously

assessed for or diagnosed with FASD, suggesting that their difficulties and needs had gone unrecognized and unaddressed. Unlike MacPherson et al. (2011), we did not find a high degree of further unique needs in the FASD sample, but rather, high rates of complex mental health and substance abuse related problems and needs across the entire sample. Unlike the work conducted by CSC however, we did not evaluate criminogenic needs or offending profiles in our diagnostic groups. This will prove an important and additional focus of future research to inform correctional intervention programming based on the Risk-Needs-Responsivity approach. Further, we did not evaluate specifically the way complex neurocognitive disorder could adversely impact problematic outcomes resulting from challenges in other areas (e.g., mental health concerns, substance use) or their success in programming to address these needs. Future research is warranted.

1. Screening and Assessing for FASD and Complex Neurocognitive Deficits.

Given the high rates of FASD and neurocognitive deficits identified in this study, further efforts to validate efficient and cost-effective approaches to FASD screening remains an important goal. Screening continues to play an important role in developing an evidence base to inform offender risks and needs. However, it should be coupled with access to more comprehensive assessment resources in cases of positive screening using validated tools. The sample-optimized BSC may benefit from future evaluation in the Yukon context, in addition to alternative approaches to identifying neurocognitive deficits. Screening cannot replace assessment and diagnosis, which should follow the recently updated Canadian Guidelines for FASD Diagnosis (Cook et al., 2015).

2. Identifying Mental Health and Substance Use Needs. In addition to screening for neurocognitive deficits, the high rates of substance use and mental health related problems demonstrated in this research, in particular potential risk for self-harm, warrants consideration of screening approaches in this area. This may prove particularly important for female offenders in custody, coupled with trauma-focused approaches to screening, assessment, intervention, support, and management in the correctional context.

3. Training and Resource Development. Consistent with recommendations offered by both MacPherson et al. (2011) and Sapers (2016), staff involved in the care and management of offenders with FASD will benefit from training and education about best practices for supporting offenders with FASD and similar complex neurocognitive deficits. Staff should be supported in understanding and accommodating offenders with FASD. Moving forward, developing case plans to modify supervision approach, with an emphasis on inter-sectoral collaborative case management of offenders with FASD, may prove helpful. This may improve responsivity to interventions, and ultimately, create better system-wide outcomes. The Correctional Service of Canada has developed a toolbox that can be used by front line service providers to assist them to adapt programming to match the individualized needs of offenders with FASD. This approach may prove useful to explore in the Yukon context. In addition, developing innovative ways to leverage and connect individuals to services at transition points may prove beneficial (e.g., improving system navigation when offenders enter the justice

system, prepare to leave the correctional environment for a community placement, and upon transition out of a correctional supervision order following desistance from offending). This can occur at the intersection of justice, and other support agencies and branches of government (e.g., social services, disability services, housing, mental health and addictions services, education, NGO supports).

Future Directions. Ultimately, this study provides a wealth of critical information concerning the needs of offenders in Yukon, including those with FASD or at risk of having FASD, along with individuals who have significant neurocognitive deficits. This information can be used in the first step on the path toward developing the best services possible to address the rehabilitation and community safety based needs relevant to offenders in Yukon. Replication of these findings in additional correctional contexts and jurisdictions will add confidence to the stability of prevalence estimates. Given the conservative sample size and low absolute number of adults diagnosed, combining these data with samples drawn from other adult correctional jurisdictions may provide a low-cost method of pooling a larger dataset to explore the needs of these individuals. Confirming the prevalence, characteristics, and needs of individuals with FASD in the criminal justice system in Yukon is important to better assist them while involved in the justice system. However, collaboration with other stakeholders will also prove critical in supporting and addressing their complex needs across health, education, housing, and social welfare domains. A collaborative and intergovernmental/interagency response is necessary to prevent re-offending by this population and promote improved health and wellbeing for individuals, families, and communities in Yukon.

References

- Asante, K. O., & Nelms-Maztke, J. (1985). *Report on the survey of children with chronic handicaps and fetal alcohol syndrome in the Yukon and Northwest British Columbia*. Whitehorse, YK: Council for Yukon Indians.
- Astley, S. J. (2004). *Diagnostic guide for fetal alcohol spectrum disorders: the 4-digit diagnostic code* (3rd ed.). Seattle, WA: University of Washington Publication Services.
- Astley, S. J. (2010). Profile of the first 1,400 patients receiving diagnostic evaluations for fetal alcohol spectrum disorder at the Washington State Fetal Alcohol Syndrome Diagnostic & Prevention Network. *Canadian Journal of Clinical Pharmacology*, 17(1), e132-e164.
- Astley, S. J. (2012). *FAS Facial Photographic Analysis Software Manual: Version 2.0*. Seattle, WA.
- Astley, S. J., & Clarren, S. K. (2001). Measuring the facial phenotype of individuals with prenatal alcohol exposure: correlations with brain dysfunction. *Alcohol and Alcoholism*, 36(2), 147–159. <https://doi.org/10.1093/alcalc/36.2.147>
- Astley, S. J., Stachowiak, J., Clarren, S. K., & Clausen, C. (2002). Application of the fetal alcohol syndrome facial photographic screening tool in a foster care population. *The Journal of Pediatrics*, 141(5), 712–717. <https://doi.org/10.1067/mpd.2002.129030>
- Beaudette, J. N., Power, J., & Stewart, L. A. (2015). *National prevalence of mental disorders among incoming federally-sentenced men offenders (Research Report, R-357)*. Ottawa: ON: Correctional Service of Canada.
- Brown, C. E., & Dunn, W. (2002). *Adolescent/Adult Sensory Profile: User's Manual*. San Antonio, TX: Psychological Corporation.
- Burd, L., Fast, D. K., Conry, J., & Williams, A. (2010). Fetal alcohol spectrum disorder as a marker for increased risk of involvement with correction systems. *The Journal of Psychiatry and Law*, 38(4), 559–583. <http://doi.org/10.1177/009318531003800408>
- Burd, L., Martsof, J. T., & Juelson, T. (2004). Fetal alcohol spectrum disorder in the corrections system: Potential screening strategies. *Journal of FAS International*, 2, e1.
- Burd, L., Selfridge, R. H., Klug, M. G., & Juelson, T. (2003). Fetal alcohol syndrome in the Canadian corrections system. *Journal of FAS International*, 1, 1–7.
- Calhoun, F., & Warren, K. (2007). Fetal alcohol syndrome: Historical perspectives. *Neuroscience and Behavioral Reviews*, 31(2), 168–171. <https://doi.org/10.1016/j.neubiorev.2006.06.023>

- Canada Northwest Research Network. (2007). *The use of Psychoemtric tools for evaluating individuals with FASD: Reaching consensus*.
- Caprara, D. L., Nash, K., Greenbaum, R., Rovet, J., & Koren, G. (2007). Novel approaches to the diagnosis of fetal alcohol spectrum disorder. *Neuroscience and Behavioral Reviews*, 31(2), 254–260.
<https://doi.org/10.1016/j.neubiorev.2006.06.015>
- Chudley, A. E., Conry, J., Cook, J. L., Looock, C., Rosales, T., & LeBlanc, N. (2005). Fetal alcohol spectrum disorder: Canadian guidelines for diagnosis. *Canadian Medical Association Journal*, 172, S1–S21. <http://doi.org/10.1503/cmaj.1040302>
- Chudley, A. E., Kilgour, A. R., Cranston, M., & Edwards, M. (2007). Challenges of diagnosis in fetal alcohol syndrome and fetal alcohol spectrum disorder in the adult. *American Journal of Medical Genetics Part C: Seminars in Medical Genetics*, 145C(3), 261–272. <http://doi.org/10.1002/ajmg.c.30140>
- Clarren, S. K., & Lutke, J. (2008). Building clinical capacity for fetal alcohol spectrum disorder diagnoses in western and northern Canada. *The Canadian Journal of Clinical Pharmacology*, 15(2), e223-37.
- Clarren, S. K., Lutke, J., & Sherbuck, M. (2011). The Canadian guidelines and the interdisciplinary clinical capacity of Canada to diagnose fetal alcohol spectrum disorder. *Journal of Population Therapeutics and Clinical Pharmacology*, 18(3), e494–e499.
- Clarren, S. K., & Smith, D. W. (1978). The fetal alcohol syndrome. *New England Journal of Medicine*, 298, 1063–1067. <http://doi.org/10.1056/nejm197805112981906>
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Hillsdale, NJ: Lawrence Erlbaum.
- Conners, C. K. (2004). *Conner's continuous performance test II: Technical guide*. Toronto, Canada: Multi-Health Systems Inc.
- Conroy, M. A., & Murrie, D. C. (2007). *Forensic assessment of violence risk: A guide for risk assessment and risk management*. Hoboken, New Jersey: Wiley & Sons, Inc..
- Conry, J., & Asante, K. O. (2010). *Youth probation officer's guide to FASD screening and referral*. Asante Centre for Fetal Alcohol Syndrome.
- Conry, J., & Lane, K. A. (2009). *Characteristics of youth on adjudicated probation orders with FASD: Final report to to the department of Justice Canada, Youth Justice Policy and British Columbia Ministry of Children and Family Development*. Maple Ridge, B.C.: Asante Centre.
- Cook, J. L., Green, C. R., Lilley, C. M., Anderson, S. M., Baldwin, M. E., Chudley, A. E., ... Rosales, T. (2015). Fetal alcohol spectrum disorder: a guideline for diagnosis across the lifespan. *Canadian Medical Association Journal*, 188(3), 191-197.
<http://doi.org/10.1503/cmaj.141593>

- Crocker, A. G., Cote, G., Toupin, J., & St-Onge, B. (2007). Rate and characteristics of men with an intellectual disability in pre-trial detention. *Journal of Intellectual and Developmental Disability*, 32(2), 143–152.
- Daniel, W. W. (1999). *Biostatistics: A foundation for analysis in health sciences* (7th Ed.). New York, NY: John Wiley & Sons, Ltd.
- Delis, D. C., Kaplan, E., & Kramer, J. H. (2001). *Delis-Kaplan executive function system*. San Antonio, TX: The Psychological Corporation.
- Delis, D. C., Kramer, J. H., Kaplan, E., & Ober, R. A. (2000). *California Verbal Learning Test (2nd Ed.) Adult Version*. San Antonio, TX: The Psychological Corporation.
- Derkzen, D., Booth, L., McConnell, A., & Taylor, K. (2012). *Mental health needs of federal women offenders. (Research Report R-267)*. Ottawa: ON: Correctional Service of Canada.
- Ernhart, C. B., Morrow-Tlucak, M., Sokol, R. J., & Martier, S. (1988). Underreporting of alcohol use in pregnancy. *Alcoholism Clinical and Experimental Research*, 12(4), 506–511.
- Famy, C., Streissguth, A. P., & Unis, A. S. (1998). Mental illness in adults with fetal alcohol syndrome or fetal alcohol effects. *American Journal of Psychiatry*, 155(4), 552–554. <http://doi.org/10.1111/j.1530-0277.1988.tb00233.x>
- Fast, D. K., & Conry, J. (2009). Fetal alcohol spectrum disorders and the criminal justice system. *Developmental Disabilities Research Review*, 15(3), 250–257. <http://doi.org/10.1002/ddrr.66>
- Fast, D. K., Conry, J., & Looock, C. A. (1999). Identifying fetal alcohol syndrome among youth in the criminal justice system. *Journal of Developmental and Behavioral Pediatrics*, 20(5), 370–372.
- Forrester, P., Davis, C. G., Moser, A., MacPherson, P., Gobeil, R., & Chudley, A. E. (2015). *Assessing fetal alcohol spectrum disorder in women offenders (research report R-346)*. Ottawa, ON: Correctional Service of Canada.
- Fraser, C. (2011). *Methodological Development: Identifying the prevalence of FASD, other neurocognitive disorders, mental disorders, and substance abuse among adult territorial offenders: Yukon Correctional File Review*. Ottawa: ON, Justice Canada.
- Gagnier, K. R., Moore, T. E., & Green, M. (2011). A need for closer examination of FASD by the criminal justice system: has the call been answered? *Journal of Population Therapeutics and Clinical Pharmacology*, 18(3), e426-39.
- Goh, Y. I., Chudley, A. E., Clarren, S. K., Koren, G., Orrbine, E., Rosales, T., & Rosenbaum, C. (2008). Development of Canadian screening tools for fetal alcohol spectrum disorder. *The Canadian Journal of Clinical Pharmacology*, 15(2), e344–66.

- Goldner, E. (2006). *Review: Yukon mental health services*. Burnaby, Canada.
- Green, P. (2003). *Green's Word Memory Test for Windows: User's Manual*. Edmonton, AB: Green's Publishing.
- Hanley, J. A., & McNeil, B. J. (1982). The meaning and use of the area under a receiver operating characteristic (ROC) curve. *Radiology*, 143, 29–36. <http://doi.org/10.1148/radiology.143.1.7063747>
- Harrison, P. L., & Oakland, T. (2003). *Adaptive behavior assessment system (2nd Ed.)*. San Antonio, TX: The Psychological Corporation.
- Hellenbach, M., Karatzias, T., & Brown, M. (2016). Intellectual disabilities among prisoners : Prevalence and mental and physical health comorbidities. *Journal of Applied Research in Intellectual Disabilities*, 30(2), 230-241. <http://doi.org/10.1111/jar.12234>
- Hoyme, H. E., Kalberg, W. O., Elliott, A. J., Blankenship, J., Buckley, D., Marais, A, ... May, P. A. (2016). Updated clinical guidelines for diagnosing fetal alcohol spectrum disorders. *Pediatrics*, 138(2), 1-18. <http://doi.org/10.1542/peds.2015-4256>
- Institute of Health Economics. (2013). *Consensus statement on legal issues of fetal alcohol spectrum disorder (FASD)*. Edmonton, Alberta.
- Johnston, J. C. (2000). Aboriginal federal offenders surveys: A synopsis. *Forum on Correctional Research*, 12, 25–27.
- Jones, K. L., & Smith, D. W. (1973). Recognition of the fetal alcohol syndrome in early infancy. *The Lancet*, 302(7836), 999–1001. [https://doi.org/10.1016/S0140-6736\(73\)91092-1](https://doi.org/10.1016/S0140-6736(73)91092-1)
- Kodituwakku, P., & Kodituwakku, E. (2014). Cognitive and behavioral profiles of children with fetal alcohol spectrum disorders. *Current Developmental Disorders Reports*, 1(3), 149–160. <http://doi.org/10.1007/s40474-014-0022-6>
- Lindsay, W., Haut, F., & Steptoe, L. (2011). Referral patterns for offenders with intellectual disability: a 20-year study. *The Journal of Forensic Psychiatry & Psychology*, 22(4), 513–517. <http://doi.org/10.1080/14789949.2011.594903>
- Lukoff, D., Nuechterlein, K. H., & Ventura, J. (1986). Manual for expanded brief psychiatric rating scale. *Schizophrenia Bulletin*, 12, 594–602.
- MacPherson, P. H., Chudley, A. E., & Grant, B. A. (2014). *Fetal alcohol spectrum disorder (FASD) in a correctional population: Prevalence, screening and diagnosis (Research Report R-247)*. Ottawa: ON: Correctional Service of Canada.
- Mattson, S. N., Crocker, N., & Nguyen, T. T. (2011). Fetal alcohol spectrum disorders: neuropsychological and behavioral features. *Neuropsychology Review*, 21(2), 81–101. <http://doi.org/10.1007/s11065-011-9167-9>

- May, P. A., Baete, A., Russo, J., Elliott, A. J., Blankenship, J., Kalberg, W. O., ... Hoyme, H. E. (2014). Prevalence and characteristics of fetal alcohol spectrum disorders. *Pediatrics*, 134(5), 855–866. doi: 10.1542/peds.2013-3319
- May, P. A., Gossage, J. P., Kalberg, W. O., Robinson, L. K., Buckley, D., Manning, M., & Hoyme, H. E. (2009). Prevalence and epidemiologic characteristics of FASD from various research methods with an emphasis on recent in-school studies. *Developmental Disabilities Research Review*, 15(3), 176–192. <https://doi.org/10.1002/ddrr.68>
- McLachlan, K., Andrew, G., Pei, J., & Rasmussen, C. (2015). Assessing FASD in young children: Exploring clinical complexities and diagnostic challenges. *Journal of Population Therapeutics and Clinical Pharmacology*, (22), e108–e124.
- McLachlan, K. (2012). An examination of the abilities, risks, and needs of adolescents and young adults with fetal alcohol spectrum disorder (FASD) in the criminal justice system. *Dissertation Abstracts International: The Humanities and Social Sciences*.
- McLachlan, K., Rasmussen, C., Oberlander, T. F., Looock, C. A., Pei, J., Andrew, G., ... Weinberg, J. (2016). Dysregulation of the cortisol diurnal rhythm following prenatal alcohol exposure and early life adversity. *Alcohol*, 53, 9-18. <http://doi.org/10.1016/j.alcohol.2016.03.003>
- McLachlan, K., & Roesch, R. (2012). Examining the validity of the Asante FASD screening and referral tool for youth probation officers in justice involved youth. Paper presented at the 13th Annual Fetal Alcohol Canadian Expertise Research Roundtable. Saskatoon, Saskatchewan.
- McLachlan, K., Roesch, R., Vijoien, J. L., & Douglas, K. S. (2014). Evaluating the psycholegal abilities of young offenders with fetal alcohol spectrum disorder. *Law and Human Behavior*, 38, 10-22. <http://doi.org/10.1037/lhb0000037>
- Meyers, J. E., & Meyers, K. R. (1995). *Rey Complex Figure Test and Recognition Trial: Professional manual*. Lutz, FL: Psychological Assessment Resources.
- Miller, F. G., & Lazowski, L. E. (1999). *The SASSI-3 Manual (2nd Ed.)*. Springville: IN: SASSI Institute.
- Morey, L. C. (2007). *Manual for the Personality Assessment Inventory (2nd Ed.)*. Lutz, FL: Psychological Assessment Resources.
- Mossman, D. (1994). Assessing predictions of violence: Being accurate about accuracy. *Journal of Consulting and Clinical Psychology*, 62(4), 783–792. <http://doi.org/10.1037/0022-006X.62.4.783>
- Mullet, J., Fletcher, S., & Hume, A. (2010). *Improving Access to Health Services for Yukon First Nations*. Whitehorse, YK.
- Naing, L., Winn, T., & Rusli, B. N. (2006). Practical issues in calculating the sample size

- for prevalence studies. *Archives of Orofacial Sciences*, 1(1), 9–14.
- Nicholls, T. L., Roesch, R., R. O. J., Olley, M. C., Ogloff, J. R. P., & Hemphill, J. F. (2005). *Jail Screening Assessment Tool (JSAT): Guidelines for Mental Health Screening in jails*. Burnaby, BC: Mental Health Law and Policy Institute, Simon Fraser University.
- O'Connor, M. J., Shah, B., Whaley, S., Cronin, P., Gunderson, B., & Graham, J. (2002). Psychiatric illness in a clinical sample of children with prenatal alcohol exposure. *The American Journal of Drug and Alcohol Abuse*, 28(4), 743–754.
<http://dx.doi.org/10.1081/ADA-120015880>
- Pearson Assessment. (2009). *Advanced clinical Solutions for the WAIS-IV/WMS-IV*. San Antonio, TX: Author.
- Pei, J., Denys, K., Hughes, J., & Rasmussen, C. (2011). Mental health issues in fetal alcohol spectrum disorder. *Journal of Mental Health*, 20(5), 473–483.
<http://doi.org/10.3109/09638237.2011.577113>
- Popova, S., Lange, S., Burd, L., & Rehm, J. (2016). The economic burden of fetal alcohol spectrum disorder in Canada in 2013. *Alcohol and Alcoholism*, 51(3), 367–375. <http://doi.org/10.1093/alcalc/agv117>
- Popova, S., Lange, S., Probst, C., Gmel, G., & Rehm, J. (2017). Estimation of national, regional, and global prevalence of alcohol use during pregnancy and fetal alcohol syndrome: a systematic review and meta-analysis. *The Lancet Global Health*, 5(3), e290–e299. [http://doi.org/10.1016/S2214-109X\(17\)30021-9](http://doi.org/10.1016/S2214-109X(17)30021-9).
- Rasmussen, C., & Bisanz, J. (2009). Exploring mathematics difficulties in children with fetal alcohol spectrum disorders. *Child Development Perspectives*, 3(2), 125–130. DOI: 10.1111/j.1750-8606.2009.00091.x
- Rice, M. E., & Harris, G. T. (1995). Violent recidivism: Assessing predictive validity.
- Rice, M. E., & Harris, G. T. (2005). Comparing effect sizes in follow-up studies: ROC Area, Cohen's d, and r. *Law and Human Behavior*, 29(5), 615–620.
<http://doi.org/10.1007/s10979-005-6832-7>
- Roach, K., & Bailey, A. (2009). The relevance of fetal alcohol spectrum disorder in Canadian criminal law from investigation to sentencing. *University of British Columbia Law Review*, 42, 1.
- Robinson, G. C., Conry, J. L., & Conry, R. F. (1987). Clinical profile and prevalence of fetal alcohol syndrome in an isolated community in British Columbia. *Canadian Medical Association Journal*, 137(3), 203–207.
- Rogers, B. J., McLachlan, K., & Roesch, R. (2013). Resilience and enculturation: Strengths among young offenders with Fetal Alcohol Spectrum Disorder. *The First Peoples Child & Family Review*, 8, 62–80.

- Royal Commission on Aboriginal Peoples. (1993). *The Path to Healing: Report of the National Round Table on Aboriginal Health and Social Issues*. Ottawa: ON: Canadian Government Publishing.
- Sapers, H. (2016). *Annual Report of the Office of the Correctional Investigator 2015-2016*. Ottawa, ON: The Correctional Investigator of Canada.
- Sokol, R. J., Delaney-Black, V., & Nordstrom, B. (2003). Fetal alcohol spectrum disorder. *Journal of the American Medical Association*, 290(22), 2996–2999. doi:10.1001/jama.290.22.2996
- Stade, B., Ali, A., Bennett, D., Campbell, D., Johnston, M., Lens, C., ... Koren, G. (2009). The burden of prenatal exposure to alcohol: Revised measurement of cost. *Canadian Journal of Clinical Pharmacology*, 16, e91-102.
- Stewart, L. A., Wilton, G., & Sapers, J. (2016). Offenders with cognitive deficits in a Canadian prison population: Prevalence, profile, and outcomes. *International Journal of Law and Psychiatry*, 44, 7–14. doi: 10.1016/j.ijlp.2015.08.026
- Streissguth, A. P., Barr, H. M., Kogan, J., & Bookstein, F. L. (1996). *Understanding the occurrence of secondary disabilities in clients with fetal alcohol syndrome (FAS) and fetal alcohol effects (FAE): Final report to the Centers for Disease control and Prevention*. Seattle: University of Washington, Fetal Alcohol and Drug Unit.
- Streissguth, A., Bookstein, F., Barr, H., Sampson, P. D., O'Malley, K., & Young, J. K. (2004). Risk factors for adverse life outcomes in fetal alcohol syndrome and fetal alcohol effects. *Journal of Developmental and Behavioral Pediatrics*, 25(4), 228–238.
- Tait, C. (2003). *Fetal Alcohol Syndrome among Aboriginal People in Canada: Review and Analysis of the Intergenerational Links to Residential Schools*. Ottawa: ON. Retrieved from <http://www.ahf.ca/publications/research-series>
- Turner, A., Crompton, S., & Langlois, S. (2011). *Aboriginal peoples in Canada*. Ottawa, Canada: Statistics Canada.
- Waldram, J. B., Herring, A., & Young, T. K. (2006). *Aboriginal health in Canada: Historical, cultural, and epidemiological perspectives*. Toronto, ON: University of Toronto Press.
- Wechsler, D. (2008). *Wechsler Adult Intelligence Scale (4th ed.)*. San Antonio, TX: Psychological Corporation.
- Wechsler, D. (2009). *Wechsler Memory Scale (4th ed.)*. San Antonio, TX: Pearson.
- Wilkinson, G., & Robertson, G. (2006). *Wide Range Achievement Test 4: Professional Manual*. Lutz, FL: Psychological Assessment Resources.

Appendix A: Neurocognitive Measures

Domain	Measures
Cognition (IQ)	Wechsler Adult Intelligence Scale-IV Similarities, Vocabulary, Information, Block Design, Matrix Reasoning, Visual Puzzles, Digit Span, Arithmetic, Letter-Number Sequencing, Symbol Search, Coding
Academic Achievement	Wide Range Achievement Test – Fourth Edition Word Reading, Sentence Comprehension, Spelling, Math Computation
Memory	Wechsler Memory Scale – 4 th Ed: Logical Memory I & II, Design Memory I & II California Verbal Learning Test – 2 nd Ed. Rey Osterreith Complex Figure Test
Language/Communication	WAIS-IV Vocabulary, Similarities, Information
Attention	Connors' Continuous Performance Test – II WAIS-IV: Digit Span
Executive Functioning	Delis Kaplan Executive Function System: Sorting, Color-Word Interference, Verbal Fluency, Design Fluency, Trails
Adaptive Functioning	ABAS-II
Sensory	Adolescent/Adult Sensory Profile
Validity	Advanced Clinical Solutions for WAIS-IV and WMS-IV
	Word Memory Test
Mental Health and Substance Abuse	Jail Screening Assessment Tool Brief Psychiatric Rating Scale –Expanded Personality Assessment Inventory Personality Assessment Inventory