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Research Paper

Criminal legal system contact in fetal alcohol spectrum disorders (FASD): Experiences and support needs

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ABSTRACT

People with fetal alcohol spectrum disorder (FASD) often receive inadequate supports, which can lead to an increased risk of becoming involved in the criminal legal system (CLS). This study compared the needs of people with prenatal alcohol exposure (PAE)/FASD with and without CLS contact and examined patterns of intervention recommendations across groups. Data was drawn from the Canadian National FASD Database and included 544 people with PAE/FASD (*M* age = 21.1, *SD* = 8.9, 69.1 % male), matched on age, IQ, and sex, in CLS (*n* = 272) and non-CLS (*n* = 272) groups. Several key indicators of CLS contact were identified including having a diagnosis of substance use disorder and experiences of alcohol use/misuse. Recommendations for intervention were more often given for people with CLS contact compared to those without, particularly in respect to mental/physical health and safety needs. Understanding these needs is critical for informing clinical and forensic practice, prevention and intervention planning, and developing and implementing evidence-informed practices to support individuals with FASD.

1. Introduction

Fetal alcohol spectrum disorder (FASD) is a term used to describe the impacts of prenatal alcohol exposure (PAE) on the brain and body (Cook et al., 2016). Though individuals with FASD experience a range of neurodevelopmental differences, both mental and physical health needs, and elevated rates of adversity (Mattson et al., 2019; Tan et al., 2022), clinical guidelines and diagnostic language for PAE and FASD differ widely across the globe. While the Canadian FASD Diagnostic Guidelines (Cook et al., 2016) apply the FASD label in a diagnostic context, other systems use a broader range of terms under a general diagnostic umbrella (Coles et al., 2016), and there is now consideration of neurobehavioral disorder associated with prenatal alcohol exposure in the *Diagnostic and Statistical Manual of Mental Disorders* (5th ed., text rev.; DSM-5-TR; American Psychiatric Association, 2022). Despite these variations, neurodevelopmental impairment remains a hallmark difficulty for individuals with FASD. Importantly, with recognition, understanding, and appropriate support, people with FASD can experience successful developmental trajectories and healthy outcomes (Flannigan, Wrath, Ritter, et al., 2021). However, people with FASD often remain undiagnosed and receive inadequate support, leading to an increased risk for experiencing a range of difficulties, including involvement in the criminal legal system (CLS; McLachlan, Flannigan, et al., 2020; Popova et al., 2020; Streissguth et al., 2004).

It is increasingly understood that people with FASD are overrepresented in the CLS (Flannigan et al., 2018; McLachlan et al., 2019). A limited number of studies in youth and adult correctional and forensic settings have shown rates of FASD ranging from 10 % to 46 %, compared to general population estimates in North America, which range from 2 % to 5 % (Bower et al., 2018; Fast et al., 1999; MacPherson et al., 2011; McLachlan et al., 2019; Mela et al., 2022). Furthermore, studies conducted with adolescents and adults accessing FASD diagnostic services indicate elevated rates of CLS contact (McLachlan, Amlung, et al., 2020; Streissguth et al., 2004). People with FASD also remain under identified and underdiagnosed in both community and CLS settings for several reasons, including a lack of evidence-based assessment and diagnostic

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resources, limited FASD knowledge among clinicians and legal professionals, stigma, and other factors (Flannigan et al., 2018; McLachlan, Amlung, et al., 2020; Pei, Flannigan, et al., 2018; Russell et al., 2021). Therefore, there are likely many more people with FASD in CLS settings than are currently recognized (Mela et al., 2022; Popova et al., 2020).

The overrepresentation of people with FASD in the CLS may result from an interaction of many complex factors including unique and variable neurodevelopmental and psychological profiles (Flannigan et al., 2019; Mattson et al., 2019; Mela et al., 2020), frequent experiences of environmental adversity (McLachlan, Flannigan, et al., 2020; Streissguth et al., 2004), and a lack of appropriate resources and supports (Flannigan et al., 2018; Pei & Burke, 2018). Early seminal work identified being a male or receiving a diagnosis of FASD after the age of 12 (compared to before the age of 12) as potential risk factors for CLS contact in people with FASD (Streissguth et al., 2004), with a small number of studies more recently adding evidence to these findings (Flannigan et al., 2023; McLachlan, Flannigan, et al., 2020). Some researchers have also identified substance use difficulties as an associated factor of CLS contact for people with FASD (Brintnell et al., 2019; Popova et al., 2021). Experiences that have been found to buffer against CLS involvement for people with FASD include having a stable, nurturing home environment, and receiving an early diagnosis of FASD (Currie et al., 2016; McLachlan, Flannigan, et al., 2020; Streissguth et al., 2004).

Once involved in the CLS, some people with FASD may also face additional difficulties compared to those without FASD. These include more complex offending trajectories, gaps in adjudicative competence/rights comprehension, and a greater risk of victimization (MacPherson et al., 2011; McLachlan et al., 2014; Reid et al., 2020). Some of these difficulties may in part be related to impairments in overall neurodevelopmental functioning, which studies have shown to be prominent among people with FASD and CLS contact (e.g., Mela et al., 2020). Higher rates of neurodevelopmental disorders like attention deficit hyperactivity disorder (ADHD) and intellectual disability have also been found for people with FASD and CLS contact compared to those with CLS contact and no FASD (Flannigan et al., 2019; Mela et al., 2022). Furthermore, researchers suggest that youth and adults with FASD in CLS settings experience high rates of physical health concerns (Flannigan, Tremblay, et al., 2022; Reid et al., 2021; Russell et al., 2021) and concurrent mental health disorders (Brintnell et al., 2019; Flannigan, Tremblay, et al., 2022). As people with FASD may experience diverse trajectories, risk factors, and needs relevant to their CLS involvement and well-being, there remains much to learn in order to provide sufficient support.

Although emerging evidence has highlighted many potential needs for people with FASD following diagnosis (Flannigan, Pei, et al., 2022), recommendations for intervention opportunities remain underexplored for those with CLS contact, for whom needs may differ in important ways. For instance, recommendations made at the time of a diagnostic FASD assessment typically address basic and immediate needs and assist clients in accessing appropriate supports and resources (Jirikowic et al., 2010). Common recommendations include accessing mental health supports, having a support worker, and using concrete memory aids (e.g., visual schedules) to assist with daily life (Pei et al., 2017). Though research on recommendations specific to the CLS remains limited among individuals with FASD, Russell et al. (2021) found that disability funding, education support, occupational therapy, and drug and alcohol services were the most common recommendations given following an FASD diagnosis among youth involved in the CLS. Their research also highlighted significant gaps, including inadequate recommendations for speech/language therapy, life skills advice, and clinician education. Improving current understanding of needs and recommendations for those with FASD and CLS contact is critical for informing clinical practice and intervention planning.

1.1. *The current study*

Research focused on understanding the needs of people with FASD experiencing CLS contact remains limited both in respect to scope and sample sizes. These gaps complicate efforts to develop and implement evidence-informed responses, policies, and interventions. The purpose of this study was to compare the experiences and needs of people 12 years and older with PAE/FASD, with and without CLS contact, using a data driven approach. Two primary research aims were examined. We first sought to evaluate differences across six domains of need including neurodevelopmental impairment, neurodevelopmental disorders, mental health disorders, substance use/misuse, physical health, and other difficulties, and whether these differences, when combined, predicted whether or not individuals were experiencing CLS contact at the time of their diagnostic assessment. Second, we examined whether patterns of recommendations for intervention differed, to better inform prevention, and support needs. Since this approach was exploratory, no prior hypotheses were formalized.

2. Materials and methods

2.1. *Study design*

This study employed a cross-sectional cohort matched-groups design using categorical data from the Canadian National FASD Database, an ongoing standardized repository of anonymized clinical and diagnostic findings following an FASD diagnostic assessment from participating clinics across Canada (Cook et al., 2021). Data were extracted in October 2022 and included cases assessed from 2016 onwards, thus aligning with the current Canadian FASD Diagnostic Guidelines (Cook et al., 2016). To create balanced groups, we opted to match on variables shown in the literature to be related to CLS contact, including age, IQ, and sex. Trends in research indicate that contact with the CLS increases throughout adolescence and then typically declines into adulthood (Farrington et al., 2013; Sweeten et al., 2013). Overall intellectual functioning has also been found to be a significant individual level factor associated with CLS contact, in that those with lower abilities have been consistently found to have higher rates of CLS contact compared to those who score higher on tests of intellectual functioning (Beaver et al., 2013). Finally, being male is a known risk factor for being convicted of a crime, and male youth and adults are represented at higher rates in the CLS compared to girls and women (Moffitt, 2018; Starr, 2015). The protocol, research questions, and planned analyses were pre-registered on Open Science Framework (OSF; doi: 10.17605/OSF.IO/GJBM3) and inclusion criteria and sample size are outlined in the supplemental material (supplemental Fig. 1). Ethics approval was obtained from the Ottawa Health Science Network Research Ethics Board (protocol #20160423-01H) and the University of Guelph Research Ethics Board (#19–07-032).

2.2. *Sample*

The sample included people ages 12 years or older with confirmed PAE at or above risk threshold using the Canadian FASD diagnostic guidelines ($\geq$7 standard drinks per week, or $\geq$2 episodes of drinking of $\geq$4 drinks on the same occasion; Cook et al., 2016). Those diagnosed with FASD with sentinel facial features (SFF) were also included as this diagnosis does not require confirmation of PAE given the specificity of the concurrent presentation of all three SFF. CLS-contact was defined as a positive endorsement of currently experiencing either ‘legal problems: offender’ or ‘incarcerated’ (both entered in the Database as ‘yes,’ ‘no,’ or ‘unknown’ or ‘to be followed up after clinic,’ the latter of which were not considered in the current analyses). Cases were excluded if data was missing for age, IQ, sex, diagnostic outcome, or CLS contact.

The final sample ($N = 544$) included adolescents and adults with ($n = 272$) and without ($n = 272$) CLS contact, matched on age, IQ (i.e., assessed categorically as <70; 70; 71 to 85; >85), and sex. The average

Table 1
Sample characteristics and chi-square tests for adolescents and adults with PAE/FASD with and without CLS contact.

	Overall sample $N = 544$	FASD+CLS $n = 272$	FASD-CLS $n = 272$	Overall test	
	n (%)	*n* (%)	*n* (%)	χ^2 (φ)	*p*
Age *M* (*SD*) (range = 12–55)	21.1 (8.9)	21.1 (8.9)	21.1 (8.9)	–	–
IQ					
<70	268 (49.3)	134 (49.3)	134 (49.3)	–	–
70	14 (2.6)	7 (2.6)	7 (2.6)	–	–
71 to 85	196 (36.0)	98 (36.0)	98 (36.0)	–	–
>85	66 (12.1)	33 (12.1)	33 (12.1)	–	–
Sex (*n*, % male)	376 (69.1)	188 (69.1)	188 (69.1)	–	–
Diagnosis					
FASD +SFF	63 (11.6)	28 (10.3)	35 (12.9)	0.88 (0.040)	0.348
FASD -SFF	378 (69.5)	189 (69.5)	189 (69.5)	–	–
At risk NDD/FASD	10 (1.8)	4 (1.5)	6 (2.2)	0.41 (0.027)	0.523
Not FASD	93 (17.1)	51 (18.8)	42 (15.4)	1.05 (0.044)	0.305
Living Situation (*n* = 543)					
Independent	72 (13.3)	33 (12.2)	39 (14.3)	0.55 (0.032)	0.458
Biological parent(s)	112 (20.6)	53 (19.6)	59 (14.3)	0.38 (0.026)	0.539
Other family	95 (17.5)	30 (11.1)	65 (23.9)	15.47 (0.169)	<0.001
Foster care	67 (12.3)	27 (10.0)	40 (14.7)	2.82 (0.072)	0.093
Adoptive parent(s)	50 (9.2)	14 (5.2)	36 (13.2)	10.57 (0.140)	0.001
Group home	42 (7.7)	34 (12.5)	8 (2.9)	17.55 (0.180)	<0.001
Unhoused	18 (3.3)	13 (4.8)	5 (1.8)	3.71 (0.083)	0.054
In custody	45 (8.3)	45 (16.6)	0 (0.0)	–	–
Other	42 (7.7)	22 (8.1)	20 (7.4)	0.11 (0.014)	0.739
Assessment Type (*n* = 543)					
Initial assessment	473 (87.1)	248 (91.2)	225 (83.0)	8.03 (0.122)	0.005
Re-assessment	46 (8.5)	17 (6.3)	29 (10.7)	3.47 (0.080)	0.063
Follow-up	24 (4.4)	7 (2.6)	17 (6.3)	4.40 (0.090)	0.036
Referral Source (*n* = 535)					
Social services	239 (44.7)	113 (42.2)	126 (47.2)	1.37 (0.051)	0.242
Medical referral	48 (9.0)	12 (4.5)	36 (13.5)	13.28 (0.158)	<0.001
Education system	15 (2.8)	6 (2.2)	9 (3.4)	0.63 (0.034)	0.428
Legal system	95 (17.8)	93 (34.7)	2 (0.7)	105.58 (0.444)	<0.001
Self-referral	32 (6.0)	13 (4.9)	19 (7.1)	1.22 (0.048)	0.269
Family referral	92 (17.2)	25 (9.3)	67 (25.1)	23.35 (0.209)	<0.001
Other	14 (2.6)	6 (2.2)	8 (3.0)	0.30 (0.024)	0.583
Referral Reason (*n* = 544)					
Behavioural issues	335 (61.6)	186 (68.4)	123 (45.2)	10.64 (0.140)	0.001
Learning difficulties	295 (54.2)	120 (44.1)	175 (64.3)	22.40 (0.203)	<0.001
Difficulties with the law	217 (39.9)	206 (75.7)	11 (4.0)	291.52 (0.732)	<0.001
Developmental delays	82 (15.1)	40 (14.7)	42 (15.4)	0.06 (0.010)	0.811
Adaptive living problems	228 (41.9)	108 (39.7)	120 (44.1)	1.09 (0.045)	0.297
Confirmed PAE	378 (69.5)	193 (71.0)	185 (68.0)	0.56 (0.032)	0.456
Social skills difficulties	212 (39.0)	100 (36.8)	112 (41.2)	1.11 (0.045)	0.291
Self-regulation difficulties	195 (35.8)	96 (35.3)	99 (36.4)	0.07 (0.011)	0.789
Reassessment	31 (5.7)	8 (2.9)	23 (8.5)	7.70 (0.119)	0.006
Follow-up	25 (4.6)	9 (3.3)	16 (5.9)	2.05 (0.061)	0.152
Eligibility for supports	246 (45.2)	117 (43.0)	129 (47.4)	1.07 (0.044)	0.301
Other	75 (13.8)	31 (11.4)	44 (16.2)	2.61 (0.069)	0.106
Region (*n* = 544)					
BC and North	15 (2.8)	13 (4.8)	NR	8.30 (0.123)	0.004
Prairies	430 (79.0)	208 (76.5)	222 (81.6)	2.17 (0.063)	0.140
Central	73 (13.4)	38 (14.0)	35 (12.9)	0.14 (0.016)	0.706
Atlantic	26 (4.8)	13 (4.8)	13 (4.8)	–	–

Note. *N*s are reported for each variable indicating the number of valid cases, due to missing data. For chi-square analyses, phi (φ) is reported as an effect size. NR = specific rates are not reported due to small sample sizes. No chi-square results are reported for Diagnosis 'FASD-SFF' and Assessment Region 'Atlantic' because both groups have an equal number of cases. Abbreviations: IQ = intelligence quotient; FASD = fetal alcohol spectrum disorder; SFF = sentinel facial features; NDD = neurodevelopmental disorder; BC = British Columbia.

age for the overall sample was 21.1 years, just over half were adolescents, and a large portion were male. Most were diagnosed with FASD, with diagnostic differences between the CLS/no-CLS groups (Table 1). Roughly half had an IQ < 70. The attributes of the present overall sample closely matched those previously reported for adolescent and adult subsets of the National FASD Database (Flannigan et al., 2023; McLachlan, Flannigan, et al., 2020); the exception being sex at birth, where there was a slightly greater representation of males in the present sample than in other studies using the database.

2.3. Domains assessed

Six domains of needs were examined given their potential relevance to CLS contact, based on experiences known at the time of diagnostic assessment. Table 2 outlines the domains, and the indicator variables contained within each domain. The neurodevelopmental impairment domain comprised the ten areas of functioning assessed during a diagnostic assessment for FASD following the Canadian Guidelines (Cook et al., 2016), entered into the Database categorically (significant impairment, not impaired, with data entered as 'not assessed' or 'incomplete' not considered in analyses).[1] The neurodevelopmental (e.g., intellectual disability, ADHD) and mental health disorders domains (e.g., anxiety disorder, mood disorder, substance use disorder) included diagnosed disorders and symptoms, entered categorically as either assessed and diagnosed/not diagnosed, or not assessed (and thus not considered in analyses). The substance use/misuse domain included variables entered categorically as 'yes,' 'no,' or 'unknown' (and thus not considered in the current analyses) and comprised experiences of alcohol use/misuse, substance use/misuse (coded for the current study as a composite of any use/misuse of marijuana, opiates, solvents, crack, and/or other substances), and current substance use treatment (coded for the current study as a composite of any alcohol, tobacco, marijuana, and/or other accessed substance treatment(s)). The physical health domain included a range of health conditions (e.g., sleep problems, sensory sensitivities), entered categorically as either present or absent ('yes,' or 'no'). The difficulties domain included adverse experiences and other emergency needs (e.g., legal problems as a victim, school expulsion/suspension), entered categorically as 'yes,' 'no,' or 'unknown' or 'to be followed up after clinic,' the latter of which were not considered in the current analyses. Two variables signaling experiences of trauma, entered dichotomously ('yes,' 'no'), were coded for the current study as a composite of postnatal trauma and/or other trauma experiences.

2.4. Recommendations

Recommendations across ten broad areas were defined using the 'Towards Healthy Outcomes' framework (THO; Pei et al., 2019), a model that describes areas for support and intervention for people with FASD, including a) mental/physical health, b) education (system intervention or specialists recommended), c) community engagement, d) decision making supports, e) daily living supports, f) safety, g) employment, h) family cohesion, i) legal supports, and j) other supports. Recommendations were entered into the Database categorically as 'yes,' 'no,' or 'yes, but service not available.' For the current study, we coded recommendations as present (recommended or recommended, but service not available) or absent (not recommended).

2.5. Analyses

Descriptive statistics were used to characterize the sample for both continuous and categorical data. Only variables with >50 % known data were included for analysis. Results from Little's (1988) Missing Completely at Random (MCAR) test indicated that the pattern of missing data used for the current study was systematic, so all cases were retained without use of imputation, and cases were excluded within specific analyses. Most variables were entered into the Database categorically. Variables for the current study were generally treated dichotomously, using only known data for the numerator and denominator, excluding unknown and missing data, or factors as 'not assessed,' within each analysis. Preliminary analyses examined possible regional differences between the CLS contact and no-CLS contact groups. Although differences emerged indicating that significantly more people with CLS contact came from British Columbia and the Northern Territories compared to those with no-CLS contact, findings from subsequent mixed effects logistic regression models indicated that region did not account for a significant amount of variance between the two groups across variables and domains. Therefore, as a departure from pre-registered analyses, chi-square analyses and logistic regressions were conducted to examine differences between the two groups, without controlling for region.

We first evaluated differences between individuals with and without CLS contact for each indicator variable within a given domain, using chi-square analyses. Second, for each domain, indicator variables that differed significantly ($p < .05$) in the first step were included as predictors in a series of logistic regressions to identify those that significantly predicted group membership (CLS vs. no-CLS contact) with consideration for other indicators in the same domain. Third, we identified whether indicators that remained significant at step 2, across domains of need, predicted group membership (CLS vs. no-CLS contact) via a final logistic regression. For each logistic regression, all variables were entered simultaneously in a single block. Last, differences in recommendations between people with and without CLS contact were evaluated using chi-square analyses. A false discovery rate (FDR) correction of 10 % using the Benjamini and Hochberg (1995, 2000) method was used for all chi-square analyses given the number of comparisons. For chi-square analyses, phi (φ) is reported as an effect size and for logistic regressions, odds ratios and 95 % confidence intervals are reported. All analyses were conducted using IBM SPSS version 28 for Mac.

3. Results

3.1. Sample characteristics

Several differences emerged between the CLS and no-CLS contact groups (Table 1; Fig. 1). Significantly more people with CLS contact lived in a group home, and fewer lived with other family members and adoptive parents, compared to the no-CLS group. Although most of the sample was accessing FASD assessment services for the first time, significantly more people with CLS contact were receiving initial diagnostic services compared to those without CLS contact. Significantly more people with CLS contact were referred for a diagnostic assessment due to behavioural issues, and fewer were referred for learning difficulties or for reassessment, compared to those with no-CLS contact.

3.2. Within domain comparisons

3.2.1. Neurodevelopmental impairment

People with CLS contact experienced significantly higher rates of impairment in adaptive functioning, and lower rates of impairment in academic achievement, compared to those without CLS contact (Table 2). Fewer people with CLS contact had severe impairment in the neuroanatomy and neurophysiology domain, compared to those without CLS contact. Logistic regression results indicated that adaptive functioning and academic achievement each significantly predicted group membership (Table 3). Individuals with severely impaired adaptive functioning were 2.5 times more likely to have CLS contact compared to those without severe impairment in this area. Alternatively, people with severe impairments in academic achievement were 0.5 times more likely to belong to the no-CLS contact group compared to people without similar deficits.

3.2.2. Neurodevelopmental disorders

Although there were high rates of intellectual disability and attention deficit disorder (ADD)/ADHD across the sample, no differences emerged between the two groups across indicators.

3.2.3. Mental health disorders

People with CLS contact were more likely to be diagnosed with mood disorders, substance use disorders, and to have experienced suicide attempts/ideation, compared to the no-CLS contact group. However, logistic regression results indicated that only substance use disorder independently predicted membership to the CLS contact group; people with a diagnosis of substance use disorder were 4.7 times more likely to have CLS contact compared to those without this diagnosis.

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[1] 'Severe impairment' was assessed by the diagnostic team and is defined for each domain of functioning. Specifically, the Canadian Diagnostic Guidelines define severe impairment as "a global score or a major subdomain score on a standardized neurodevelopmental measure that is ≥ 2 standard deviations below the mean, with appropriate allowance for test error" (Cook et al., 2016 p. 193).

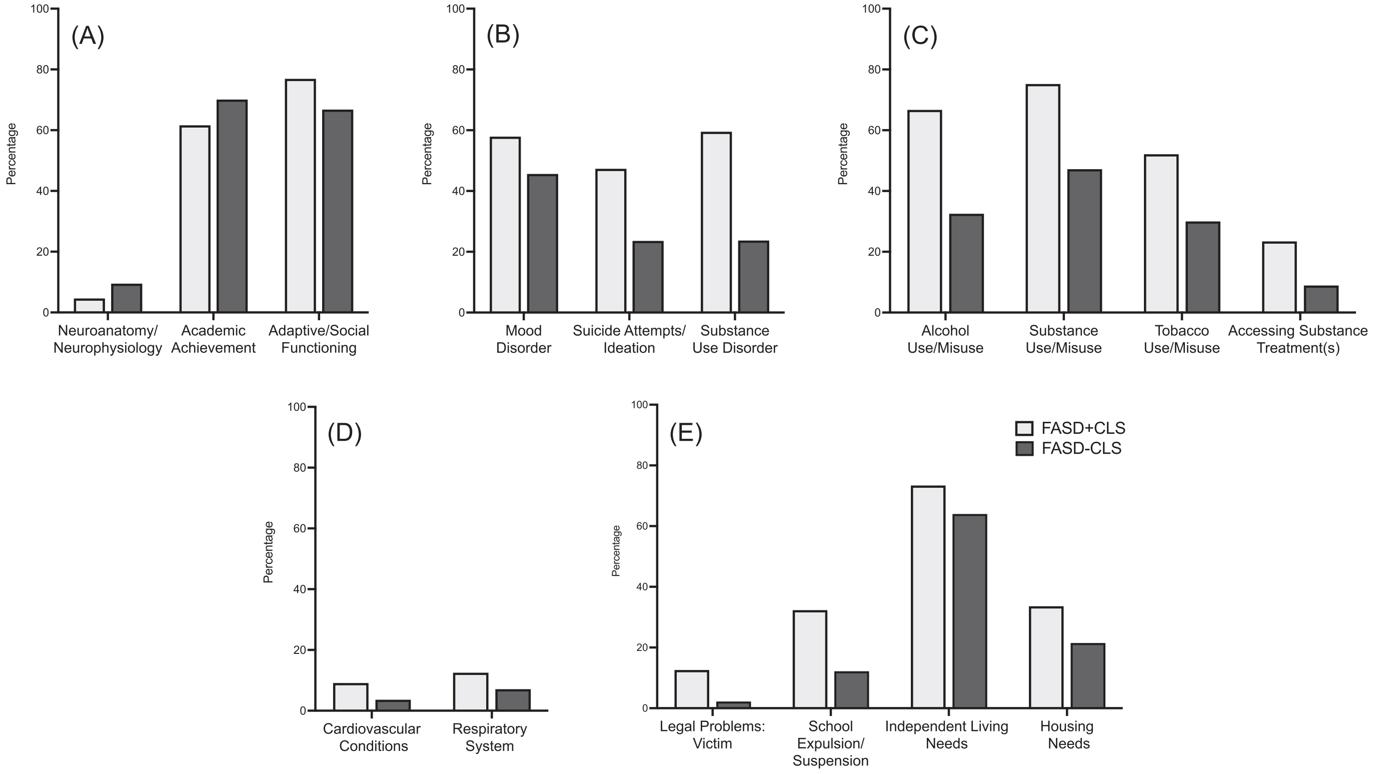

Fig. 1. Percentage of people experiencing (A) neurodevelopmental impairment, (B) mental health disorders, (C) substance use/misuse, (D) physical health, (E) difficulties, differing significantly by CLS or no-CLS contact.

3.2.4. *Substance use/misuse*

The CLS contact group had higher rates of alcohol use/misuse, substance use/misuse, and tobacco use/misuse, compared to the no-CLS contact group. Similarly, significantly more people in the CLS contact group were accessing substance treatment, compared to the no-CLS contact group, although rates were low for both groups given the identified rates of substance use/misuse. Logistic regression results indicated only alcohol use/misuse predicted membership into the CLS contact group; people with identified alcohol use/misuse were 2.5 times more likely to have CLS contact compared to those without this difficulty.

3.2.5. *Physical health*

People with CLS contact had significantly higher rates of cardiovascular conditions, respiratory system conditions, and infectious diseases, compared to the no-CLS contact group. Logistic regression results indicated that only cardiovascular conditions independently predicted membership into the CLS contact group; people with cardiovascular conditions were 2.7 times more likely to have CLS contact than people without those needs.

3.2.6. *Difficulties*

People with CLS contact were significantly more likely to have been a victim of a crime, experienced school expulsion/suspension, and needed help with both independent living and housing, compared to those in the no-CLS contact group. Logistic regression results revealed that being a victim of a crime, and experiencing school expulsion or suspension, each independently predicted membership into the CLS contact group; people who were a victim of crime were 4.3 times more likely to have had CLS contact and those who experienced school expulsion or suspension were 2.3 times more likely to have CLS contact, compared to people who had not experienced these difficulties. However, few individuals in this sample had experienced crime victimization (n = 38, 7.3 %), likely impacting the stability and power of this result, suggesting a need for cautious interpretation.

3.3. *Cross domain comparisons*

Results from the final combined logistic regression model indicated that a diagnosis of substance use disorder, experiences of alcohol use/misuse, and legal problems as a victim, each independently predicted membership into the CLS contact group. Specifically, people who were diagnosed with substance use disorder were 4.2 times more likely to have CLS contact, those with alcohol use/misuse were 2.1 times more likely to have CLS contact, and those experiencing legal problems as a victim were 3.9 times more likely to have CLS contact, compared to those without these needs (Table 4).

3.4. *Recommendations*

Several recommendations were given to the CLS contact group at significantly higher rates compared to the no-CLS contact group (Table 5). Within mental and physical health recommendations, therapy for substance use, medication/psychopharmacology, and anger management services, were recommended at higher rates to the CLS contact group compared to the no-CLS contact group. Coaching as a form of community engagement was also recommended more to people in the CLS contact group than to those in the no-CLS contact group. The CLS contact group was also more likely to receive recommendations around safety including accessing foodbank support, child protection, and emergency housing, compared to those without CLS contact. Last, legal supports were more often recommended to the CLS contact group compared to the no-CLS contact group, including accessing legal aid, services for civil court issues, and other legal services.

4. Discussion

The aim of this study was to compare the needs and intervention

Table 2
Differences in indicators among adolescents and adults with PAE/FASD with and without CLS contact.

	Overall sample	FASD+CLS	FASD-CLS	Overall test	
	$N = 544$	$n = 272$	$n = 272$		
	n (%)	*n* (%)	*n* (%)	χ^2 (φ)	*p*
Neurodevelopmental impairment					
Motor skills ($n = 487$)	106 (21.8)	45 (19.0)	61 (24.4)	2.09 (0.066)	0.148
Neuroanatomy/neurophysiology ($n = 460$)	32 (7.0)	11 (4.6)	21 (9.5)	4.15 (0.095)	0.042
Cognition (IQ) ($n = 537$)	357 (66.5)	179 (66.8)	178 (66.2)	0.02 (0.007)	0.879
Language ($n = 517$)	197 (38.1)	99 (38.8)	98 (37.4)	0.11 (0.015)	0.740
Academic achievement ($n = 531$)	350 (65.9)	162 (61.6)	188 (70.1)	4.32 (0.090)	0.038
Memory ($n = 525$)	271 (51.6)	129 (48.7)	142 (54.6)	1.85 (0.059)	0.174
Attention ($n = 523$)	334 (63.9)	170 (65.1)	164 (62.6)	0.37 (0.026)	0.546
Executive function ($n = 532$)	360 (67.7)	183 (69.1)	177 (66.3)	0.47 (0.030)	0.495
Affect regulation ($n = 504$)	252 (50.0)	133 (53.2)	119 (46.9)	2.03 (0.063)	0.154
Adaptive/social ($n = 533$)	383 (71.9)	206 (76.9)	177 (66.8)	6.69 (0.112)	0.010
Neurodevelopmental disorders					
Intellectual disability ($n = 487$)	247 (50.7)	124 (49.6)	123 (51.9)	0.26 (0.023)	0.612
ADD/ADHD ($n = 485$)	304 (62.7)	160 (66.1)	144 (59.3)	2.44 (0.071)	0.119
DCD ($n = 364$)	35 (9.6)	15 (8.2)	20 (11.0)	0.85 (0.048)	0.356
Language disorder ($n = 455$)	146 (32.1)	73 (32.6)	73 (31.6)	0.05 (0.011)	0.822
Mental health disorders					
Anxiety disorder ($n = 359$)	155 (43.2)	83 (46.4)	72 (40.0)	1.48 (0.064)	0.223
Mood disorder ($n = 328$)	169 (51.5)	92 (57.9)	77 (45.6)	4.96 (0.123)	0.026
Suicide attempts/ideation ($n = 330$)	118 (35.8)	80 (47.3)	38 (23.6)	20.22 (0.248)	<0.001
Attachment disorder ($n = 327$)	30 (9.2)	18 (11.2)	12 (7.2)	1.53 (0.068)	0.216
Substance use disorder ($n = 320$)	136 (42.5)	100 (59.5)	36 (23.7)	41.94 (0.362)	<0.001
Substance use/misuse					
Alcohol use/misuse ($n = 428$)	213 (49.8)	144 (66.7)	69 (32.5)	49.82 (0.341)	<0.001
Substance use/misuse ($n = 436$)	267 (61.2)	164 (75.2)	103 (47.2)	35.95 (0.287)	<0.001
Tobacco use/misuse ($n = 372$)	149 (40.1)	88 (52.1)	61 (30.0)	18.63 (0.224)	<0.001
Accessing substance treatment(s) ($n = 451$)	71 (15.7)	50 (23.4)	21 (8.9)	17.83 (0.199)	<0.001
Physical health					
Sleep problems ($n = 544$)	226 (41.5)	121 (44.5)	105 (38.6)	1.94 (0.060)	0.164
Sensory sensitivities ($n = 544$)	152 (27.9)	74 (27.2)	78 (28.7)	0.15 (0.016)	0.702
Sensory processing ($n = 544$)	144 (26.5)	73 (26.8)	71 (26.1)	0.04 (0.008)	0.846
Congenital malformations ($n = 412$)	32 (7.8)	18 (8.5)	14 (7.0)	0.35 (0.029)	0.553
Neurological conditions ($n = 512$)	33 (6.4)	13 (5.0)	20 (7.9)	1.77 (0.059)	0.184
Head and neck issues ($n = 521$)	25 (4.8)	16 (6.0)	9 (3.5)	1.71 (0.057)	0.191
Cardiovascular conditions ($n = 515$)	33 (6.4)	24 (9.1)	9 (3.6)	6.62 (0.113)	0.010
Respiratory system ($n = 518$)	51 (9.8)	33 (12.5)	18 (7.1)	4.27 (0.091)	0.039
Endocrinological conditions ($n = 518$)	17 (3.3)	8 (3.0)	9 (3.6)	0.12 (0.015)	0.731
Musculoskeletal issues ($n = 514$)	82 (16.0)	39 (14.9)	43 (17.0)	0.40 (0.028)	0.525
Infectious diseases ($n = 511$)	9 (1.8)	8 (3.1)	NR	5.19 (0.101)	0.023
Difficulties					
Legal problems: victim ($n = 524$)	38 (7.3)	32 (12.6)	6 (2.2)	21.18 (0.201)	<0.001
School expulsion/suspension ($n = 497$)	112 (22.5)	83 (32.3)	29 (12.1)	29.04 (0.242)	<0.001
Employment problems ($n = 497$)	238 (47.9)	127 (51.2)	111 (44.6)	2.19 (0.066)	0.139
Independent living needs ($n = 499$)	343 (68.7)	185 (73.4)	158 (64.0)	5.18 (0.102)	0.023
Housing needs ($n = 507$)	140 (27.6)	86 (33.6)	54 (21.5)	9.25 (0.135)	0.002
Trauma ($n = 544$)	332 (61.0)	176 (64.7)	156 (57.4)	3.09 (0.075)	0.079
Sexual or physical abuse ($n = 544$)	162 (29.8)	86 (31.6)	76 (27.9)	0.88 (0.040)	0.348

Note. *Ns* are reported for each variable indicating the number of valid cases, due to missing data. NR = specific rates are not reported due to small sample sizes. All chi-square results are significant after FDR correction for multiple comparisons (1/41*0.10 = 002; Benjamini & Hochberg, 1995, 2000). Abbreviations: ADD = attention deficit disorder; DCD = developmental coordination disorder; ADHD = attention deficit hyperactivity disorder.

recommendations of people with PAE/FASD with and without CLS contact to better understand and support these groups. Diagnosis of substance use disorder and experiences of alcohol use/misuse emerged as strong predictors of CLS contact, suggesting their importance in future research and clinical practice related to supporting healthy outcomes for people with FASD. People with PAE/FASD and CLS contact also received recommendations for many different intervention services which acknowledges a need for tailored support for this population (Currie et al., 2016; Flannigan, Tremblay, et al., 2022). Our findings add to a limited body of evidence demonstrating the needs of adolescents and adults with FASD who have CLS contact in key areas, such as substance use/misuse, crime victimization, school-related difficulties, mental and physical health needs, and adaptive functioning.

Consistent with research linking substance use to CLS contact (including for those with FASD), this study found high rates of substance use disorders, use/misuse of alcohol and other substances across the sample (Flannigan, McMorris, et al., 2021 McLachlan, Flannigan, et al., 2020; Streissguth et al., 2004). However, concerningly few people were accessing substance use treatment at the time of their assessment. Several barriers may factor into low treatment rates, including limited availability of general and FASD-informed substance use services, exclusion from services due to FASD and/or CLS contact, and individuals themselves not wanting to access treatment (Flannigan et al., 2020; McLachlan et al., 2013; Owens et al., 2018). FASD-informed strategies can increase successful outcomes in treatment and may include tailoring content and delivery to include hands-on experiences and helping front line staff "re-frame" the way they work with and respond to people with FASD (Kapasi et al., 2022; Olson et al., 2023; Passmore et al., 2021). Adolescents represented more than half of this sample, adding weight to the importance of providing early and structured FASD-informed

Table 3
Logistic regressions with significant indicators among adolescents and adults with PAE/FASD with and without CLS contact.

	B (SE)	Wald	*p*	Odds Ratio (95 % CI)
Neurodevelopmental impairment (*n* = 445)				
Neuroanatomy/neurophysiology	0.69 (0.39)	3.05	0.081	0.50 (0.23, 1.09)
Academic achievement	0.65 (0.22)	8.93	0.003	0.52 (0.34, 0.80)
Adaptive/social	0.91 (0.23)	15.40	<0.001	2.48 (1.57, 3.89)
Mental health disorders (*n* = 258)				
Mood disorder	0.15 (0.28)	0.30	0.587	1.17 (0.67, 2.02)
Suicide attempts/ideation	0.37 (0.31)	1.37	0.242	1.44 (0.78, 2.66)
Substance use disorder	1.54 (0.30)	25.68	<0.001	4.66 (2.57, 8.45)
Substance use/misuse (*n* = 366)				
Alcohol use/misuse	0.90 (0.29)	9.77	0.002	2.46 (1.40, 4.34)
Substance use/misuse	0.33 (0.29)	1.31	0.253	1.39 (0.79, 2.46)
Tobacco use/misuse	0.32 (0.29)	1.27	0.260	1.38 (0.79, 2.41)
Accessing substance treatment(s)	0.61 (0.39)	2.40	0.121	1.83 (0.85, 3.94)
Physical health (*n* = 508)				
Cardiovascular conditions	1.01 (0.45)	4.99	0.025	2.74 (1.13, 6.65)
Respiratory system	0.58 (0.35)	2.77	0.096	1.79 (0.90, 3.53)
Infectious diseases	1.77 (1.08)	2.69	0.101	5.86 (0.71, 48.54)
Difficulties (*n* = 445)				
Legal problems: victim	1.46 (0.51)	8.20	0.004	4.30 (1.58, 11.64)
School expulsion/suspension	0.82 (0.26)	10.23	0.001	2.27 (1.37, 3.76)
Independent living needs	0.29 (0.22)	1.78	0.182	1.33 (0.87, 2.03)
Housing needs	0.43 (0.23)	3.62	0.057	1.54 (0.99, 2.41)

Note. *Ns* are reported for each variable indicating the number of valid cases, due to missing data. Each domain of needs was analyzed using a logistic regression. There is no logistic regression for neurodevelopmental disorders as none of the indicator variables were significant at the bivariate chi-square level.

substance use intervention to youth identified at risk, and lifespan considerations for later treatment and support (McLachlan et al., 2013; Peled et al., 2014). Ultimately, further research is needed to better understand the role that substance use plays in CLS pathways for individuals with PAE/FASD, and whether or how these may differ from people without similar neurodevelopmental disabilities, and will be key for improving treatment and intervention supports.

Adolescents and adults with FASD and CLS contact experienced more than double the rate of exclusionary discipline (e.g., expulsion and suspension) and school-related difficulties compared to those without CLS contact. Both of these factors are in line with prior FASD research and associated with an elevated risk for CLS involvement (Novak & Fagan, 2022; Streissguth et al., 2004). Our findings align with calls to better support youth with FASD at school, which may help to mitigate against adverse experiences including pathways toward the CLS (Flannigan et al., 2017). Youth with FASD may experience challenges at school for several reasons including increased cognitive, communication, and learning difficulties, as well as additional support needs related to social skills and adaptive behaviours (Brett et al., 2018). Teachers typically have limited resources to identify and support youth with FASD in the classroom, and this may require staff to work closely with their special education departments to develop an FASD-informed learning environment and team (Green, 2007; Lees et al., 2022; Pei et al., 2013). While findings suggested lower rates of academic difficulties among those with FASD and CLS-contact, this may be the result of referral bias, or difficulties assessing academic functioning due to alternative school placements, disruptions in learning (e.g., frequent absences), or significant behavioural difficulties, rather than reflecting a true difference between groups. From a primary prevention lens, school and community-based programs are well supported for addressing risk factors and reducing opportunities for crime for youth and adolescents more broadly (Abt, 2017). By incorporating an FASD-informed lens into these programs (Olson et al., 2023), youth with FASD may be able to participate and engage meaningfully.

The present findings ultimately highlighted the complexity and diversity of whole-body needs and intervention areas relevant for support and recognition for people with FASD and CLS contact (Coles et al., 2022; McLachlan et al., 2023; Weyrauch et al., 2017). Related to mental health, rates of both mood disorders and suicide attempts/ideation were significantly higher and mental health services more often recommended for people with CLS contact compared to those without. As acknowledged in previous analyses of the Database, rates of mental and physical health conditions may underrepresent the true experiences in these areas given that these needs may not be comprehensively assessed

Table 4
Logistic regression predicting the likelihood of CLS contact among adolescents and adults with PAE/FASD (n = 215).

	B (SE)	Wald	*p*	Odds Ratio (95 % CI)
Neurodevelopmental impairment				
Academic achievement	0.32 (0.33)	0.95	0.331	0.72 (0.38, 1.39)
Adaptive/social	0.48 (0.37)	1.74	0.187	1.62 (0.79, 3.31)
Mental health disorders				
Substance use disorder	1.44 (0.31)	21.41	<0.001	4.22 (2.29, 7.78)
Substance use/misuse				
Alcohol use/misuse	0.73 (0.31)	5.66	0.017	2.08 (1.14, 3.82)
Physical health				
Cardiovascular conditions	1.28 (0.86)	2.23	0.136	3.61 (0.67, 19.45)
Difficulties				
Legal problems: victim	1.36 (0.69)	3.89	0.049	3.90 (1.01, 15.08)
School expulsion/suspension	0.60 (0.39)	2.38	0.123	1.83 (0.85, 3.92)

Note. Indicators for each domain of need were entered in a single block in the regression model and the CLS group was the outcome variable. The low *N* in this analysis is due to missing data across variables.

Table 5
Differences in recommendations received by adolescents and adults with PAE/FASD with and without CLS contact (N = 544).

	Overall sample $N = 544$	FASD+CLS $n = 272$	FASD-CLS $n = 272$	Overall test	
	n (%)	n (%)	n (%)	χ^2 (φ)	p
Mental/physical health					
Counselling support group ($n = 515$)	86 (16.7)	41 (15.5)	45 (17.9)	0.53 (0.032)	0.466
Individual counselling ($n = 532$)	353 (66.4)	178 (66.7)	175 (66.0)	0.02 (0.007)	0.878
Substance intervention ($n = 526$)	225 (42.8)	164 (61.2)	61 (23.6)	75.72 (0.379)	<0.001
Mental health support ($n = 534$)	365 (68.4)	187 (69.3)	178 (67.4)	0.21 (0.020)	0.649
Medication ($n = 522$)	268 (51.3)	150 (55.6)	118 (46.8)	3.98 (0.087)	0.046
Medical referral ($n = 532$)	253 (47.6)	138 (51.5)	115 (43.6)	3.36 (0.079)	0.067
Anger management ($n = 420$)	84 (20.0)	53 (23.7)	31 (15.8)	4.02 (0.098)	0.045
Education					
SLP ($n = 509$)	59 (11.6)	28 (10.8)	31 (12.4)	0.35 (0.026)	0.554
Behaviour therapy services ($n = 511$)	69 (13.5)	38 (14.5)	31 (12.4)	0.46 (0.030)	0.497
Occupational therapy ($n = 510$)	73 (14.3)	33 (12.6)	40 (16.1)	1.30 (0.050)	0.255
Communication (FASD education) ($n = 515$)	326 (63.3)	159 (60.5)	167 (66.3)	1.87 (0.060)	0.171
Early FASD intervention ($n = 514$)	73 (14.2)	32 (12.2)	41 (16.3)	1.83 (0.060)	0.176
Sexual health education ($n = 421$)	90 (21.4)	53 (23.6)	37 (18.9)	1.36 (0.057)	0.243
Community engagement					
Coaching ($n = 514$)	339 (66.0)	188 (71.8)	151 (59.9)	8.01 (0.125)	0.005
Decision making supports					
Guardianship ($n = 520$)	168 (32.3)	89 (33.7)	79 (30.9)	0.48 (0.030)	0.487
Power of attorney ($n = 514$)	55 (10.7)	27 (10.3)	28 (11.2)	0.11 (0.014)	0.744
Personal directive ($n = 513$)	37 (7.2)	21 (8.0)	16 (6.4)	0.48 (0.031)	0.488
Anticipatory guidance ($n = 536$)	375 (70.0)	196 (72.9)	179 (67.0)	2.16 (0.063)	0.142
Other DM options ($n = 511$)	127 (24.9)	72 (27.4)	55 (22.2)	1.85 (0.060)	0.174
Daily living supports					
Accommodations ($n = 537$)	463 (86.2)	232 (86.2)	231 (86.2)	0.00 (0.000)	0.986
Safety					
Spousal abuse intervention ($n = 514$)	12 (2.3)	9 (3.4)	3 (1.2)	2.75 (0.073)	0.097
Foodbank ($n = 514$)	45 (8.8)	31 (11.8)	14 (5.6)	6.20 (0.110)	0.013
Child protection ($n = 512$)	15 (2.9)	13 (4.9)	2 (0.8)	7.71 (0.123)	0.005
Emergency housing/shelter ($n = 513$)	53 (10.3)	44 (16.8)	9 (3.6)	24.14 (0.217)	<0.001
Safety precautions/measures ($n = 534$)	275 (51.5)	141 (52.4)	134 (50.6)	0.18 (0.019)	0.669
Employment					
Income support ($n = 531$)	306 (57.6)	157 (58.6)	149 (56.7)	0.20 (0.020)	0.653
Family cohesion					
Couple/family counselling ($n = 514$)	94 (18.3)	43 (16.3)	51 (20.3)	1.35 (0.051)	0.245
Respite ($n = 515$)	110 (21.4)	50 (19.0)	60 (23.8)	1.76 (0.059)	0.184
Daycare ($n = 513$)	3 (0.6)	2 (0.8)	1 (0.4)	0.29 (0.024)	0.593
Legal supports					
Legal Aid ($n = 510$)	37 (7.3)	32 (12.3)	5 (2.0)	20.13 (0.199)	<0.001
Civil court services ($n = 513$)	37 (7.2)	36 (13.7)	1 (0.4)	33.82 (0.257)	<0.001
Family court services ($n = 512$)	11 (2.1)	8 (3.0)	3 (1.2)	2.05 (0.063)	0.152
Other legal services ($n = 510$)	58 (11.4)	46 (17.6)	12 (4.8)	20.73 (0.202)	<0.001
Other					
Reassessment ($n = 519$)	36 (6.9)	13 (5.0)	23 (8.9)	3.20 (0.078)	0.074
Support (individual/group) ($n = 530$)	460 (86.8)	235 (88.7)	225 (84.9)	1.65 (0.056)	0.200
FASD specific intervention ($n = 416$)	223 (53.6)	117 (52.5)	106 (54.9)	0.25 (0.025)	0.616

Note. All chi-square results are significant after FDR correction for multiple comparisons (1/36*0.10 = 003; Benjamini & Hochberg, 1995, 2000). Abbreviations: SLP = speech language pathologist; DM = decision making.

within the context of an FASD diagnostic assessment or may not be readily apparent at the clinic (McLachlan, Amlung, et al., 2020). Broadly, mental health remains an important need to consider for improving overall well-being for people with FASD (Flannigan et al., 2020; Pei et al., 2011) and for reducing recidivism risk and informing prevention pathways (Pei et al., 2016). As suicide is one of the leading causes of death in correctional facilities, findings also highlight the importance of FASD-informed suicide prevention programs and safety planning in these contexts, which may include consideration of sleep quality, social connection, affect regulation, substance use, and trauma (Flannigan, McMorris, et al., 2021; Stijelja & Mishara, 2022).

Though physical health was not independently predictive of CLS group membership, it is nonetheless important to consider when supporting whole body needs of people with FASD (Flannigan, Tremblay, et al., 2022; Hellenbach et al., 2017; Himmelreich et al., 2020; Russell et al., 2021). In line with current research, our findings continue to highlight the importance of awareness and competency among healthcare and correctional providers to identify and address health needs and to advocate on behalf of clients to access safe, FASD- gender- and trauma-informed healthcare (McLachlan et al., 2021). Findings from this study, where IQ was used as a matching variable, indicated that individuals with CLS contact had significantly greater rates of severe impairment in adaptive and social functioning. This is supported by research that has highlighted that people with FASD may experience more substantial adaptive functioning-related support needs relative to their overall level of intellectual functioning (Fagerlund et al., 2012; Kautz-Turnbull & Petrenko, 2021). This is important as such difficulties can contribute to practical challenges within the CLS such as remembering mandated court dates/ legal appointments, filling out paperwork, and communicating with counsel (Reid et al., 2020) and more abstract difficulties including comprehension of legal proceedings, and competence to stand trial (McLachlan et al., 2014).

Finally, people with FASD and CLS contact were more likely to be a victim of crime and recommendations made for this group more commonly included accessing safety or emergency services. Some of the core cognitive, adaptive, and social difficulties often associated with

FASD, coupled with experiences of adversity may increase the likelihood a person with FASD becomes a victim of crime (Glowatski & Stewart, 2018; Pei et al., 2016). This is important for service providers to consider as a priority area for intervention and support, a need that unmet, may increase risk for continued involvement in the CLS (Pei & Burke, 2018). For example, many people with FASD experience a lack of adequate, affordable, and safe housing, highlighting an important system level barrier (Pei, Carlson, et al., 2018). Overall, the provision of services for people with FASD and CLS contact should include intersectional support and the integration of clinical and forensic needs, and important policy needs to advocate for increased access to FASD-informed supports and services (Flannigan, Wrath, McFarlane, et al., 2021; Masotti et al., 2015).

4.1. Strengths and limitations

Along with a large sample size, one major strength of this study was the matched CLS and no-CLS contact groups. This allowed for interpretation of findings while minimizing the potentially contributing effects of age, IQ, and sex. There are also several important limitations. Data from the National FASD Database is categorical and therefore provides a breadth of information about individuals assessed for FASD but offers only a cross-sectional perspective and lacks details needed to make meaningful conclusions about the context, severity, and frequency of experiences. Important details that would greatly contextualize our results are missing with the use of binary data. Further, little is known about the likely dynamic and variable nature of CLS involvement for those in the current sample. For example, some individuals with CLS contact could have experienced lengthy and violent offending histories while others may have only had brief contact for summary offences (e.g., disturbing the peace). These results do not allow us to make conclusions about the causality or directionality of the variables examined, such as whether substance use challenges may have contributed to increased risk of CLS contact, or vice versa. The database is also lacking data on several risk factors known to be associated with CLS contact, such as child welfare system involvement or antisocial behaviour/attitudes, which would further contextualize experiences and needs (Ou & Reynolds, 2010). Due to differences in services across Canada and the clinically referred nature of the sample, findings may not generalize across all diagnostic programs or individuals with PAE/FASD not accessing services, nor to those in higher risk CLS settings.

This study took a deficit-focused approach, reporting only on areas of difficulties that differentiated people with and without CLS contact. There has been an increased focus on understanding strengths and protective factors in people with FASD (Flannigan, Wrath, Ritter, et al., 2021), which is particularly critical for people who have CLS contact to reduce recidivism and promote overall well-being (McLachlan, Amlung, et al., 2020; Olson & Sparrow, 2021). Though not addressed within the current study, critical next research steps should also include collaborative explorations of the ways in which the current findings may differ for groups who are overrepresented in the CLS owing to the historical and ongoing impacts of colonization, systemic racism, and oppression, particularly Indigenous and other racialized people before the courts (Blagg et al., 2017; Nielsen & Robyn, 2003; Tait, 2009; Wolfson et al., 2019).

4.2. Implications and conclusion

Overall, this study demonstrated the elevated rates of needs of people with FASD who have CLS contact and underscore important implications for clinical practice and research. Given that many people in this sample, particularly those with CLS contact, were accessing FASD diagnostic services for the first time, we emphasize the importance of early FASD screening in CLS settings to allow referrals for appropriate services and to inform treatment so both clinical and forensic needs are understood (Winsor, 2021). These findings also highlight the need for early support for youth with FASD to address factors like substance misuse and school difficulties through targeted care and resource allocation (Flannigan et al., 2017; McLachlan et al., 2013). Intervention should be evidence-based and FASD-informed to maximize success, with clinicians and service providers taking a holistic approach to best understand each individual's strengths and needs (Olson et al., 2023; Pedruzzi et al., 2021).

CRediT authorship contribution statement

Martina Faitakis: Writing – review & editing, Writing – original draft, Visualization, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Kaitlyn McLachlan:** Writing – review & editing, Writing – original draft, Visualization, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Christopher Fiacconi:** Writing – review & editing, Visualization, Software, Methodology, Formal analysis, Conceptualization. **Katherine Flannigan:** Writing – review & editing, Visualization, Methodology, Conceptualization. **Valerie Temple:** Writing – review & editing, Visualization, Methodology, Conceptualization. **Mansfield Mela:** Writing – review & editing, Visualization, Methodology, Conceptualization. **Jocelynn Cook:** Writing – review & editing, Visualization, Methodology, Data curation, Conceptualization. **Kathy Unsworth:** Writing – review & editing, Visualization, Methodology, Data curation, Conceptualization. **Jacqueline Pei:** Writing – review & editing, Visualization, Methodology, Conceptualization.

Declaration of competing interest

None.

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Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijlp.2025.102106.

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