Adverse Childhood Experiences, Associated Stressors and Comorbidities in Children and Youth with Fetal Alcohol Spectrum Disorder across the Child Protection and Justice Settings in Western Australia

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Abstract

Background: Individuals with Fetal Alcohol Spectrum Disorder (FASD) are at risk of having adverse childhood experiences (ACEs), especially those with child protection or justice system involvement. The complex relationship between FASD and psychosocial vulnerabilities in the affected individual is an important clinical risk factor for comorbidity. This study (1) explored the ACEs and associated stressors in individuals with FASD; (2) compared the ACEs profiles of those who had been involved with the child protection system only, justice system only, both or neither; (3) examined the relationship between ACEs and comorbid conditions such as mood and neurodevelopmental disorders.

Methods: Data were collected retrospectively via file review from diagnostic clinics in Western Australia. Life adversity was coded using a standardised ACEs questionnaire. 211 participants (71.6% males) with FASD with a mean age of 11.12 (range = 2-21) were included in the total sample.

Results: Exposure to drinking/substance misuse at home (70.1%) and domestic violence (51.7%) were the two most common ACEs across the total sample. In the entire cohort, 39.3% had four or more ACEs. Additional stressors reported were involvement with child protection system (69.7%), disengagement from school (43.1%), trouble with the law (40.3%), transiency (19.0%), documented victims of bullying (12.3%), traumatic brain injury (9.0%) and homelessness (5.2%). Further, individuals who had been involved with both the child protection and justice system were four to eleven times more likely than those without any involvement to report parental drinking/substance misuse at home, parental incarceration, exposure to domestic violence and emotional/physical neglect. Higher rates of life adversity in this clinical population were associated with an increased number of comorbidities, p <.001. Specifically, those with FASD who had comorbidities such as attachment disorder (p =.001), substance use disorder (p =.006), and PTSD (p <.001) also reported higher ACEs score.

Conclusion: ACEs were common in this clinical population, particularly those who had been involved with both the child protection and justice system. Increased ACEs in this clinical population were associated with increased comorbidities. This highlights that prevention, intervention and early diagnosis of FASD are important for at risk children to reduce the negative effects of ACEs.

Introduction

Alcohol is a teratogen, a substance that can alter growth and normal development in the central nervous system, including brain structure and other organs of a developing foetus (1). Fetal Alcohol Spectrum Disorder (FASD) is a condition characterised by a variety of cognitive, physical, emotional and behavioural difficulties resulting from prenatal alcohol exposure (PAE). A meta-analysis estimated the worldwide prevalence of FASD to be 0 to 176.7 per 1000 births (2). The prevalence rate of FASD in Australia is mainly monitored through passive case ascertainment; thus, the figures are likely to be an underestimate (3). In Western Australia (WA), the estimate in 2015 was 0.26 per 1000 births (4). While FASD is a condition that can potentially affect individuals from all socioeconomic and cultural

backgrounds (5, 6), some communities are more at risk. The rates of FASD in a group of remote Australian Aboriginal communities was the highest, with a reported prevalence of 194 per 1000 births (7). The causes of excessive drinking in Aboriginal communities are multifaceted and are a product of cultural dislocation due to colonisation, intergenerational trauma and social/economic marginalisation (8, 9).

Children born with FASD often encounter a range of adverse psychosocial situations, such as having early childhood characterised by parental unemployment and substance/alcohol misuse, mental health problems, and child protection involvement (10, 11). In Australian Aboriginal children with FASD, these adverse environmental factors may also occur within the context of historical and intergenerational trauma (12). (13) proposed that when a child with FASD is born into a vulnerable family, the functional impairments as a result of PAE are likely to be exacerbated. Consequently, the expression of FASD could be characterised by a series of negative events starting from the initial PAE to the accumulation of adverse childhood experiences (CEs) over the lifespan. ACEs are traumatic events that range from abuse (e.g., sexual, physical and emotional), neglect (e.g., emotional and physical) to household dysfunctions (e.g., parental separation/divorce, parental mental illness, domestic violence, household substance misuse, incarceration) (14).

Importantly, individuals who endorsed more than four categories of ACEs were four to twelve times more likely to engage in health-risk behaviours (e.g., alcohol/substance misuse, suicide attempt) and have chronic health problems (e.g., cancer, coronary heart disease) in adulthood; while those with one to three ACEs did not fare as well as those who had experienced none (14). In the context of FASD, pregnant women who reported higher number of ACEs were more likely to consume alcohol to cope with stress and anxiety associated with ongoing life stressors (15). In addition to the ten categories of ACEs outlined above, individuals with FASD are also at an increased risk of experiencing other stressors in life such as coming into contact with the child protection and justice system (16, 17). For example, a recent study reported the prevalence rate of FASD among young people in an Australian youth detention centre as 36.0% (18).

Further, the complex relationship between FASD and psychosocial vulnerabilities in the affected individual is also an important clinical risk factor for comorbidity (19). It is well-established that individuals with FASD are at risk of developing a range of comorbid disorders (20). For example, (21) found that they are eleven times more likely to experience an anxiety disorder and ten times more likely to be diagnosed with attention-deficit-hyperactivity disorder (ADHD) than the general population. Other frequently occurring comorbidities include disorders of the nervous system, conduct disorder, receptive/expressive language disorders, hearing impairment and intellectual disabilities (20). In an Australian FASD sample, (5) found ADHD, sleep disturbance and anxiety disorder were the three most common comorbidities reported.

Numerous studies (13, 22) have explored the relationship between PAE and early life trauma, but research investigating the relationship between ACEs and FASD is still in its infancy, with only four

published papers using a standardised ACEs questionnaire (11, 23-25). These studies revealed high rates of early life adversity in individuals with FASD. Additionally, it was also documented that childhood trauma is associated with child protection or justice system involvement, especially among children with FASD (11, 26). However, little to no research has examined the ACEs profiles of those with FASD who have been in contact with these government systems. To our knowledge, this study is the first to explore ACEs in an Australian FASD sample characterised by a high proportion of individuals who had been involved with the child protection and/or justice systems. Notably, both (i.e., child protection/justice) represent priority populations for the reduction of ACEs given their psychosocial vulnerabilities. A better understanding of the frequency and type of ACEs in at-risk children is important to help improve their physical, social/emotional and behavioural outcomes through the development of better early screening tools, services and more targeted interventions (27). Consequently, this study aimed to (1) explore the ACEs and associated stressors in children and youth with FASD; (2) compare the ACEs profiles of those who had been involved with the child protection system only, justice system only, both or neither; (3) examine the relationship between ACEs and comorbid conditions in the sample.

Method

Participants

Between November 2016 and June 2019, approximately 480 individuals attended Patches Paediatrics, a multidisciplinary FASD diagnostic assessment service operating across Western Australia (WA). Participants' files were reviewed retrospectively, and individuals were included if they had a diagnosis of FASD and were under 22 years of age. The age cut-off was determined using the median absolute deviation method and resulted in a sample size of 211 individuals (151 male) with FASD aged 2 to 21 years old.

Diagnostic Process

In the Patches multidisciplinary FASD clinics, referrals for the diagnostic assessment came from general practitioners, paediatricians, caseworkers and other health, justice or education service providers. A paediatrician and a neuropsychologist were always part of the team, while a speech pathologist was only usually present when the participant was a child/adolescent. Participants were diagnosed with FASD using the Australian FASD diagnostic guidelines (28). As part of the FASD diagnostic process, participants' neurocognitive performances were assessed in multiple domains including executive functioning, cognition, memory, attention, academic achievement, language, motor, affect regulation and adaptive functioning. Participants' medical, psychosocial and developmental history was gathered through clinical interviews with the client and/or parents/legal guardians and self-report/informant questionnaires.

Adverse Childhood Experiences (ACEs) and Associated Stressors

Psychologists or paediatricians on the Patches multidisciplinary team routinely gather information on early life adversities through a clinical interview which is then included in the FASD diagnostic reports. These reports and all other available source documents (e.g., allied health, medical and educational reports) were reviewed. The presence of nine early life adversities (e.g., victim of physical abuse, sexual abuse, emotional/verbal abuse, physical neglect, emotional neglect) and household dysfunctions (e.g., exposure to domestic violence, drinking/substance misuse, incarcerated relative, mentally ill family members/family members who attempt suicide) were retrospectively coded by the researcher against the 10-item ACEs questionnaire (29). No missing information apart from participants' parental marital status was identified during retrospective coding of data. This left only nine categories comprising the ACEs total score. Therefore, a maximum score of nine (range = 0-9) was attainable. A score of more than four indicated increased risk of negative health outcomes (14, 30). Seven additional life stressors (i.e., involvement with child protection, justice systems, victims of bullying, homelessness, transiency, severe traumatic brain injury, disengagement from school) not included in the 10-item ACEs questionnaire were also gathered from the Patches team diagnostic reports.

Diagnosis of Comorbid Conditions

Information on participants' pre-existing diagnoses of neurodevelopmental, medical or mental health conditions was gathered from allied health and medical reports. Additional diagnoses were given by the Patches diagnostic team if criteria according to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) were met (31). Only comorbidities with a frequency of at least 10% were coded as binary variables (Yes/No) and included in the analysis. These included ADHD, sleep disorder, attachment disorder, anxiety disorder, hearing impairment, post-traumatic stress disorder (PTSD), intellectual disability (ID), substance use disorder, conduct disorder and depression.

Procedure

This study was approved by the Human Ethics Committee from the University of Western Australia and the Western Australian Aboriginal Health Ethics Committee (HREC Approval Number: 901) in consultation with an Aboriginal community reference group. For participants who were over 18 and capable of providing informed consent, consent was obtained in writing or electronically from the participant. For participants under 18, or who were 18 or older and not capable of providing informed consent, assent was obtained from the participant and consent was obtained in writing or electronically from each participant's parent or legal guardian.

Statistical Analysis

Data analysis was conducted using IBM SPSS-22. Descriptive analyses were conducted to examine the demographics of the total sample, demographics of the subgroups ("child protection only", "justice system only", "both", "no involvement") as well as the frequency and proportion of ACEs scores/categories and associated stressors.

An alpha level of 0.05 was used for all statistical tests. Pearson correlations were employed to explore the relationship between the total ACEs score of the overall sample and demographic variables (age, sex, cultural background). A series of logistic regressions was performed to investigate the predictors (age, sex, cultural backgrounds) of each ACEs category endorsed by the total sample. Another set of logistic regressions was used to examine the subgroup differences in each ACEs category. Group membership ("child protection only", "justice system only", "both", "no involvement") was entered as the independent variable and each ACEs category was entered as the dependent variable. This was repeated for all ACEs category except for sexual abuse as no participants from the "no involvement" subgroup had reported this. All assumptions for the regression analyses were checked and met unless otherwise stated.

Descriptive statistics were used to explore the mean ACEs score and standard deviation for each stressor and comorbid condition. A Pearson's correlation was performed to investigate the relationship between the total ACEs score and total number of comorbidities across the sample. This was followed up by a series of point-biserial correlations to explore the relationship between the total ACEs score and each comorbid condition. The Benjamini-Hochberg procedure (32) was used to correct for multiple comparisons for each family of tests.

Results

Participant Demographics

The mean age of the total sample was 11.12 years (SD = 4.58, range = 2 – 21). The majority were individuals aged below 18 (n = 199, 94.3%). Most participants were males (n = 151, 71.6%) and identified as Australian Aboriginal (n = 163, 77.3%). Of the total sample, 137 (64.9%) came from regional or remote parts of WA, while 74 (35.1%) were from major cities. Across the entire sample, 147 (69.7%) had contact with the child protection system and 85 (40.3%) were involved with the justice system. Demographic characteristics based on group membership can be seen in Table 1.

Table 1. Participant demographics based on group membership

Demographics	Group membership			
	CP only	Justice only	Both CP and Justice	No involvement
	n = 95 (%)	n = 33 (%)	n = 52 (%)	n = 31 (%)
Mean Age (SD)	8.50 (3.73)	15.61 (2.70)	14.75 (2.20)	8.32 (3.54)
Sex				
Male	58 (61.1)	28 (84.8)	44 (84.6)	21 (67.7)
Female	37 (38.9)	5 (15.2)	8 (15.4)	10 (32.3)
Cultural background				
Aboriginal	67 (70.5)	27 (81.8)	46 (88.5)	23 (74.2)
Non-aboriginal	28 (29.5)	6 (18.2)	6 (11.5)	8 (25.8)
Geographical area				
Major cities	35 (36.8)	13 (39.4)	19 (36.5)	7 (22.6)
Regional/remote	60 (63.2)	20 (60.6)	33 (63.5)	24 (77.4)

Note. CP only = Child protection system involvement only; Justice only = Justice system involvement only; Both CP and Justice = Involvement with both the child protection and justice systems; No involvement = No involvement with both government systems

Adverse Childhood Experiences (ACEs) Scores

The mean ACEs scores for the entire cohort were 2.84 (SD = 1.88, range = 0-8). Within the subgroups, the mean ACEs score for those in the “child protection and justice” subgroup was the highest 3.79 (SD = 1.55, range 0-8), followed by the “child protection” only subgroup 3.04 (SD = 1.84, range 0-7), the “justice” only subgroup 2.33 (SD = 1.52, range 0-6) and the “no involvement” subgroup 1.16 (SD = 1.63, range = 0-5).

In the overall sample, 83 (39.3%) participants endorsed four or more ACEs (See Table 2). Within the subgroups, more than half (57.7%) of those with dual involvement had four or more ACEs. In contrast, only 4 (12.9%) participants from the “no involvement” subgroup reported four or more ACEs.

Table 2. Frequency and proportion of nine categories of ACEs in the overall sample and by group

ACEs category	Overall sample	Group membership			
		CP only	Justice only	Both CP and Justice	No involvement
	N = 211 (%)	n = 95 (%)	n = 33 (%)	n = 52 (%)	n = 31 (%)
Drinking/Substance misuse in home	148 (70.1)	73 (76.8)	21 (63.6)	44 (84.6)	10 (32.3)
Domestic Violence	109 (51.7)	44 (46.3)	19 (57.6)	39 (75.0)	7 (22.6)
Physical Neglect	98 (46.4)	56 (58.9)	8 (24.2)	30 (57.7)	4 (12.9)
Emotional Neglect	97 (46.0)	56 (58.9)	7 (21.2)	30 (57.7)	4 (12.9)
Physical Abuse	42 (19.9)	21 (22.1)	4 (12.1)	14 (26.9)	3 (9.7)
Parental Incarceration	38 (18.0)	14 (14.7)	4 (12.1)	17 (32.7)	3 (9.7)
Emotional/Verbal Abuse	23 (10.9)	12 (12.6)	3 (9.1)	6 (11.5)	2 (6.5)
Suicide attempt/mentally ill family	22 (10.4)	4 (4.2)	7 (21.2)	8 (15.4)	3 (9.7)
Sexual Abuse	22 (10.4)	9 (9.5)	4 (12.1)	9 (17.3)	0 (0)
Total ACEs Scores					
Zero	31 (14.7)	9 (9.5)	4 (12.1)	1 (1.9)	17 (54.8)
One to three	97 (46.0)	45 (47.4)	21 (63.6)	21 (40.4)	10 (32.3)
Four or more	83 (39.3)	41 (43.2)	8 (24.2)	30 (57.7)	4 (12.9)

Note. CP only = Child protection system involvement only; Justice only = Justice system involvement only; Both CP and Justice = Involvement

with both the child protection and justice system; No involvement = No involvement with both government systems

The total ACEs score of the overall sample was significantly positively correlated with age, r(211) = .14, *p* =.04. Specifically, older children reported more ACEs than younger children. However, there was no

association between the total ACEs score and sex, r(211) = .06, *p* = .36. Similarly, no significant correlation was found between the total ACEs score and cultural background, r(211) = .03, *p* =.71.

ACEs Categories

The most common ACEs endorsed by the entire sample was exposure to drinking/substance misuse at home (70.1%). Other common ACEs included domestic violence (51.7%), physical neglect (46.4%), and emotional neglect (46.0%) – (Table 2). Exposure to drinking/substance misuse at home was also the most common ACEs reported across all the subgroups.

Logistic regression results (Table 3) show that age and being a male were associated with increased risks of exposure to domestic violence, being a victim of sexual abuse and having a family member who was mentally ill or had attempted suicide. However, these results were no longer significant when the Benjamini-Hochberg corrections were applied.

Table 3. Logistic regressions predicting endorsement of ACEs categories from demographic variables in the overall sample

ACEs Category	Odds Ratio (95% CI)	Odds Ratio (95% CI)	Odds Ratio (95% CI)
	Age	Male[#]	Cultural background[#]
Drinking/Substance misuse at home	1.02 (.95, 1.09)	1.30 (.67, 2.53)	1.35 (.68, 2.69)
Domestic Violence	1.09[+] (1.02, 1.17)	2.37[+] (1.24, 4.53)	1.41 (.71, 2.78)
Emotional Neglect	1.00 (.94, 1.06)	.73 (.39, 1.36)	.92 (.48, 1.76)
Physical Neglect	1.00 (.94, 1.07)	.74 (.40, 1.38)	.94 (.49, 1.80)
Physical Abuse	1.01 (.93, 1.09)	1.38 (.61, 3.14)	.49 (.23, 1.04)
Parental Incarceration	1.02 (.94, 1.10)	1.51 (.64, 3.60)	1.67 (.65, 4.26)
Suicide attempt/mentally ill family members	1.14[+] (1.02, 1.27)	1.41 (.44, 4.50)	1.91 (.52, 6.88)
Sexual Abuse	1.15[+] (1.03, 1.28)	.37[+] (.14, .98)	1.29 (.41, 4.10)
Emotional/Verbal Abuse	1.02 (.92, 1.12)	.88 (.33, 2.34)	.63 (.24, 1.65)

Note. [+] = results were no longer significant after the Benjamini-Hochberg correction for multiple comparisons was applied; [#]Reference Group = females and non-Aboriginal participants.

Logistic regression analyses in Table 4 show that participants in the “child protection only” subgroup were two to nine times more likely than those in the “no involvement” subgroup to be exposed to drinking/substance misuse at home, domestic violence, emotional and physical neglect. Those in the “justice only” subgroup were three to four times more likely than the “no involvement” subgroup to report exposure to drinking/substance misuse at home and domestic violence. Finally, participants with dual involvement were four to eleven times more likely than the “no involvement” subgroup to report exposure to drinking/substance misuse at home, domestic violence, emotional, physical neglect and endorse the item, “Was a member of the household mentally ill/did a household member attempt suicide?”. These results remained statistically significant even after applying the Benjamini-Hochberg correction – see Table 7 for unadjusted p-values and the corresponding Hochberg threshold.

Table 4. Logistic regressions predicting endorsement of ACEs categories from group membership

ACEs Category	Odds Ratio (95% CI)	Odds Ratio (95% CI)	Odds Ratio (95% CI)
	Group Membership[#]		
	CP only	Justice only	Both CP and Justice
Drinking/Substance misuse at home	6.97*** (2.86, 16.99)	3.68* (1.31, 10.334)	11.55*** (3.98, 33.51)
Domestic Violence	2.96* (1.16, 7.52)	4.65** (1.57, 13.82)	10.29*** (3.60, 29.40)
Emotional Neglect	9.70*** (3.14, 29.91)	1.62 (.48, 6.95)	9.21*** (2.81, 30.12)
Physical Neglect	9.69*** (3.13, 29.90)	2.61 (.58, 8.07)	9.20*** (2.80, 30.11)
Physical Abuse	2.65 (.73, 9.58)	1.29 (.26, 6.28)	3.44 (.90, 13.12)
Parental Incarceration	1.61 (.43, 6.03)	1.29 (.26, 6.28)	4.53* (1.21, 17.04)
Suicide attempt/mentally ill family members	.41 (.09, 1.94)	2.51 (.59, 10.76)	1.70 (.42, 6.94)
Sexual Abuse	-	-	-
Emotional/Verbal Abuse	2.10 (.44, 9.93)	1.45 (.23, 9.32)	1.89 (.36, 10.01)

Note. *p<.05, **p<.01 ***p<.001 where p-values were still statistically significant after applying the Benjamini-Hochberg correction – See Table 7 for unadjusted p-values; CP only = Child protection system involvement only; Justice only = Justice system involvement only; Both CP and Justice = Involvement

with both the child protection and justice system; #Reference Group = No involvement with both government systems

Associated Stressors

Other stressors in life not measured by the ACEs questionnaire were reported in Table 5. Almost half (43.1%) of the total sample reported disengagement from school. Other less common stressors reported were transiency, documented victims of bullying, sustained traumatic brain injury and homelessness.

Table 5. Frequency of associated stressors in the overall sample and the corresponding mean ACEs

Associated stressors	N = 211 (%)	Mean ACEs (SD)
Involvement with the child protection system	147 (69.7)	3.30 (1.77)
Disengagement from school	91 (43.1)	3.27 (1.76)
Involvement with the justice system	85 (40.3)	3.22 (1.69)
Transiency	40 (19.0)	3.33 (1.77)
Documented victims of bullying	26 (12.3)	2.50 (1.94)
Sustained severe traumatic brain injury	19 (9.0)	3.21 (1.32)
Homelessness	11 (5.2)	3.82 (1.72)

Note. Involvement with the child protection system = sum of participants from the “CP only” and “Both CP and Justice” subgroups; Involvement with the justice system = sum of participants from the “Justice only” and “Both CP and Justice” subgroups.

Comorbid Conditions

The total number of comorbid conditions across all participants ranged from 0 to 8 (mean = 2.27, SD = 1.67). Higher total ACEs score in the overall sample was associated with an increased number of comorbidities, $r(211) = .27$, $p<.001$. Specifically, those who had comorbidities such as substance use disorder $r(211) = .19$, $p = .006$, attachment disorder $r(211) = .24$, $p = .001$ and PTSD $r(211) = .26$, $p<.001$ also had higher ACEs score. Conversely, individuals with FASD who also had ID $r(211) = -.17$, $p = .012$, reported lower ACEs score. These correlations remained statistically significant even after the Benjamini-Hochberg corrections were applied – see Table 7 for adjusted corrections.

Table 6. Mean ACEs for the total sample by different comorbidities

10 most common comorbidities	N = 211 (%)	Mean ACEs (SD)
ADHD	89 (39.2)	2.95 (1.90)
Sleep disorder	77 (33.9)	3.06 (1.91)
Attachment disorder	65 (28.6)	3.70 (1.72)
Anxiety disorder	61 (26.9)	3.21 (1.90)
Hearing impairment	57 (25.1)	2.87 (2.03)
Post-traumatic stress disorder	55 (24.2)	3.89 (1.73)
Intellectual disability	48 (21.1)	2.30 (1.78)
Substance use disorder	35 (15.4)	3.63 (1.75)
Conduct disorder	27 (11.9)	2.88 (1.82)
Depression	27 (11.9)	3.50 (1.82)
0 to 2 diagnoses	127 (60.2)	2.44 (1.83)
3 to 5 diagnoses	76 (36.0)	3.32 (1.78)
6 to 8 diagnoses	8 (3.8)	4.50 (1.60)

Table 7: Benjamini-Hochberg corrections

	Unadjusted p-value	Hochberg Threshold	Hochberg correction
Logistic regressions from Table 4			
“CP only” as a predictor			
Domestic violence	0.023	0.025	Significant
Emotional neglect	0.000	0.019	Significant
Physical neglect	0.000	0.019	Significant
Drinking/substance misuse	0.000	0.013	Significant
“Justice only” as a predictor			
Drinking/substance misuse	0.014	0.019	Significant
Domestic violence	0.006	0.013	Significant
“Both CP and Justice” as a predictor			
Parental incarceration	0.024	0.031	Significant
Emotional Neglect	0.000	0.025	Significant
Physical Neglect	0.000	0.025	Significant
Drinking/substance misuse	0.000	0.019	Significant
Domestic violence	0.000	0.019	Significant
Correlation analyses (see text)			
Intellectual disability	0.012	0.020	Significant
Substance use disorder	0.006	0.015	Significant
Attachment disorder	0.001	0.010	Significant
Post-traumatic stress disorder	0.000	0.005	Significant

Note. CP only = Child protection system involvement only; Justice only = Justice system involvement only; Both CP and Justice = Involvement with both the child protection and justice system

Discussion

To the best of our knowledge, this is the first Australian study to explore the types and frequency of ACEs and associated stressors in children and youth with FASD. This study highlighted that ACEs were common in this clinical population, particularly those who were involved with both the child protection and justice system.

ACEs in the overall FASD sample

The highest frequency of ACEs reported by the overall sample was exposure to drinking/substance misuse at home. This was present in over 70% of the cases and aligns with results from a Canadian FASD/PAE sample (69.7%) (24). Alcohol/substance misuse was previously found to be associated with social and economic disadvantage, especially in parents of children with FASD (6). Thus, highlighting the importance of multilevel interventions that address the economic/social disparities among marginalised populations to reduce the negative effects of alcohol/substance misuse. Additionally, given past research (33, 34) shows that child maltreatment and domestic violence are commonly associated with alcohol/substance misuse, this again emphasises the need for multidimensional interventions to support families and children living with FASD.

Domestic violence was present in half of this sample. This may be due to the high number of participants in the current study from regional/remote areas, where domestic violence is more common as a result of unique geographical and social structures in these communities (35). Two other ACEs categories, including emotional neglect and physical neglect were experienced by approximately 46% of the overall sample, rates (i.e., 40.0%) that were similar to a vulnerable/disadvantaged paediatric population from South Western Sydney (36). Importantly, the rate of sexual abuse in this sample was higher (10.7% in our study versus 7.5%) than the national statistics of substantiated sexual abuse in children involved in the Australian child protection system (37). Similarly, 10.4% of the overall sample reported having a family member who was mentally ill or had previously attempted suicide, rates that were nearly twice as high as the 5.7% base rate of suicide in Aboriginal and Torres Strait Islander Peoples and 1.9% in non-Aboriginal people in WA (38). For children with FASD, instability in their caregiving environment can have significant negative consequences for their socioemotional development and educational engagement (39).

Findings from this study build upon evidence related to ACEs profiles in individuals with FASD in countries other than Australia. An American study (11) similarly found a high proportion of individuals with FASD involved with the child protection system, where ACEs tend to be more prevalent. Interestingly, the mean ACEs score was higher (5.30 versus 2.83 in our sample) in the study by (11). This may be because the North Dakota FASD Centre is a tertiary referral centre where most of the referrals were FASD cases with complex backgrounds and severe clinical presentations. Further, the total ACEs scores were summed from 10 items, while the current study only had complete data for nine ACEs items. Thus, this difference may explain the higher rates of ACEs in the American FASD group. Similarly, children with FASD/PAE from a Canadian sample (24) also reported higher mean ACEs scores (3.40 compared with 2.83 in our sample). This may be because a different version of the ACEs questionnaire was employed in the study; thus, capturing somewhat different types of life adversity (e.g., “not raised by both biological parents” was endorsed by 97.3% of participants).

Arguably, an important finding in the current study was that 39.0% of the total sample reported experiencing four or more ACEs categories across their lifespan, rates (25.9% to 31%) which were much

higher than individuals with other physical/neurodevelopmental disabilities (e.g., hearing/visual disability, intellectual disability) (40, 41). This is particularly concerning given the young age of participants in our study and individuals who endorsed more than four categories of ACEs are four to twelve times more likely to engage in health-risk behaviours (e.g., substance use, alcohol dependence, suicidality) and have chronic health problems later in life (14). Further, we found a significant positive association between age and the total ACEs scores. This is unsurprising given older children would have more time to be exposed to life adversity, thus highlighting the importance of early identification of ACEs and implementing appropriate interventions to prevent re-exposure of ACEs.

Numerous studies have documented the long-term repercussions (e.g., intergenerational trauma, disconnection from family and culture) of colonisation in Aboriginal communities (12, 42). While Aboriginal participants with FASD were disproportionately represented in the current study, cultural background was not significantly associated with the total ACEs score. This suggests other risk factors may explain the high rates of ACEs in this sample. Indeed, (6) highlighted that children with FASD are often born into less stable families where parents are likely to be alcohol/substance users themselves. Furthermore, many children with FASD display a range of challenging behaviours (e.g., lack of impulse control, immature social development, inability to predict consequences) as a result of underlying brain pathology (43). Children with FASD may have sensory processing differences that can lead to them becoming easily upset/irritated by environmental triggers, and having difficulties with emotional regulation and social pragmatics (44). The challenging behaviours that children with FASD manifest could potentially increase the risk of them being exposed to ACEs (e.g., domestic violence, physical, emotional abuse) and pose difficulties for parents, some of whom will have experienced ACEs themselves and find parenting a child with a range of deficits difficult (Brown, 2015). Most importantly, our findings highlight the importance of prevention/intervention, early screening and diagnosis of FASD in at-risk children to reduce the negative effects of ACEs and health risk behaviour.

ACEs profiles of the subgroups

The proportion of individuals involved with the child protection system was much higher (69.7% in our sample vs. 56.0%) than a vulnerable/disadvantaged paediatric population from South Western Sydney (36).Those in out-of-home care were more vulnerable to ACEs such as parental drinking/substance misuse, domestic violence and emotional/physical neglect. Further, we found individuals who had been involved with both the child protection and justice system were at a much higher risk of experiencing ACEs (e.g., exposure to drinking/substance misuse at home, domestic violence, neglect, parental incarceration) than those without any involvement with these government systems. Thus, it is crucial for child protection/justice workers to routinely screen for ACEs as this is essential in the development of trauma-informed systems of care (45). Experiences of trauma are rarely an isolated event with more than half (57.7%) of those with dual involvement reported experiencing four or more ACEs. As children involved with the child protection/justice system have a range of psychosocial vulnerabilities, this highlights the needs of multidimensional services/programs for identifying ACEs, facilitating health promotion and protection of at-risk children in the community.

Associated Stressors

Of the overall sample, 43.1% reported disengagement from school. This finding is concerning as research has consistently established that students who disengage from school are more likely to engage in offending behaviour due to poor emotional connections with peers/teachers and having more time/energy available for illegal activities (46). These findings emphasise the importance of early FASD screening at schools to better identify their learning needs and promote school engagement. Other common stressors in the overall sample include involvement with the justice system (40.3%). (18) suggest the neurocognitive deficits (e.g., poor impulse control, lack of consequential thinking) associated with FASD can increase susceptibility to victimisation and involvement with the justice system. Most importantly, those with FASD tend to have fewer protective factors due to their complex backgrounds and social vulnerability (47). This finding highlights the importance of FASD prevention programs and interventions that reduce the risk of children/young people experiencing criminogenic factors such as homelessness (48), bullying (49) and exposure to early life ACEs (50) to break the cycle of recidivism.

Comorbidities

It is apparent that FASD is a risk factor for many comorbidities because of the physical consequences associated with PAE (20). This interaction is further compounded by exposure to ACEs which is linked to increased rates of comorbid conditions (11). We found higher ACEs scores were associated with more comorbidities, consistent with findings from previous research (11, 24). For specific conditions such as attachment disorder, PTSD and substance use disorder, those with FASD also experienced more ACEs. Interestingly, comorbid conditions such as ID were not associated with increased ACEs scores, similar with findings from (24). It may be that those with FASD and ID have better access to services and were protected against exposure to ACEs, though we did not examine this in our study. The high rates of neurodevelopmental/mental health comorbidities in this clinical population not only place a great demand on healthcare systems but also on parents/carers who are supporting a child with FASD, especially for those from disadvantaged backgrounds (51, 52). Therefore, it is essential to ensure that caregivers are supported by specialised culturally secure and competent caseworkers who understand FASD and communicate well between medical/educational and community services.

Strengths, Limitations, And Future Research

This research is valuable given children with FASD are at heightened risk of experiencing ACEs over their lifespan. Understanding the nature and frequency of ACEs and other stressors in this clinical population is important as it can help inform FASD/ACEs prevention programs, interventions and the development of government policies (22). A methodological strength of this study is the systematic and consistent assessments using internationally accepted FASD diagnostic criteria and the unique insight into the frequency and type of ACEs in Australian individuals with FASD.

This study has several limitations. Firstly, as ACEs data were retrospectively coded against the standardised ACEs questionnaire by the researcher rather than asking the caregivers directly, the number of ACEs may be underestimated. However, this was mitigated to a certain extent as ACEs data were collected from various sources including allied health, medical, educational and diagnostic reports. Secondly, given the disproportionately high number of Aboriginal participants in this study when compared with the general population, the use of a traditional ACEs questionnaire may not accurately or adequately capture life adversities in this population as it did not consider for example the effects of colonisation and systemic racism (53). This highlights the importance of working with Aboriginal communities to co-develop a culturally appropriate tool to better capture ACEs in this high-risk population. Further, given the absence of a control group in this study, it will be important for future research to compare the life adversities of those with FASD versus those without to elucidate the unique effects of PAE on ACEs.

Conclusions

Numerous studies have investigated the relationship between PAE and early life trauma. However, limited research has examined the ACEs profiles in individuals with FASD. Our study conducted a comprehensive examination of ACEs, associated stressors and comorbidities reported by children and youth with FASD in Australia. High rates of life adversity in this clinical population were associated with an increased number of comorbidities. Those with dual involvement with the child protection and the justice system were more vulnerable to ACEs than those without any involvement with these government systems. Common associated stressors (e.g., involvement with the child protection/justice systems, school disengagement) were also identified. This finding highlights an important need for enhanced access to early diagnosis/services for children with FASD, particularly in higher risk populations such as Aboriginal communities and those involved with child protection and the justice system to reduce the adverse impact of ACEs and the development of comorbid conditions. At a service provision level, it is crucial that clinicians/educators/child protection/justice workers routinely screen for, discuss, and provide psychoeducation around ACEs to promote better outcomes in vulnerable children (Fogliani, 2019).

Abbreviations

ACEs: Adverse childhood experiences; **FASD**: Fetal alcohol spectrum disorder; **PAE**: prenatal alcohol exposure; **ADHD**: Attention-deficit hyperactivity disorder; **PTSD**: Post-traumatic stress disorder; **ID**: Intellectual disability; **OR**: odds ratio**; CP only**: child protection involvement only; **Justice only**: justice system involvement only **Both CP and Justice**: Involvement with both the child protection and justice system

Declarations

Ethics approval

This study was approved by the Human Ethics Committee from the University of Western Australia and the Western Australian Aboriginal Health Ethics Committee (HREC Approval Number: 901) in consultation with an Aboriginal community reference group.

Consent for publication

Not applicable

Availability of data and material

The dataset used in the study is available from the corresponding author on reasonable request.

Competing interest

JF is the director of Patches Paediatrics, and JF and CP provide clinical services through Patches Paediatrics.

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This study was not funded.

Authors contributions

KT, CP and MS formulated the overarching research design and aims. KT, MS and CP contributed to data analysis. All authors participated in manuscript development, revisions and provided important intellectual input. All authors read and approved of the submitted manuscript.

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Supplementary Files

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- ACEsQuestionnaire.pdf