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Adverse childhood experiences in individuals who primarily use fentanyl: The importance of early, trauma-focused intervention

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ABSTRACT

Background: Early trauma is a well–established risk factor for substance use disorders, mental illness, and suicidality, contributing to high–risk opioid use. This study explored whether childhood adversity contributes to risk behaviour among individuals with fentanyl use disorder and whether they receive trauma–specific care.

Methods: The fentanyl cohort study is a cross-sectional survey of 256 adults (>18 years) with opioid use disorder (OUD) reporting fentanyl as their primary substance, recruited through physician–referred convenience sampling from an acute-care hospital in Vancouver, Canada. Participants completed a structured interview including the Adverse Childhood Experiences (ACE) tool, covering substance use history, stressful life events (SLE), mental health, suicidality, and overdose history. ACE scores were analysed using Welch T-test, Kruskal-Wallis tests, Spearman correlations, and multiple linear regressions with Benjamin–Hochberg corrections.

Results: Among 197 participants completing the ACE questionnaire, 94.9% reported at least one ACE (mean ACE score 4.83, SD 3.09). The most common ACE were parental separation or divorce (54.7%), household substance use (54.3%), emotional abuse (50.8%), physical abuse (45.3%), and domestic violence (43.4%). Higher ACE scores were associated with concurrent mental illness (p=0.027), suicidal ideation (p<0.001), and lifetime suicide attempts (p<0.001). Indigenous participants had significantly higher ACE scores than other ethnicities (p=0.002). Greater ACE burden correlated with younger age at assessment (p=0.01) and earlier fentanyl initiation (p=0.02), and lifetime overdose frequency after pairwise comparisons (ρ=0.239, p=0.001) and regressions (B = 0.884, SE = 0.402, p = 0.029).

Conclusions: Childhood trauma is highly prevalent among individuals who use fentanyl and is associated with earlier initiation, increased suicidality, mental illness, and overdose risk. Systematic trauma assessment remains rare. Given traumas role in the two leading causes of early mortality, suicide, and overdose; trauma informed and family focus interventions should be central to any opioid crisis response.

Keywords: Adverse Childhood Experiences, Fentanyl, Opioid-Related Disorders, Drug Overdose, Suicidal Ideation, Early Intervention.

INTRODUCTION

Adverse childhood experiences (ACE) occur with markedly higher frequency among individuals who later develop high-risk substance use. The ACE framework demonstrates strong predictive validity for a wide range of physical and mental health (1,2). Early work by Krausz and colleagues, identified parental loss, severe illness, suicidal ideation, and family disruption as significant predictors of later heroin use (3). Subsequent studies have consistently documented the central role of family dysfunction—particularly parental substance use, loss of life, mental illness, other physical illnesses, separation or divorce, and exposure to family violence—in shaping vulnerability to substance use (4).

Exposure to early trauma has been shown to exert lasting effects on both physical and mental health (5,6). Children exposed to multiple adversities are at increased risk of developing depression, anxiety disorders, ADHD, conduct disorders, and complex comorbid conditions extending into adulthood (7–10). ACE are also associated with diminished psychological resilience and poorer overall health outcomes (11), suggesting that early trauma not only increases vulnerability to concurrent mental disorders but also erodes coping capacity.

Children and youth in Canadian Indigenous populations particularly experience a disproportionate burden of childhood adversity, reflecting the enduring impacts of colonization, systemic inequities, and intergenerational trauma (12). First Nations Health Authority and coroner reports from British Columbia (BC), document profound links between childhood trauma, substance use, suicide, and overdose mortality (13,14). While exploring opioid use in relation to trauma, this evidence emphasizes the necessity of discussing populations heavily impacted and underserved by their structural environments in order to interrupt cycles of adversity — especially for Indigenous populations. Current evidence further links trauma exposure to substance use initiation and escalation. Children exposed to high levels of adversity are more likely to start using psychotropic substances such as tobacco and alcohol at earlier ages (5). Longitudinal evidence indicates that each additional ACE is associated with significantly higher use of cigarettes, cannabis, and alcohol (15). Importantly, it is estimated that more than 70% of opioid misuse in their sample could be attributed to adverse childhood experiences (16). Structural factors such as social marginalization, housing instability, and homelessness—often beginning in childhood or adolescence—further compound trauma exposure and substantially limit opportunities for recovery (17).

Although the association between childhood adversity and substance use is well established (18), a critical gap remains in understanding how childhood trauma relates specifically to the use of high-potency synthetic opioids such as fentanyl, which differ from other opioids in both pharmacological risk and market dynamics (19). A recent systematic review of intentional non-medical fentanyl use highlighted substantial heterogeneity in motivations, risk contexts, and trajectories among people who use drugs, underscoring the need for population-specific empirical data (20).

Despite the current landscape of literature, trauma is not routinely assessed in acute care settings — representing a critical gap, as these encounters may be one of the few healthcare contacts for high-risk individuals outside addiction services. Collectively, the evidence forms a multi-faceted model whereby trauma, structural inequity, and mental and physical health factors manifest in opioid use patterns. We sought to explore these facets by focusing on a high-needs population with complex health conditions simultaneous to their opioid use, engaging with the health system non-specifically for substance use. This

study examines a medically complex acute care cohort of people who use fentanyl, testing whether early life trauma is associated with overdose, suicidality, and stressful life experiences; and discussing whether trauma-related risks are identified within the existing systems of care.

METHODS

The Fentanyl Cohort Study is a cross-sectional survey of patients with an opioid use disorder (OUD) and active opioid use within six months before data collection admitted to an inpatient unit in the largest hospital in Vancouver, British Columbia. Convenience sampling recruited 250 participants at Vancouver General Hospital's Complex Pain & Addiction Service (CPAS). Participants meeting the inclusion criteria (aged 18 years or older, willing to provide written informed consent, with a diagnosed OUD and having used street opioids in the six months prior to participation in the study) were referred to the research coordinator. The research coordinator then facilitated the consent process and administered a questionnaire prompting information about sociodemographic characteristics, current and past fentanyl use, overdose experiences, mental and physical health, childhood trauma, as well as other factors relating to opioid use. Exposure to childhood traumatic experiences was measured with the 10-item Adverse Childhood Experiences (ACE) questionnaire, asking participants about abuse, neglect, and household dysfunction experienced before the age of 18 (21). The questionnaire, attached in the appendix, was developed through an iterative process with expert consensus. Participants were given a tablet to complete the questionnaire, which was hosted on Qualtrics software. A research associate was present during survey completion to respond to any questions that the participant might ask throughout completion of the survey. The total duration of the survey is approximately 45 - 60 minutes.

Data from the 256 participants recruited between November 2022 and September 2023were analyzed. All analyses were conducted on the analytic subcohort of participants who completed the ACE questionnaire (N = 197). Sociodemographic, psychosocial, and substance use-related characteristics related to mental health and addictions in literature were assessed exploratively. Participant characteristics, ACE prevalence, stressful life events (SLEs), and lifetime overdose histories were summarized using descriptive statistics, with categorical variables reported as counts and proportions and continuous variables reported as means and standard deviations.

The ACE score was calculated by summing endorsed ACE categories (range 0-10) and treated as a continuous variable for primary analyses. Mean ACE scores were compared across binary variables (e.g., presence of concurrent mental illness, recent suicidal ideation, lifetime suicide attempt) using independent samples Welch *t*-tests to account for unequal variances. For categorical variables with more than two groups (e.g., ethnicity, age group, age at first fentanyl use categories), Kruskal-Wallis tests were used due to non-normal ACE score distributions, followed by post-hoc pairwise comparisons where global tests were statistically significant. Ethnicity categories were collapsed into White, Indigenous, and Other for post-hoc analyses to address small cell sizes.

Spearman's rank correlation coefficients (ρ) were used to assess associations between ACE scores and ordinal or continuous variables, including age group, age at first fentanyl use, duration of fentanyl use, total SLE count, and lifetime opioid overdose frequency.

Associations between individual ACE or SLE events (dichotomous predictors) and lifetime overdose frequency (ordinal outcome) were examined using global non-parametric tests, followed by pairwise

Spearman correlations where applicable. To reduce the risk of type I error arising from multiple comparisons, Benjamin-Hochberg corrections were applied to correlation analyses, and both unadjusted and adjusted p-values are reported.

Pairwise Spearman correlation analyses were performed to examine interrelationships between cumulative childhood adversity (ACE score), recent stress exposure (total SLE count), and lifetime overdose frequency. Multiple linear regression was conducted to further evaluate correlation patterns, with ACE and SLE as predictors and lifetime overdoses as an outcome. Results from both types of tests were compared. Missing data and ambiguous answers such as "Rather not answer" and "Other" were removed according to complete-case analysis for each comparison, with denominators reported accordingly. All statistical tests were two-tailed, and statistical significance was defined a priori as $p < 0.05$ after correction for multiple testing where applicable. All analyses were performed using R studio software (version 2025.09.0+387). All participants provided written informed consent prior to study participation.

RESULTS:

ACE distributions, scores, and lifetime overdose history

The ACE-reported sub cohort (analytic sample size N=197) predominantly consisted of male (62.8%) and White (56.4%) self-identified demographics (Table 1). Overall, the majority (94.9%, n=187) of all participants experienced an ACE event ($r = 0.21$, $p = 0.003$), and 69.8% had a concurrent mental illness. Participants experienced an average of approximately five out of ten possible ACE events (aggregate ACE score, M = 4.83, SD = 3.09). By risk stratification, 36.5% of individuals had seven or more ACE events ($r = 0.12$, $p = 0.9$).

Among the ten questions asked on the ACE scale, parental separation/divorce was the most frequently reported, with 54.7% of participants having this experience. This was closely followed by living with a household member with SUD (54.3%) and emotional abuse (50.8%), indicating that more than half of the cohort experienced these forms of adversity during childhood. Other commonly reported ACE included physical abuse (45.3%), domestic violence (43.4%), and living with a household member with mental illness (36.7%). The least frequently reported, though still present in nearly one-third of participants, incarceration of a household member (32.8%), neglect of basic needs (32.4%), neglect specifically due to parental substance use (29.7%), and sexual abuse (28.5%) (Figure 1).

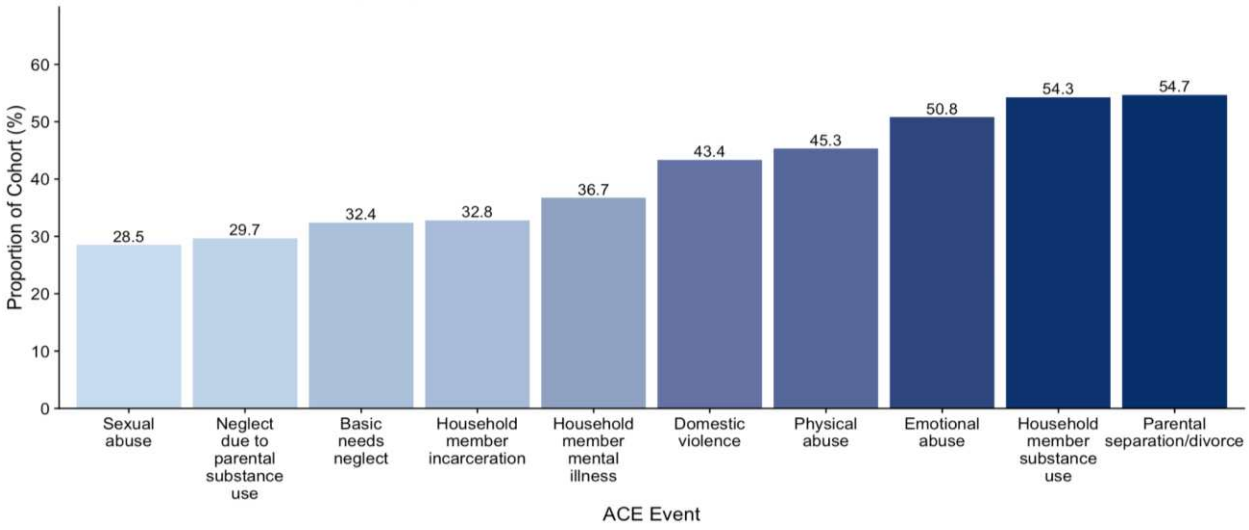


Figure 1. **Bar plot showing the proportion of participants reporting each of 10 adverse childhood experiences.** The y-axis represents the proportion of the cohort (%) and the x-axis lists the ACE categories.

Examining ACE occurrences, ethnicity (p=0.002), concurrent mental disorders (p=0.027), suicidal ideation in the last 6 months (p<0.001), and history of suicide attempt (p<0.001) were associated with higher mean ACE scores (range 2.50 - 8.00). After post-hoc analyses of ethnic groups, Indigenous participants scored significantly higher in ACE compared to both White and other ethnic backgrounds (Table 1). Other socioeconomic or psychosocial factors (e.g. employment, housing status, recent contact with family or friends) did not have significant associations with ACE.

Higher ACE scores were associated with younger age at the time of survey and earlier initiation of use. At the individual level, age group (ρ = -0.163, p = 0.021) and age group of first fentanyl use (ρ = -0.158, p = 0.026) were negatively correlated with mean ACE score, while duration of fentanyl use yielded no significant associations (Table 1).

Table 1. ACE subcohort characteristics (n=197) and mean ACE scores. Questions that specifically related to their experiences in the last 6 months were labeled with (last 6 mo).

Category	**Characteristic**	**Overall n (%)**	**Mean ACE**	**SD**	***p***
Age range *(n = 196)*	Youth and Young Adults (<= 24)	2 (1.02)	9.50	0.71	**0.010***
	Adults (25–49)	128 (65.31)	5.08	3.04	
	Middle-aged Adults (50–64)	54 (27.55)	4.69	3.15	
	Older Adults (65+)	12 (6.12)	2.25	1.71	

Gender *(n = 196)*	Man	123 (62.8)	4.60	2.93	0.098
	Non-Binary	4 (2)	8.00	2.71	
	Woman	69 (35.2)	5.09	3.30	
Ethnicity *(n = 195)*	Black	7 (3.6)	5.43	4.35	**0.002****
	East/South/ South East Asian	9 (4.6)	3.00	2.96	
	Indigenous	52 (26.7)	6.42	3.01	
	Latino	2 (1)	5.00	5.66	
	Middle Eastern	2 (1)	2.50	0.71	
	Mixed	13 (6.7)	4.62	3.84	
	White	110 (56.4)	4.27	2.70	
High school completion *(n = 197)*	No	80 (40.6)	5.25	3.19	0.121
	Yes	117 (59.4)	4.55	2.99	
Employment (last 6 mo) *(n = 197)*	No	154 (78.2)	4.80	3.06	0.779
	Yes	43 (21.8)	4.95	3.22	
Housing status (last 6 mo) *(n = 196)*	Stable	76 (38.8)	4.59	3.32	0.383
	Unstable	120 (61.2)	5.00	2.94	
Significant other (last 6 mo) *(n = 195)*	No	130 (66.7)	4.77	3.06	0.560
	Yes	65 (33.3)	5.05	3.15	
Have children *(n = 193)*	No	88 (45.6)	4.52	3.11	0.194
	Yes	105 (54.4)	5.10	3.07	
Stressful life event (last 6 mo) *(n = 190)*	No	44 (23.2)	4.48	2.93	0.345
	Yes	146 (76.8)	4.97	3.18	
Contact with friend (last 6 mo) *(n = 190)*	No	46 (24.2)	4.72	2.94	0.831
	Yes	144 (75.8)	4.83	3.17	
Contact with family (last 6 mo) *(n = 190)*	No	50 (26.3)	5.42	3.09	0.165
	Yes	140 (73.7)	4.71	3.10	
Daily substance use on average (*n = 115)*	No	33 (28.7)	4.94	2.78	0.521

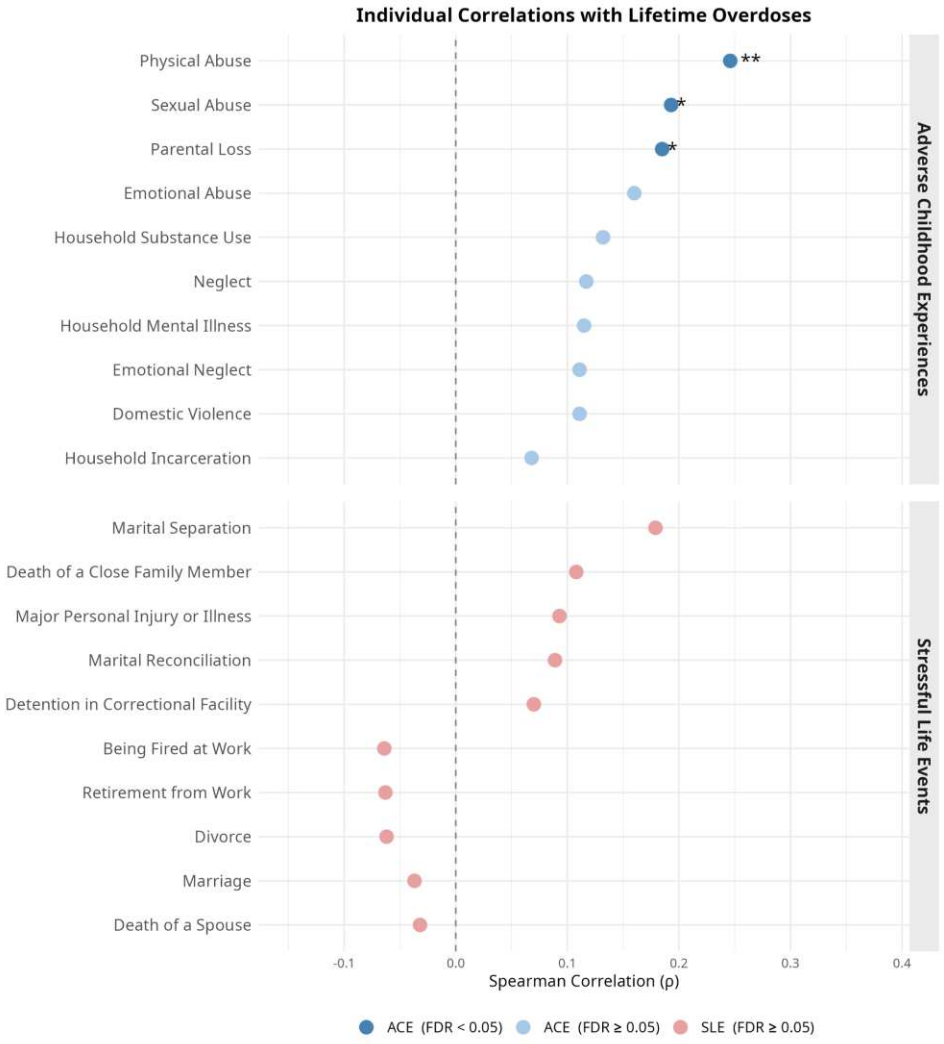
	Yes	82 (71.3)	5.33	3.27	
Usual use alone (*n = 117)*	No	66 (56.4)	5.06	2.97	0.672
	Yes	51 (43.6)	5.31	3.36	
Chronic pain (last 6 mo) (*n = 192)*	No	50 (26)	4.42	3.09	0.241
	Yes	142 (74)	5.02	3.10	
Mental illness diagnosis (*n = 172)*	No	52 (30.2)	4.19	3.08	**0.027***
	Yes	120 (69.8)	5.33	3.02	
Self harm (last 6 mo) *(n = 189)*	No	167 (88.4)	4.68	2.97	0.230
	Yes	22 (11.6)	5.59	3.32	
Suicidal ideation (last 6 mo) *(n = 188)*	No	128 (68.1)	4.10	2.89	**0.000****
	Yes	60 (31.9)	6.08	2.83	
Suicide attempt (lifetime) (*n = 189)*	No	123 (65.1)	4.18	2.93	**0.000****
	Yes	66 (34.9)	5.77	2.88	
Age at first use *(n = 197)*	Youth and Young Adults (<= 24)	35 (17.77)	4.83	2.81	**0.023***
	Adults (25–49)	113 (57.36)	5.38	3.25	
	Middle-aged Adults (50–64)	20 (10.15)	3.50	2.63	
	Older Adults (65+)	29 (14.72)	3.62	2.47	
Duration of use *(n = 171)*	≤ 1 year	8 (4.68)	3.50	2.56	0.306
	2–5 years	64 (37.43)	4.98	3.20	
	6–10 years	49 (28.65)	5.02	3.02	
	11–15 years	26 (15.2)	5.00	3.22	
	15+ years	24 (14.04)	5.50	3.34	

Labeled counts indicate observations for a specific variable after removing missing values. Overall count and percentages represent the prevalence among all respondents. Mean and standard deviation (SD) values indicate the average and variance of individuals for a given characteristic. Statistical significance: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Across ACE events, a greater proportion of individuals experienced one to five opioid overdoses in their lifetime, with larger proportions for parental separation/divorce (29.8%), neglect due to parental

substance use (27.2%), sexual abuse (27.2%), basic needs neglect (25.7%), household member substance use (25.1%), emotional abuse (23.6%), domestic violence (22.5%), and physical abuse (21.5%) (Appendix A). The remaining ACE events with one to five lifetime overdoses ranged from 12.6% to 20.9%. Physical abuse, parental loss, sexual abuse, and emotional abuse were significantly correlated with lifetime overdose frequencies pairwise and across all groups ($p < 0.05$), of which physical abuse, sexual abuse, and parental loss remained significant after adjustment tests (Figure 2; Appendix B).

Figure 2. Correlation results for lifetime overdose frequency by Adverse Childhood Experience (ACE) or recent Stressful Life Event (SLE) event. Adjusted *p*-values yielded from Benjamin-Hochberg correction tests.



Recent Stressful Life Events (SLE) among people with ACE history

Among these individuals with any ACE exposure (> 0), the majority of individuals (n = 146, 76.8%) experienced a negative SLE in the last 6 months. More individuals experienced major injury or illness (39.8%) and death of a close family member (33.7%), followed by other less frequently experienced events such as death of a spouse (7.14%), marital separation (6.12%), and detention in a correctional facility (5.1%), and divorce (3.1%) (Figure 3). In employment-related events, 3.1% had undergone retirement from work and 2.0% experienced employment dismissal. Major personal injury or illness and death of a close family member were highly prevalent across all lifetime overdose ranges (Appendix C). Marital separation was significantly correlated with lifetime overdose numbers out of other SLE events (r = 0.179, p = 0.015), but did not remain significant after corrections.

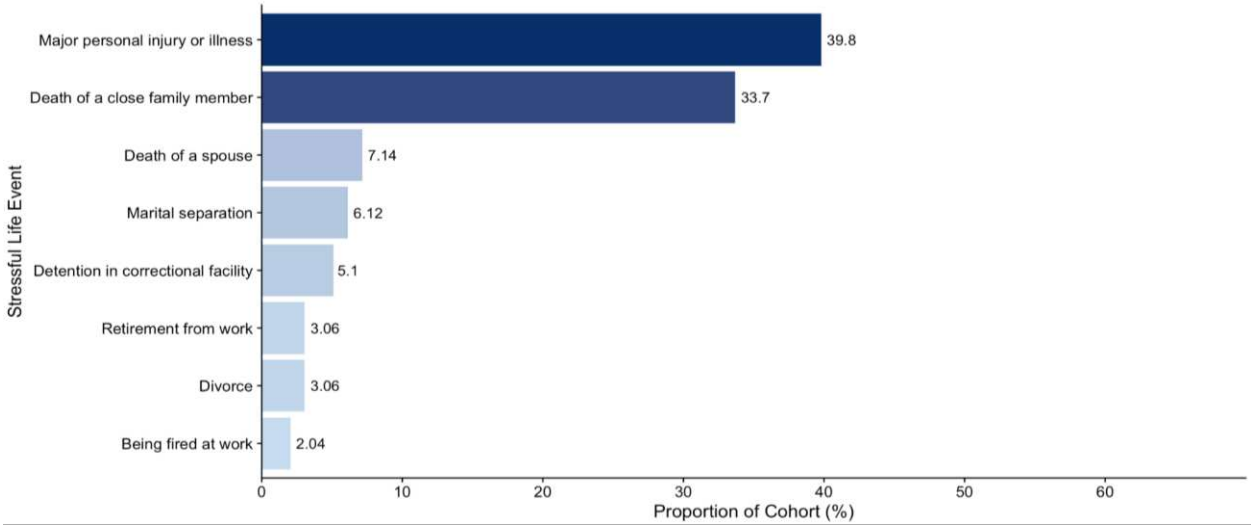


Figure 3. Bar plot showing the proportion of individuals with ACE reporting any various stressful life events (SLE) (> 0) in the last 6 months. The y-axis represents the proportion of the cohort (%) and the x-axis lists the stressful life events. Participants that responded "rather not answer" and "other" for this question were removed (n=242, 14 respondents did not answer this question). 30.1% of participants reported not having any SLE in the last 6 months.

Comparison tests between ACE, SLE, and Lifetime Overdoses

Within the ACE sub cohort, 78.6% reported experiencing at least one opioid overdose in their lifetime (n = 192). After listwise deletion (n = 186), pairwise correlations were conducted among ACE scores, SLE counts, and lifetime overdose frequency. A significant positive correlation was observed between ACE and lifetime overdose frequency (ρ = 0.239, p = 0.001; Figure 4), whereas no significant correlations were observed between SLE counts and overdose frequency, or between ACE and SLE scores.

To further examine the unique contributions of childhood and recent stressors, a multiple linear regression was estimated with lifetime overdose frequency as the dependent variable. Higher ACE scores were associated with a greater number of lifetime overdoses (β = 0.884, SE = 0.402, p = 0.029), while SLE counts were not significantly associated with overdose frequency (β = 0.170, SE = 1.485, p = 0.909). Although lifetime overdose frequency represents a count outcome that may deviate from normality, results were consistent with the correlational findings, suggesting that childhood adversity shows a more consistent association with overdose frequency than recent stressful life events in this sample.

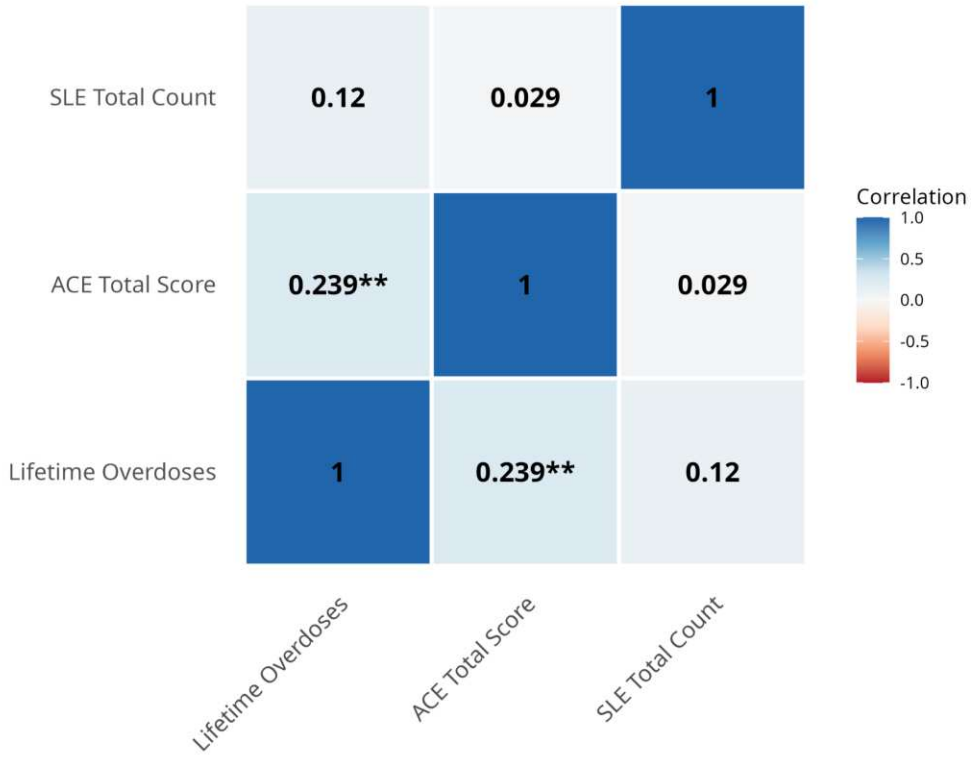


Figure 4. Three-way correlation matrix summary of Spearman correlation tests comparing SLE total count, ACE total score, and lifetime overdose numbers, displaying ρ correlation values.

DISCUSSION

This study provides compelling evidence that childhood adversity are highly prevalent among individuals who use fentanyl and are strongly associated with earlier initiation of use, greater burden of mental illness, suicidal ideation and attempts, and increased lifetime overdose frequency.

Our findings support a conceptual model in which early life trauma functions as a key upstream determinant of both opioid-related harm and suicidality (22). The co-occurrence of overdose and self-harming behaviors observed in this cohort suggests that trauma-related vulnerability manifests across multiple domains of morbidity. Importantly, this reinforces the potential utility of trauma

history as a clinically actionable predictor of high-risk trajectories, including overdose and suicide attempts.

Extending the well-established dose–response relationship between childhood trauma and substance use (2,7,23), our findings demonstrate its relevance in the context of high-potency synthetic opioids, a domain in which empirical data remain limited despite the escalating public health burden (19).

Despite robust evidence linking ACE to later substance use and mental health outcomes, our findings suggest that trauma remains under-recognized and not addressed within clinical care pathways. In this cohort, trauma exposure was highly prevalent, yet there was limited evidence of systematic assessment or trauma-informed intervention when participants provided additional anecdotes.Their engagement with the healthcare system at primarily an acute care level also reflects potential unmet needs in trauma-focused psychosocial support. This disconnect highlights a critical systems-level gap, wherein well-established risk factors are neither routinely screened for nor meaningfully incorporated into care planning.

Upon identification by physicians, many patients recruited in this sample had multiple previous points of healthcare contact. Another analysis of this cohort found a majority prevalence (72.6%) of chronic pain related to and along with other acute conditions (24), relating to a self-medicative mechanism of opioid use. This is in addition to the high prevalence of trauma, concurrent mental illness, overdose, and suicide history as found in the present analysis, reflecting complex clinical comorbidities in these participants who use fentanyl. This suggests that earlier identification of trauma and provision of appropriate family or psychosocial supports could have altered clinical trajectories, potentially mitigating later morbidity and mortality. The association between higher ACE scores and younger age at first fentanyl use is particularly noteworthy. While duration of use was not significantly related to ACE burden, earlier initiation may indicate accelerated progression into high-risk substance use rather than simply prolonging exposure (25,26). This pattern aligns with developmental and neurobiological models of addiction, which emphasize early stress-related alterations in the hypothalamic–pituitary–adrenal (HPA) axis, impaired affect regulation, and heightened sensitivity to reward under conditions of adversity (8,9,18). In this context, fentanyl use may reflect not only market availability but also the convergence of early vulnerability and the rapid onset of dependence associated with high-potency opioids (27).

ACE burden showed also a relationship between ACE and suicidality, including recent suicidal ideation and lifetime suicide attempts. This is consistent with prior evidence linking childhood maltreatment to increased suicide risk across the lifespan (1,10). The overlap between suicidality, overdose risk, and fentanyl use supports emerging conceptualizations of opioid use as suicide-adjacent or self-harming behavior for some individuals, rather than solely compulsive or recreational drug use (28–30)

Associations between specific ACE categories such as physical abuse, sexual abuse, and parental loss and lifetime overdose frequency underscore the enduring impact of early relational and environmental trauma on later risk-taking and mortality. Most participants reported parental separation or divorce, exposure to household substance use, and high rates of emotional or psychological abuse, with nearly half also reporting physical abuse. These patterns align with prior evidence linking family dysfunction to substance use, mental illness and suicidality (2,10,21). This underscores calls for trauma-focused and family-centred approaches prior to the escalation of substance use (4,31).

Substance use and mental health challenges, by parents and/or children, are felt by the whole family unit, and manifests into systemic dysfunction. Expanding from child-focused supports, individualized care for parents or caregivers in these family-based frameworks is critical for resolving family instability holistically, addressing untreated psychiatric needs, substance use, and unresolved trauma (32).

The overrepresentation of Indigenous participants with higher ACE scores highlights the critical role of intergenerational trauma and structural inequities in shaping risk. This Vancouver-based cohort is reflective of BC reporting's on The disproportionate rates of overdose mortality, suicide, and substance-related harms among Indigenous peoples, particularly youth (33). These disparities are importantly interrelated with historical and ongoing impacts of colonization, including residential schools, forced family separation, systemic racism, and inequitable access to health and social services (34,35).The biopsychosocial mechanisms of intergenerational trauma transmission (36)impact the entire family system, requiring support for all family members. Our findings reinforce the need for not only early intervention for Indigenous youth in vulnerable environments, but integration with Indigenous-led, family-based, culturally safe, and trauma-informed approaches that address both individual and collective healing.

Adverse life experiences in adulthood, or SLEs, emerged as important compounding factors, with a substantial proportion of participants reporting major losses or health crises in the six months preceding assessment. The positive correlation between ACE scores, recent SLEs, and lifetime overdoses suggests a cumulative risk process in which early trauma establishes vulnerability that is reactivated or intensified by later stressors (5,31). This life-course perspective challenges episodic models of care and supports sustained, anticipatory interventions that address trauma exposure across developmental stages and life transitions.

In medicine, systems of care are typically organized around the prevention of morbidity and mortality. However, our findings suggest that current models are not adequately structured to address trauma as a foundational driver of these outcomes. Despite the predictive power of ACE and related constructs, trauma-focused screening and interventions remain inconsistently implemented, limiting the ability of healthcare systems to intervene before high-risk outcomes such as overdose, suicide, and further difficult adult experiences occur.

The strong predictive value of ACE for later high-risk opioid use underscores a persistent gap between what is known about childhood trauma and what is implemented in practice. Despite decades of evidence linking early adversity to substance use, mental illness, and suicide (8,21), early intervention remains inconsistently applied and often inaccessible to families facing the greatest burden. Trauma-focused, family-based interventions delivered in childhood and adolescence have demonstrated efficacy in improving mental health and reducing later risk behaviors (4,10), yet remain underutilized within public health systems.

Implications for clinical practice and policy

The results support the integration of routine trauma screening and trauma treatment within addiction medicine, emergency care, and mental health services (37). However, screening without access to culturally safe, trauma-specific treatment risks re-traumatization and limited clinical benefit. Investment in early intervention frameworks, particularly those that are family-centered, community-based, and Indigenous-led are essential. Addressing childhood trauma should be recognized not only as a mental health priority but as a core component of overdose prevention.

In the context of the ongoing opioid overdose crisis, policies focused exclusively on downstream harm reduction, while essential, are insufficient. A comprehensive response must also address upstream determinants, including childhood maltreatment, family instability, poverty, and social marginalization (17,38). Prevention efforts targeting vulnerable youth in unstable environments may yield long-term benefits that extend beyond substance use outcomes to include reductions in suicide, chronic mental illness, and intergenerational harm.

Evidence from the United States suggests that adolescents and young adults often fail to receive sustained treatment engagement following overdose events (39), underscoring systemic gaps relevant in the Canadian context. The overdose response should not end with naloxone but rather initiate active engagement into withdrawal management and treatment options, protection through evidence-based OAT and long-term recovery, including vocational rehabilitation, healthcare connection, and re-integration into society.

Limitations and future directions

Reliance on retrospective self-report may introduce recall bias, although self-reports among substance use populations have been found to be generally accurate (40). The use of convenience sampling from a single urban hospital limits generalizability, particularly to individuals not engaged with healthcare services. Additionally, while the ACE questionnaire captures cumulative adversity, it does not assess actual severity, chronicity, or timing of trauma, nor does it account for protective factors that may mitigate risk (5). Future research should employ longitudinal designs to clarify causal pathways between early trauma, fentanyl use initiation, and overdose risk. Greater attention is needed to disentangle the roles of suicidality, market dynamics, and structural determinants in shaping fentanyl use behaviours. Research conducted in partnership with Indigenous communities is essential to ensure ethical interpretation and to inform interventions aligned with community priorities (35).

Conclusion

Despite its high prevalence and significance, trauma is not routinely assessed or integrated into care pathways, reflecting a significant gap between evidence and practice. Trauma serves as a key upstream determinant of morbidity and mortality and highlight the need to treat in a model-driven, trauma-focused approach rather than crisis response-based. Earlier identification and intervention may represent a critical opportunity to reduce preventable adverse outcomes, including overdose and suicide. Dedicated trauma treatment and family-based interventions could be instrumental to prevent high-risk substance use and overdose, if the necessary treatment capacities would exist.

Author Contributions

Vivian W. Tsang (Conceptualization, Funding acquisition, Formal analysis, Data curation, Investigation, Visualization, Writing – original draft, Writing – review & editing); Andrea Wong Koo (Conceptualization, Formal analysis, Data curation, Investigation, Visualization, Validation, Writing – original draft, Writing – review & editing); Mark Short (Writing – original draft, Writing – review & editing); Belal Mnur (Formal analysis, Data curation, Visualization, Validation, Writing – review & editing); Rishika Daswani (Data curation, Visualization, Writing – original draft); Martha J. Ignaszewski (Funding acquisition, Project administration, Resources, Supervision, Writing – review & editing), Roberto Sassi (Funding acquisition, Supervision, Writing – review & editing), Reinhard Michael Krausz (Funding acquisition, Project administration, Resources, Supervision, Writing – review & editing)

Data Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declaration of competing interest

The authors state that they have no recognized competing financial interests or personal relationships that could be perceived as influencing the work presented in this paper.

Ethics approval

This study was conducted in accordance with the ethical standards set by the World Medical Association Declaration of Helsinki and followed the International Committee of Medical Journal Editors (ICMJE) recommendations. The study protocol was reviewed and approved by the University of British Columbia's Clinical Research Ethics Board (CREB), with approval granted on January 16 2023 under reference number H22-00879. All participants were fully informed of the study's purpose and procedures, and written informed consent was obtained from each participant prior to their involvement. The privacy rights of the participants were rigorously protected throughout the study.

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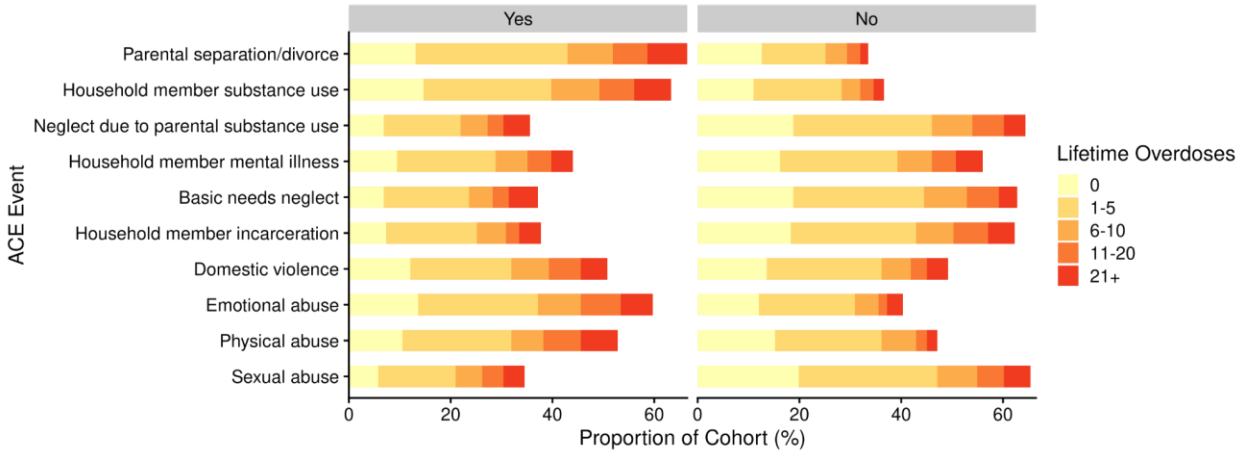
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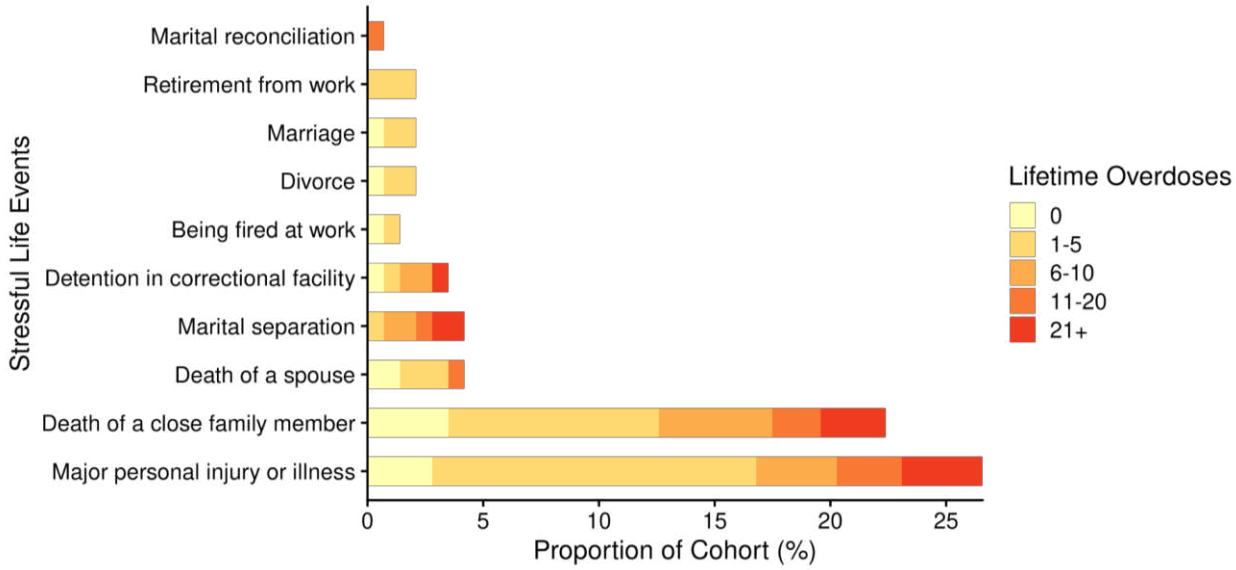
APPENDIX



Appendix A. Stacked bar plot showing lifetime overdose frequency amongst people using fentanyl across "Yes/No" groups for each ACE category. The y-axis represents the proportion of the cohort (%) and the x-axis lists the ACE categories.

Appendix B. Correlation values for lifetime overdose frequency by Adverse Childhood Experience (ACE) or recent Stressful Life Event (SLE) event. Adjusted p-values yielded from Benjamin-Hochberg correction tests.

Category	**Event**	Rho (ρ) correlation	*p*	Adjusted *p*
ACE	Physical Abuse	0.246	0.0007	**0.0071****
	Sexual Abuse	0.193	0.0083	**0.0387***
	Parental Loss	0.185	0.0116	**0.0387***
	Emotional Abuse	0.16	0.0296	0.074
	Household Substance Use	0.132	0.0733	0.1457
	Neglect	0.117	0.1109	0.1457
	Household Mental Illness	0.115	0.1184	0.1457
	Domestic Violence	0.111	0.1304	0.1457
	Emotional Neglect	0.111	0.1311	0.1457
	Household Incarceration	0.068	0.3589	0.3589
SLE	Marital separation	0.179	0.0145	0.1453
	Death of a close family member	0.108	0.1421	0.5021
	Major personal injury or illness	0.093	0.2044	0.5021
	Marital reconciliation	0.089	0.2258	0.5021
	Detention in correctional facility	0.07	0.342	0.5021
	Being fired at work	-0.064	0.3872	0.5021
	Retirement from work	-0.063	0.3896	0.5021
	Divorce	-0.062	0.4017	0.5021
	Marriage	-0.037	0.6128	0.6611
	Death of a spouse	-0.032	0.6611	0.6611



Appendix C. Stacked bar plot showing lifetime overdose frequency ranges amongst participants who have experienced SLE within the past six months. The y-axis represents the proportion of the cohort (%) and the x-axis lists the SLE.

Appendix D.

ACE	ACE Status	Bin	Percentage
Sexual abuse	Yes	21	4.2
Sexual abuse	Yes	11-20	4.2
Sexual abuse	Yes	6-10	5.2
Sexual abuse	Yes	1-5	**15.2**
Sexual abuse	Yes	0	5.8
Sexual abuse	No	21	5.2
Sexual abuse	No	11-20	5.2
Sexual abuse	No	6-10	7.9
Sexual abuse	No	1-5	**27.2**
Sexual abuse	No	0	19.9
Physical abuse	Yes	21	7.3

Physical abuse	Yes	11-20	7.3
Physical abuse	Yes	6-10	6.3
Physical abuse	Yes	1-5	**21.5**
Physical abuse	Yes	0	10.5
Physical abuse	No	21	2.1
Physical abuse	No	11-20	2.1
Physical abuse	No	6-10	6.8
Physical abuse	No	1-5	**20.9**
Physical abuse	No	0	15.2
Emotional abuse	Yes	21	6.3
Emotional abuse	Yes	11-20	7.9
Emotional abuse	Yes	6-10	8.4
Emotional abuse	Yes	1-5	**23.6**
Emotional abuse	Yes	0	13.6
Emotional abuse	No	21	3.1
Emotional abuse	No	11-20	1.6
Emotional abuse	No	6-10	4.7
Emotional abuse	No	1-5	**18.8**
Emotional abuse	No	0	12
Domestic violence	Yes	21	5.2
Domestic violence	Yes	11-20	6.3
Domestic violence	Yes	6-10	7.3
Domestic violence	Yes	1-5	**19.9**
Domestic violence	Yes	0	12
Domestic violence	No	21	4.2

Domestic violence	No	11-20	3.1
Domestic violence	No	6-10	5.8
Domestic violence	No	1-5	**22.5**
Domestic violence	No	0	13.6
Household member incarceration	Yes	21	4.2
Household member incarceration	Yes	11-20	2.6
Household member incarceration	Yes	6-10	5.8
Household member incarceration	Yes	1-5	**17.8**
Household member incarceration	Yes	0	7.3
Household member incarceration	No	21	5.2
Household member incarceration	No	11-20	6.8
Household member incarceration	No	6-10	7.3
Household member incarceration	No	1-5	**24.6**
Household member incarceration	No	0	18.3
Basic needs neglect	Yes	21	5.8
Basic needs neglect	Yes	11-20	3.1
Basic needs neglect	Yes	6-10	4.7
Basic needs neglect	Yes	1-5	**16.8**
Basic needs neglect	Yes	0	6.8
Basic needs neglect	No	21	3.7

Basic needs neglect	No	11-20	6.3
Basic needs neglect	No	6-10	8.4
Basic needs neglect	No	1-5	**25.7**
Basic needs neglect	No	0	18.8
Household member mental illness	Yes	21	4.2
Household member mental illness	Yes	11-20	4.7
Household member mental illness	Yes	6-10	6.3
Household member mental illness	Yes	1-5	**19.4**
Household member mental illness	Yes	0	9.4
Household member mental illness	No	21	5.2
Household member mental illness	No	11-20	4.7
Household member mental illness	No	6-10	6.8
Household member mental illness	No	1-5	**23**
Household member mental illness	No	0	16.2
Neglect due to parental substance use	Yes	21	5.2
Neglect due to parental substance use	Yes	11-20	3.1
Neglect due to parental substance use	Yes	6-10	5.2
Neglect due to parental substance use	Yes	1-5	**15.2**
Neglect due to parental substance use	Yes	0	6.8

Neglect due to parental substance use	No	21	4.2
Neglect due to parental substance use	No	11-20	6.3
Neglect due to parental substance use	No	6-10	7.9
Neglect due to parental substance use	No	1-5	**27.2**
Neglect due to parental substance use	No	0	18.8
Household member substance use	Yes	21	7.3
Household member substance use	Yes	11-20	6.8
Household member substance use	Yes	6-10	9.4
Household member substance use	Yes	1-5	**25.1**
Household member substance use	Yes	0	14.7
Household member substance use	No	21	2.1
Household member substance use	No	11-20	2.6
Household member substance use	No	6-10	3.7
Household member substance use	No	1-5	**17.3**
Household member substance use	No	0	11
Parental separation/divorce	Yes	21	7.9
Parental separation/divorce	Yes	11-20	6.8
Parental separation/divorce	Yes	6-10	8.9

Parental separation/divorce	Yes	1-5	**29.8**
Parental separation/divorce	Yes	0	13.1
Parental separation/divorce	No	21	1.6
Parental separation/divorce	No	11-20	2.6
Parental separation/divorce	No	6-10	4.2
Parental separation/divorce	No	1-5	**12.6**
Parental separation/divorce	No	0	12.6

Appendix E. Adverse Childhood Experiences (ACE) questions in interview survey.

Q10.1 Adverse Childhood Experiences (ACE): Volunteer: these next questions ask about things that may have happened during your first 18 years of your life while you were growing up. Remember these are only yes or no answers, you don't need to provide any further details, and you can choose not to answer a question, or skip the section.

Q10.2 Were your parents ever separated or divorced?

- o Yes
- o No
- o Rather not answer

Q10.3 Did you live with anyone who was a problem drinker or alcoholic or who used street drugs?

- o Yes
- o No
- o Rather not answer

Q10.4
 Or your parents were too intoxicated (drunk or high) to take care of you or take you to the doctor if you needed it?

- o Yes
- o No
- o Rather not answer

Q10.5 Was a household member depressed or mentally ill or did a household member attempt suicide?

- o Yes
- o No
- o Rather not answer

Q10.6 Did you often feel that you didn’t have enough to eat, had to wear dirty clothes, and had no one to protect you?

- o Yes
- o No
- o Rather not answer

Q10.7 Did a household member go to prison?

- o Yes
- o No
- o Rather not answer

Q10.8 Did you experience domestic violence at home? (For example, was your mother or stepmother often pushed, grabbed, slapped or had something thrown at her?)

- o Yes

- o No
- o Rather not answer

Q10.9 Did you experience emotional or psychological abuse?

- o Yes
- o No
- o Rather not answer

Q10.10 Did you experience physical abuse?

- o Yes
- o No
- o Rather not answer

Q10.11 Did you experience sexual abuse?

- o Yes
- o No
- o Rather not answer

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