



Adverse Childhood Experiences (ACEs) and Health Histories Among Clients in a First Nations-Led Treatment for Substance Use

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Abstract

First Nations adults continue to experience significant health disparities compared to non-First Nations adults in Canada. Ongoing difficulties associated with intergenerational trauma among First Nations peoples may be examined using the adverse childhood experiences (ACEs) model, which measures various forms of abuse, neglect, and household dysfunction. We examined prevalence rates of ACEs and physical and mental health outcomes within a predominately First Nation sample of clients seeking substance use treatment from a First Nations-led treatment facility. The prevalence of ACEs was higher than national averages and previous data collected with broader Indigenous samples in Canada. Descriptive analyses of ACEs and health outcomes for those seeking First Nations-led substance use treatment showed these participants had more chronic health difficulties co-morbid with clinical levels of problematic substance use. To improve ongoing best-treatment options for those seeking substance use treatment, continued assessment and promotion of broader aspects of health and wellbeing are required, including the balance of physical, emotional, spiritual, and mental health and wellbeing across a lifespan.

Keywords Adverse childhood experiences · ACEs · Indigenous health · Trauma · Post-traumatic stress disorder · First Nation Health · Substance use treatment

The ACE model, first described by Felitti and colleagues in 1998, has provided a useful framework to quantify complex relationships of intergenerational experiences of adversity for First Nations people. Experiencing four or more ACEs prior to the age of 18 has been

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affiliated with increased rates of chronic disease and lower mental health functioning. For potentially vulnerable populations, examining the relationships between early childhood experiences, adult substance use, and current health outcomes can be useful in considering how health trajectories may differ across the lifespan. Although there are many pathways to the development of a substance use disorder, it is possible that intergenerational experiences of abuse, neglect, and increased exposure to maladaptive environments during childhood directly affect an individual's mental and physical health outcomes as an adult. Furthermore, given the epigenetic disruption of typical neuroanatomical and neuroendocrine development associated with ACEs (Herzog & Schmahl, 2018), there may be biological risk factors among individuals whose parents endured adversity (Lê-Scherban et al., 2018). These relationships have yet to be documented within First Nations populations.

Experiences of intergenerational trauma are previously documented within Indigenous¹ populations in Canada (Truth and Reconciliation Commission of Canada [TRCC], 2015; Gone et al., 2019). Moreover, it is likely that a grandparent and/or parent's involvement in the child welfare or residential school system may negatively affect the mental and physical health of subsequent generations. Given that Indigenous peoples' experiences with residential schools and child welfare have been previously associated with increased rates of abuse and neglect (TRCC, 2015), the ACE framework serves as a useful model to describe possible intergenerational transmission of adversity. Indeed, Felitti and colleagues (Felitti et al., 1998) examined ten common forms of childhood adversity, including physical, emotional, and sexual abuse, physical and emotional neglect, parental separation/divorce, exposure to intimate partner violence, as well as a household member who has experienced substance use difficulties, mental health difficulties, or who has been incarcerated. To date, no studies have examined the prevalence of all ten ACEs exclusively within First Nations communities in Canada. While two provincial-wide studies on ACEs have been published, there was limited representation of any Indigenous population. Furthermore, these endeavors did not assess all ten ACEs, making it difficult to compare results across studies (Radford et al., 2021). Research that documents the prevalence of all ACEs for First Nations individuals can be particularly valuable for First Nations communities and may inform existing prevention and treatment efforts within substance use treatment settings, where the impact of ACEs is particularly salient.

Various biopsychosocial models have considered the influence of intergenerational stress in relation to broad predictors of mental health functioning affiliated with substance use. For example, levels of cortisone obtained from hair samples provided by Indigenous and non-Indigenous individuals were significantly higher in Indigenous women but were lower among Indigenous men (Davison et al., 2019). Notably, Indigenous women in this study reported higher levels of psychological distress, lower self-reported wellbeing, and high rates of stressful events in their lives. Biological markers of stress hormone levels have been proposed to be a unique way to measure physical health outcomes associated with increased rates of substance use, suggesting that prolonged exposure to distressful events may contribute to problematic substance use and a higher likelihood of relapse

¹ Indigenous populations in Canada are characterized by three distinct communities of First Nation, Métis, and Inuit populations. Within these communities, there is tremendous diversity, and as such, these terms are not interchangeable. The terminology used in this manuscript represents the community referenced within the available literature that was cited. Given the paucity of literature related to First Nation ACE research, we opted to cite broader Indigenous-specific research as required. In particular, these studies can reflect shared experiences among these communities of colonization, marginalization, and discrimination in Canada.

(Milivojevic & Sinha, 2018). These models are similar to the explanatory ACE pyramid developed by the Centers for Disease Control and Prevention (2012), which articulates that ACEs contribute to increased chronic health disparities through disrupted neurobiology and maladaptive coping strategies that can increase the likelihood of harm.

Measuring ACEs is a useful avenue for considering how adversity is associated with the emergence of problematic substance use across a lifespan. For example, among parents and grandparents, intergenerational transference of problematic substance use is at a one-to-one ratio to disease transference (Escario & Wilkinson, 2015; Henry & Augustyn, 2017; Hill et al., 2018). Recent research has explored commonly co-occurring disorders affiliated with problematic substance use, including mental health disorders and chronic diseases. For First Nations populations, contextualizing high rates of problematic substance use in a way that reflects the needs of these individuals may better inform understanding of high rates of chronic physical and mental health concerns in relation to intergenerational trauma.

Increased risk of co-morbid concerns may be mitigated by the presence of positive life reinforcers and factors that promote resilience. For example, engagement in life reinforcers by Indigenous youth, including cultural, social, and extracurricular activities, has been associated with decreased alcohol use 3 months prior (Spillane et al., 2021). The ability to engage in harm reduction solutions, or engage in activities that promote resilience within communities, can also be addressed within substance use treatment, as treatment options often aim to address co-morbid physical and mental health concerns using a variety of treatment approaches. Treatment strategies that exemplify a holistic approach and balance aspects of mental, physical, emotional, and spiritual wellbeing have been developed and used with Indigenous populations to address substance use concerns (Rowan et al., 2014). Among Indigenous communities, access to integrated supports, such as those that prioritize both physical and mental health are particularly useful (Niccols et al., 2010), given the increased complexity of individual client needs, in conjunction with the broader health disparities experienced within these communities.

Indigenous models of wellness, such as the First Nations Mental Wellness Continuum Framework (FNMWCF), can also contextualize relevant protective factors (Assembly of First Nations & Health Canada, 2015). The FNMWCF incorporates aspects of the medicine wheel, which balances physical, emotional, mental, and spiritual wellbeing. This balance is viewed to promote individual aspects of wellness related to hope, belonging, meaning, and purpose and potentially mitigate experiences of child adversity. However, among the Indigenous ACE studies completed to date (Radford et al., 2021), none have incorporated any type of existing model that promotes Indigenous wellbeing in a Canadian context. If clear relationships between ACEs and health outcomes can be established, the role of protective factors (including hope, belonging, meaning, and purpose, as described in the FNMWCF) and the promotion of resilience can be better understood.

These integrated models of wellness can be applied within Indigenous communities to tailor services to best meet community needs. Indigenous individuals seeking substance use treatment have been previously reported to have more treatment complexities, including more co-morbid concerns, reduced access to social determinants of health, and previous exposure to distressing events and ACEs (Urbanoski, 2017; Skewes & Blume, 2019; Allan et al., 2012; Ross et al., 2015). Despite these documented disparities, few studies have compared current mental and physical health concerns with ACEs within Indigenous samples seeking substance use treatment. Further contextualization of these trends with consideration of prevalent experiences specific to Indigenous communities can also broaden understanding of client experiences to inform the development of culturally-relevant treatment options for Indigenous clients.

Study Objectives and Hypotheses

The primary goal of this study was to describe the relationships between ACEs, rates of chronic disease, and mental health among individuals seeking support for substance use from a First Nations-led substance use facility. The four objectives of this study were as follows:

1. Calculate the point prevalence ACE scores for clients seeking treatment for substance use from this treatment facility;
2. Describe the participant's physical health and treatment history;
3. Describe the participant's mental health and treatment history;
4. Describe if a history of residential school attendance is associated with an increased ACE score.

We hypothesized that, as increased ACE scores have been associated with an increased likelihood of adult alcohol problems (Dube et al., 2002), it was likely that scores in this sample would be higher than the previously calculated general population mean of 1.31, as reported by the Alberta ACE study (Alberta Centre for Child, Family, and Community Research 2014; MacDonald et al., 2014) or 1.23, as reported by Chartier et al. (2010) using six ACEs from the Ontario Health Survey general population data. There were no specific hypotheses generated for Objective 1 as statistical comparisons among ACE scores calculated across groups were not feasible given diverse data collection methods and variables examined across national studies.

Additional hypotheses corresponding to other study objectives were as follows:

1. Participants with higher ACE scores will report a higher number of physical and mental health concerns.
2. Participants with higher ACE scores will report significantly lower scores on the Native Wellness Assessment upon entering treatment, indicating reduced hope, belonging, meaning, and purpose, in addition to less engagement in cultural activities.
3. Parent residential school attendance will be associated with a higher number of reported ACEs among participants and lower participation in cultural activities.

Method

Participants

A convenience sample of 141 adults seeking residential treatment for substance use completed this study. Among 216 potential participants (calculated by the sum of participants in all treatment cycles), 141 consented to participate in this study. Among this sample, 141 completed Time 1 questionnaires and 71 completed Time 2 questionnaires. Participant attrition between assessment periods was attributed to specific factors relating to client early treatment discharge (15 participants), staff related error/circumstance collecting data (19 participants), and participant withdrawal from the study (12 participants). Sixteen participants could not complete data collection due to one treatment cycle ending early as a protective measure in response to the COVID-19 pandemic. For eight participants, there was no specified reason for study withdrawal.

At the time of data collection, all participants were clients of a First Nation adult residential treatment center. The treatment center is a 20-bed treatment facility that combines local First Nation cultural teachings with additional mental health counseling services. It is operated by a local First Nation mental health community organization and is open to adults aged 18 years or older, with approximately 85% of clients self-identifying as Indigenous, the majority of which identify as First Nation. The residential treatment duration is 6 weeks, followed by a 12-week aftercare program that focuses on relapse prevention, group counseling, psychoeducation, and ongoing case management.

Potential study participant eligibility was determined by the following inclusion criteria, based on the treatment center population:

1. A current client of the partnering residential substance use treatment facility;
2. Eighteen years of age or older;
3. Capable to consent and competently participating in all study procedures (i.e., is not under the influence of non-prescribed substances; can read, speak, and understand English).

Potential participants were deemed ineligible to participate in the study if these criteria were not met. All clients who expressed interest in the study met these criteria and were thus able to participate, regardless of Indigenous status.

Among those who completed all study measures, 52 (75.5% of the sample) self-identified as Indigenous. As the treatment facility prioritizes admission of clients if they are from one of the 13 First Nation communities in partnership with the indigenous-led community-based organization, the majority of Indigenous participants identified as First Nation from the Robinson Superior Treaty Area. The mean age of the sample was 35.05 ($sd = 10.0$) and ranged from 20 to 65. Additional participant demographics are described in Table 1.

Measures

The six measures used for this study were given as part of a larger questionnaire package. These measures consisted of 310 items and took participants approximately 60 min to complete. Time 1 measures were completed independently by clients with the help of a research assistant as required, while time 2 measures (consisting of mostly trauma-specific questions) were completed in a small group setting or individually with a counselor present.

ACE and Health History Questionnaires Participant ACE scores were calculated in two ways. First, a summed score of six single items derived from the client intake questionnaire was used to provide a score of ACEs relating to childhood sexual abuse, physical abuse, emotional abuse, family alcohol use, witness to intimate partner violence, and divorce or separation of parents. The second approach combined multiple item measures to assess for 10 ACEs, calculated from items from the Family Health History Questionnaire and the Health Appraisal Questionnaire, as these were the health outcome measures used in the initial ACE study completed by Felitti et al. (1998). These questions assess current physical and mental health, prior health histories, ACEs in childhood, and other relevant health information.

Questions were used from previously validated measures such as the conflicts tactics scale (Straus, 1990) as a way to conceptualize abuse and violence. Physical health

Table 1 Participant demographics

			<i>N</i>	<i>m</i> ACE score	Sd	<i>t</i> or <i>F</i> score
Sex	Total ACEs	Male	37	5.46	2.09	-1.35
		Female	33	4.79	2.07	
	Intake ACEs	Male	81	2.47	1.95	2.70**
		Female	59	3.36	1.88	
Indigenous status	Total ACEs	Indigenous	52	5.04	2.13	-0.453
		Non-Indigenous	16	5.31	2.09	
	Intake ACEs	Indigenous	101	2.97	1.94	1.47
		Non-Indigenous	34	2.41	1.87	
Residential school history	Total ACEs	Yes	5	2.50	0.707	-4.55
		No	47	5.15	2.04	
	Intake ACEs	Yes	4	4.33	1.53	1.48
		No	92	3.00	1.92	
Parent residential school history	Total ACEs	Yes	22	5.50	2.37	0.975
		No	23	4.91	1.62	
	Intake ACEs	Yes	22	3.41	1.56	1.42
		No	25	2.60	2.24	
Marital status	Total ACEs	Married/common law	17	5.29	2.44	2.10
		Serious relationship	7	5.42	2.23	
		Widowed	3	7.67	2.31	
		Divorced/separated	8	3.75	1.58	
		Single	34	5.12	1.89	
	Intake ACEs	Married/common law	36	2.78	1.69	1.08
		Serious relationship	9	3.33	2.40	
		Widowed	3	4.33	1.53	
		Divorced/separated	18	3.28	1.93	
		Single	71	2.62	1.97	
Education	Total ACEs	Grade 8 or less	1	-	-	0.422
		Some high school	24	5.46	2.06	
		High school Graduate or GED	11	5.09	3.14	
		Some university, technical school, or college diploma	29	4.90	1.68	
		University degree	4	4.75	2.75	
	Intake ACEs	Grade 8 or less	3	2.66	1.15	0.311
		Some high school	50	2.94	2.11	
		High school or GED graduate	31	2.74	2.00	
		Some university, technical school, or college diploma	47	2.91	1.72	
		University degree	5	2.00	2.00	

Table 1 (continued)

			<i>N</i>	<i>m</i> ACE score	<i>Sd</i>	<i>t</i> or <i>F</i> score
Annual reported income	Total ACEs	<\$10 000	26	5.27	2.32	0.537
		\$10,001 to \$19,999	21	5.05	1.91	
		20,0000 to \$29,999	7	4.43	2.23	
		\$30,000 to \$39,999	2	6.50	2.12	
		\$40,000 to \$60,000	3	6.00	2.00	
		> than \$60,000	4	4.75	2.50	
	Intake ACEs	<\$10 000	53	3.08	1.84	0.698
		\$10,001 to \$19,999	35	2.86	2.13	
		20,0000 to \$29,999	16	2.44	1.79	
		\$30,000 to \$39,999	8	2.25	1.98	
		\$40,000 to \$60,000	6	2.17	1.84	
		> than \$60,000	8	2.13	1.36	
Employment status	Total ACEs	Full-time	10	5.5	2.22	0.859
		Part-time/student	6	4.33	2.16	
		Social assistance	29	5.55	2.06	
		Unemployed	19	5.00	2.21	
		Parenting/retired	2	3.50	.707	
	Intake ACEs	Full-time	25	2.44	1.82	2.40
		Part-time/student	13	2.77	2.13	
		Social assistance	56	3.39	1.99	
		Unemployed	34	2.41	1.74	
		Parenting/retired	4	1.50	1.29	
Growing up in family-owned home	Total ACEs	Yes	44	5.20	2.09	- 0.120
		No	22	5.27	2.23	
	Intake ACEs	Yes	91	2.48	1.76	- 3.42**
		No	41	3.71	1.97	

* $p < 0.05$; ** $p < 0.01$

questions were obtained from measures developed by the Centers for Disease Control and Prevention, such as the Behavioural Risk Factor Surveys (Siegel et al., 1993) and The Third National Health and Nutrition Examination Survey (Crespo et al., 1996). Additional questions were included to capture relevant health information pertinent to study goals. Two questionnaires were used in this study to assess male and female-specific health outcomes.

ACE scores were derived from the Family Health History Questionnaire by cumulating client responses to specific ACE assessment items using the method described by Dube et al. (2003). Three ACEs, household members engaging in substance use, the household member being incarcerated, and parental divorce, were assessed from participant endorsement using dichotomous “yes” or “no” responses to these items. The presence of household mental illness was quantified as an ACE by participant endorsement of either of the following two items, “Was a household member depressed or mentally ill?” or “Did a household member attempt suicide?”.

The remaining ACEs were assessed using participant responses on a 5-item Likert-type scale of “never,” “rarely,” “sometimes,” “often,” or “very often.” To assess intimate partner

violence experienced by a participant's mother, the following 5 items were asked: How often did your father (or stepfather) or mother's boyfriend do any of these things to your mother or (stepmother)?

1. Push, grab, slap, or throw something at her?
2. Kick, bite, hit her with a fist, or hit her with something hard?
3. Repeatedly hit her for at least a few minutes?
4. Threaten her with a knife or gun?
5. Use a knife or gun to hurt her?

Any response ranging from "sometime" to "very often" was classified as an endorsement of this ACE for questions 1 to 3, while any response greater than "never" for questions 4 and 5 was considered to be indicative of this ACE.

To assess parental emotional and physical neglect, Dube et al. (2003) adapted 5 items from the Childhood Trauma Questionnaire (CTQ), using the same 5-item Likert-type scale. Emotional neglect was assessed from reverse scoring and summing scores from the following five items:

1. There was someone in my family who helped me feel important or special.
2. I felt loved.
3. People in the family looked out for each other.
4. People in my family felt close to each other.
5. My family was a source of strength and support.

Participant endorsement of emotional neglect was considered to be a score greater than 15, which would indicate a CTQ score in the moderate to severe range. This scoring was used to quantify experiences of this ACE within our sample. We quantified experiences of physical neglect using 5 items derived from the CTQ in the same manner as Dube et al. (2003). These items were:

1. I didn't have enough to eat.
2. I knew there was someone to take care of me and protect me.
3. My parents were too drunk or high to take care of me.
4. I had to wear dirty clothes.
5. There was someone to take me to the doctor if I needed it.

Items 1, 3, and 5 were scored using the same Likert-type ratings, while items 2 and 4 were reverse scored. All 5 items were summed and a score greater than or equal to 10 was considered to be participant endorsement of this ACE, as this score would fall in the moderate to severe range on the CTQ.

Emotional abuse was assessed by a participant's response of "often" or "very often" to either of 2 items, "how often did a parent, step-parent, or adult living in your home swear at you, insult you, or put you down" or "act in a way that made you afraid you were going to get physically hurt?". Physical abuse was assessed by a participant's response of "sometimes," "often," or "very often" to either of 2 items, "how often did a parent, step-parent, or adult living in your home push, grab, or throw something at you," or "hit you so hard that you had marks or were injured?". Sexual abuse was assessed by a "yes" response to any of four items that described sexual experiences with an adult or

some who was five years older than them at the time of occurrence, including relatives, family friends, and strangers. The four items were if such adults had ever:

1. Touched or fondled your body in a sexual way.
2. Had you touched or fondle their body in a sexual way.
3. Attempted to have any type of sexual intercourse with you (oral, anal, or vaginal).
4. Had sexual intercourse with you (oral, anal, or vaginal).

Demographic Questionnaire During the treatment center intake process, all participants complete a brief demographic questionnaire describing employment status, educational attainment, family information, substance use concerns, and relevant health information.

Depression-Anxiety-Stress Scale 21 (DASS21) The DASS21 is a 21-item self-report measure that includes three subscales to assess states of depression, anxiety, and stress. The depression subscale has strong concurrent validity with the Beck Depression Inventory ($r=0.77$), and the anxiety subscale has strong concurrent validity with the Beck Anxiety Inventory ($r=0.84$). The measure also demonstrated good internal consistency among subscales ($\alpha=0.94$ for depression; $\alpha=0.87$ for anxiety; $\alpha=0.91$ for stress; Lovibond & Lovibond, 1995).

Native Wellness Assessment (NWA) The NWA is a 66-item measure of Indigenous individual wellness and can assess the effect of cultural intervention on an individual's wellness. It measures mental, physical, spiritual, and emotional wellness for adults through assessment of a range of individual actions or behaviors and through identification of frequently used cultural practices endorsed by self-report or observer report. The NWA measures wellness using a strength-based approach, by examining the presence of hope, belonging, meaning, and purpose experienced by an individual. First published in 2015, the NWA has demonstrated good internal consistency, with Cronbach's alphas ranging from 77.8 to 85.2, and has been validated to be used with various genders, age groups, and Indigenous groups (Fiedeldey-Van Dijk et al., 2017).

Problematic Gambling Severity Index (PGSI) The PGSI is a 9-item self-report Likert-type measure of gambling behaviors. Scores obtained on this measure classify individuals as non-problem, low risk, moderate risk, and problem gamblers based upon the reported negative consequences of gambling, including spending more money than intended, losing track of time while gambling, gambling to win back money, or feeling guilty of gambling behaviors (Ferris & Wynne, 2001).

PTSD Checklist for DSM-5 (PCL-5) The PCL-5 is a 20-item self-report measure of PTSD symptom severity that corresponds with the Diagnostic and Statistical Manual of Mental Disorders (DSM-5). A total symptom severity score is calculated by summing individual item scores to generate a score ranging from 0 to 80, with a score of 32 indicating a probable PTSD diagnosis. The PCL-5 also has subscales that assess the four categories of PTSD symptoms in the DSM-5, including intrusion, avoidance, arousal and hyperactivity, and changes in cognition and mood. The PCL-5 demonstrates high internal consistency ($\alpha=0.94$) and test-retest reliability ($r=0.82$; Blevins et al., 2015).

Procedure

Data collection was completed by the current treatment counselor of each study participant with support from student research assistants. Counselors were trained on how to deliver the specific study measures to ensure collection processes remained uniform. The training incorporated information from the ACE-International Questionnaire Interview's Guide, although minimal training was required as all counselors had the necessary clinical skills and experience required to complete interviews. The participants were given the choice to complete questionnaires individually using pen and paper or respond to questions orally that was read to them by their counselor or student researcher.

To reduce participant burden, questionnaires were completed in two intervals. The first set of questionnaires was provided to participants on day 2 or 3 of their treatment cycle. These questionnaires asked about general health information and overall wellness. The second set of questionnaires (the remaining half of the Health History Questionnaire and the Family ACE Questionnaire) were completed at the end of week 2 of the treatment cycle, as this corresponded to program components that addressed past and current trauma with clients, including factors that may maintain substance use. These questionnaires asked trauma-focused questions and assessed intergenerational family ACEs. By time 2, clients had completed some individual counseling and were more likely to be emotionally and medically stable. Given that most variables assessed in time 1 were retrospective health data and long-term experiences of culture, two assessment time points were not theorized to induce testing bias, as data collection was inherently cross-sectional in nature. One positive aspect of asking trauma-based questions during time 2 included that, by the time of questionnaire completion, clients had established a therapeutic relationship with their counselor and may have been more comfortable disclosing previous trauma in these questionnaires. If these questionnaires induced feelings of distress, in addition to support received from their counselor, cultural staff could be accessed and a staff psychologist was available if any participants experienced significant distress.

Analyses Statistical analyses were completed using IBM SPSS Statistics (Version 26). To offer preliminary comparisons of population demographics, descriptive statistics were calculated, including means, medians, and ranges, and independent *t*-tests comparing subgroup means were used when relevant. Hypotheses 1 was analyzed using linear regressions of predictors of interest with a number of chronic health conditions set as the criterion value. Hypothesis 2 used a bivariate Pearson correlation to compare NWA scores of hope, belonging, meaning, and purpose with ACEs. Hypothesis 3 compared participant mean ACE scores across parent RSA or non-RSA groups using an independent *t*-test.

Results

Objective 1: Prevalence of ACEs

Participant ACE scores were calculated using Dube et al.'s (2003) method of quantifying ACEs using the ACE Family Health questionnaire (WHO, 2018). The mean ACE score of participants was 5.22 (sd=2.14) and the median score was 5.0. Although we did not complete any inferential analyses to compare this mean score to previous literature, a mean score of 5.22 is incongruent with previous mean ACE scores calculated from general

populations. For example, a mean ACE score of 1.31 was reported by the Alberta ACE study (Alberta Centre for Child, Family, and Community Research, 2014; MacDonald et al., 2014). The mean number of ACEs endorsed by participants with respect to client demographical data is described in Table 1. Frequencies of individual ACEs are described in Table 2, by total sample, males, and females. Figure 1 describes the frequency of ACE sum scores by the total sample, male, and female samples.

Objective 2: Participant Physical Health and Treatment History

ACE scores were linked to the four most common chronic diseases within Ontario resulting in death: cancer, cardiovascular/cerebrovascular diseases, respiratory diseases, and diabetes (Public Health Ontario, 2019). Table 3 describes the ten leading causes of death (Statistics Canada, 2020), across all ages and genders, with the four types of chronic diseases we measured marked with an asterisk. For groups with five or more participants, a mean ACE score for each group was also calculated. Frequently endorsed chronic health concern not attributed as a leading cause of death included high blood pressure ($n=57$, 41.9% of sample), urinary tract/bladder concerns ($n=38$, 27.9% of sample), liver problems including yellow jaundice, hepatitis, or other concerns ($n=32$, 23.5% of sample), arthritis ($n=22$, 17.5% of sample), ulcers ($n=22$, 16.2% of sample), and asthma ($n=20$, 16% of sample).

Risk Factors to Developing Chronic Disease Risk factors for the development of chronic disease in Ontario have been linked to increased tobacco use, increased alcohol consumption, decreased exercise, and higher body mass (Public Health Ontario, 2019). Within our sample, 105 (74.5%) used tobacco regularly, while 44 participants (44%) reported alcohol use more than 4 times per week. The mean number of drinks per instance across all reported alcohol users was 10.22 ($sd=11.85$, ranging from 0 to 50). When asked about visits to a physician or other health care provider, the mean number of visits per year was 7.27 ($sd=9.5$), with a range from 0 to 60. When asked about exercise per week, participants reported a mean number of times exercising per week of 2.97 ($sd=2.75$, range of 0 to 12).

Table 2 Number of participants endorsing each ACE

Type of ACE	Total <i>N</i> endorsing (% of sample)	Male (% of <i>N</i> sample)	Female (% of <i>N</i> sample)	ACEs from intake form
Physical abuse	29 (44.6%)	19 (29.2%)	10 (15.4%)	50 (38.5%)
Sexual abuse	38 (58.5%)	17 (26.2%)	21 (32.3%)	38 (29.0%)
Emotional abuse	38 (58.5%)	23 (35.4%)	15 (23.1%)	60 (45.8%)
Emotional neglect	8 (12.3%)	3 (4.6%)	5 (7.7%)	
Physical neglect	23 (35.4%)	14 (21.5%)	9 (13.8%)	
Household substance use	57 (87.7%)	32 (49.2%)	25 (38.5%)	88 (67.2%)
Parental separation or divorce	49 (75.4%)	26 (40.0%)	23 (35.4%)	61 (46.9%)
Intimate Partner violence	28 (43.1%)	13 (20.0%)	15(23.1%)	69 (52.7%)
Household member	22 (33.8%)	14 (21.5%)	8 (12.3%)	
Incarceration				
Household member mental illness	49 (75.4%)	28 (43.1%)	21 (32.3%)	

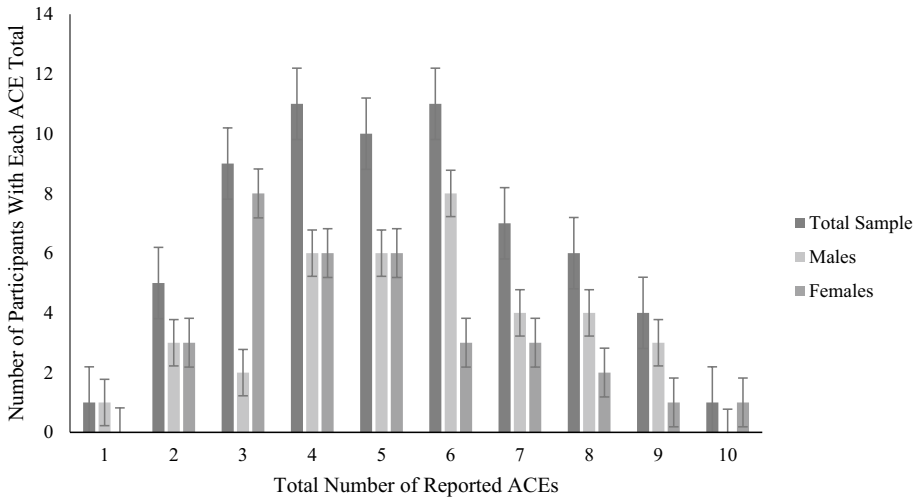


Fig. 1 Distribution of cumulative participant ACE scores

A linear regression assessed the hypothesis that participants with higher ACE scores would report a greater number of physical health concerns than participants with a lower number of ACE scores. A variable of total chronic health conditions (computed by participant endorsement of any prior history of cancer, heart disease, diabetes, stroke, emphysema, liver problems, and high blood pressure) was created. Regression results were reported two ways, first using a participant sample with all ten ACEs reported (Table 4) and second using ACE scores obtained from intake data (Table 5). Both analyses with these ACE variables supported the hypothesis that increased ACEs would significantly predict a number of chronic health conditions.

Table 3 Participant endorsement of chronic health concerns attributed to leading causes of death

Leading cause of death	Participant count (% of sample)	National average	Mean ACE Score if sample > 5 (sd)
1. Malignant neoplasms (cancer)*	2 (1.4%)	2.4% ¹	
2. Cardiovascular disease (heart disease)*	3 (2.2%)	8.5% ¹	
3. Cerebrovascular diseases*	10 (7.3%)	2.7% ¹	
4. Accidents (unintentional injuries)	Not assessed	9.6% (COPD) ¹	6.00 (2.51)
5. Respiratory diseases*	13 (10.1%)		
6. Influenza and pneumonia	Not assessed	9.8% ¹	5.00 (3.03)
7. Diabetes mellitus*	14 (9.9%)		
8. Alzheimer’s disease	Not assessed		
9. Intentional self-harm/suicide	38 (27.0%)	3.1% ²	5.50 (2.34)
10. Nephrosis and nephrotic syndrome	38 (27.9%)	10.6% ³	5.58 (1.97)

¹(Public Health Agency of Canada, 2017); ²(percentage of suicide attempts; Public Health Agency of Canada, 2016); ³(Bello et al., 2019)

Table 4 Linear regression results with chronic health scores as criterion variable ($n = 71$)

Predictor	Model 1			Model 2		
	<i>B</i>	<i>SE B</i>	β	<i>B</i>	<i>SE B</i>	β
Age	0.026	0.011	0.284	0.025	0.010	0.279
Sex	0.250	0.204	0.144	0.292	0.205	0.168
Total ACEs				0.065	0.049	0.158
R^2	0.096			0.121		
<i>F</i>	3.52*			2.97*		

* $p < 0.05$; ** $p < 0.01$ **Table 5** Linear regression results with chronic health scores as criterion variable ($n = 141$)

Predictor	Model 1			Model 2		
	<i>B</i>	<i>SE B</i>	β	<i>B</i>	<i>SE B</i>	β
Age	0.025	0.007	0.285	0.023	0.007	0.268
Sex	0.098	0.147	0.055	0.035	0.150	0.020
Total ACEs				0.068	0.038	0.149
R^2	0.082			0.103		
<i>F</i>	6.02**			5.12**		

* $p < 0.05$; ** $p < 0.01$

Objective 3: Mental Health and Treatment History

Participants reported a range of mental health symptoms and reported receiving either a diagnosis or treatment for a mean of 2.5 ($sd = 2.29$, range 0 to 11) categories of disorders (listed in Table 6). There were no significant differences in number of psychiatric disorders among those who reported a score of 4 or more ACEs ($M1 = 2.70$, $sd = 2.25$; $M2 = 1.94$, $sd = 2.11$) when an independent t -test was completed ($t = 1.28$, $p = 0.210$). Of 137 respondents, 62 (44.3% of the sample) indicated they had previously been under the care of a psychologist, psychiatrist, or therapist prior to treatment. Client intake data regarding suicidality and self-harm behaviors indicated that 60 participants (43.8%) endorsed suicide ideation, 41 (29.9%) reported intentional self-harm behavior, and 38 (27.7%) reported a previous suicide attempt. Forty participants reported previous hospitalization for a mental health issue, and 67 (48.9%) reported engaging in prior counseling or therapy.

Problematic Gambling Problematic gambling behaviors were examined using the PGSI. The mean sample score of gambling severity was 2.35 ($sd = 4.46$, range 0 to 19). Using the PGSI severity indexes, 95 participants (76.61% of sample) were in the range of a non-problem gambler (PGSI score of 0 to 2), 11 (8.9%) were in a moderate-risk range (PGSI score of 3 to 7), and 18 (14.51%) were in the range of problematic gambling (PGSI score of 8 or higher).

Post-Traumatic Stress and Internalizing Symptoms Table 7 describes the mean post-traumatic, internalizing, and wellness symptoms reported by participants. When these scores were compared by gender, no significant differences were found. Participant mean reported

Table 6 Number of participants with formal diagnosis or treatment of mental health conditions

Mental health disorder	Participant count (%)	National prevalence	Mean ACE (sd)
Anxiety (generalized anxiety and social anxiety)	74 (52.5%)	12% ¹	5.22 (2.06)
Depression (major depression and dysthymia)	68 (50.4%)	8% ¹	5.17 (2.08)
Substance use disorder (SUD)	66 (46.8%)	22% ²	5.44 (1.93)
Post-traumatic stress disorder (PTSD)	39 (27.7%)	10% ³	5.45 (2.21)
Learning disability (LD)	26 (18.4%)	14% ⁴	5.40 (2.41)
Attention-deficit hyperactivity disorder	25 (17.7%)	3% ⁵	4.86 (2.21)
Personality disorder (PD)	15 (10.6%)	1.5% ¹	5.42 (2.94)
Eating concerns (anorexia, bulimia, binge eating; ED)	14 (9.9%)	2% ¹	6.00 (2.89)
Fetal alcohol spectrum disorder (FASD)	12 (8.5%)	4% ⁶	6.33 (3.06)
Schizophrenia or psychosis	8 (5.7%)	1% ¹	5.00 (1.41)
Bipolar disorders	7 (5.0%)	1% ¹	4.00 (1.41)

¹(Mood Disorders Society of Canada, 2019); ²(Pearson et al., 2015); ³(Ameringen et al., 2008); ⁴(Bizier et al., 2014); ⁵(Connolly et al., 2019); ⁶(Flannigan et al., 2018)

Table 7 Independent *t*-test comparisons of wellness, trauma, and internalizing symptoms by gender

		<i>M</i>	<i>SD</i>	Male <i>m</i> (sd)	Female <i>m</i> (sd)	<i>T</i> -score
Trauma symptoms (PCL-5)	Total symptom Score	37.67	16.18	38.06 (17.54)	37.15 (14.47)	-0.220
	Intrusion	9.17	4.50	9.52 (5.01)	8.79 (3.95)	-0.693
	Avoidance	4.25	2.16	4.63 (2.06)	3.81 (2.26)	0.066
	Negative thoughts	13.35	6.69	13.29 (7.58)	13.39 (5.72)	0.711
	Arousal and reactivity	10.56	5.57	10.03 (5.58)	10.97 (5.57)	-1.578
Internalizing concerns (DASS-21)	Depression	16.49	10.70	17.05 (11.34)	15.53 (10.06)	0.566
	Anxiety	16.77	10.26	16.37 (10.41)	16.71 (9.82)	1.252
	Stress	19.53	9.47	19.61 (10.09)	19.12 (8.76)	1.459
Wellness (NWA)	Hope	70.36	21.87	69.38 (23.03)	71.68 (21.02)	1.424
	Belonging	70.68	21.65	68.79 (22.77)	73.67 (20.38)	-0.226
	Meaning	71.10	23.58	68.57 (25.38)	74.67 (21.27)	0.145
	Purpose	63.20	24.62	60.63 (25.80)	66.95 (23.32)	-0.615

* $p < 0.05$; ** $p < 0.01$

trauma symptoms on the PCL-5 was 37.67 (sd=16.18). Among 61 participants who completed this measure, 36 (59% of the sample) were over or equal to a score of 32, which is suggestive of meeting the criteria for a PTSD diagnosis. Current symptoms of internalizing symptoms and distress were measured by mean DASS-21 scores for anxiety ($M=16.77$, sd=10.26), depression ($M=16.49$, sd=10.7), and stress ($M=19.53$, sd=9.47). Participants with a PCL-5 score of over 32 had significantly higher anxiety, depression, and stress scores than those who did not meet this criterion (see Table 8).

Wellness One hundred and twenty-one participants completed the NWA, which provided descriptive analyses of Indigenous constructs of wellness related to hope (spiritual

Table 8 Independent *t*-tests of internalizing symptoms and ACEs with high/low PCL-5 scores

		<i>M</i>	<i>Sd</i>	<i>T</i>
Depression	PCL-5 > = 32	19.19	10.42	3.23**
	PCL-5 < 32	10.72	9.83	
Anxiety	PCL-5 > = 32	18.97	10.02	2.93*
	PCL-5 < 32	11.68	9.25	
Stress	PCL-5 > = 32	22.64	9.40	3.54**
	PCL-5 < 32	14.28	8.85	
ACEs	PCL-5 > = 32	5.12	2.29	0.288
	PCL-5 < 32	4.95	1.91	

Test* $p < 0.05$; ** $p < 0.01$

wellness), belonging (emotional wellness), meaning (mental wellness), and purpose (physical wellness). Scores were described in seven categories of wellness, ranging from exceptionally low attentiveness to wellness (score of 1 to 2) to exceptionally high attentiveness to wellness (score of 99 to 100), with a score in the range of 33 to 67 considered average. Mean scores for hope were above average, in the high attentiveness to wellness range ($m = 70.36$, median = 75.0, range = 16 to 100), similar to belonging ($m = 70.68$, median = 72.9, range 25 to 100), and meaning ($m = 71.1$, median = 75.2, range = 12.5 to 100). Purpose scores were in the average range ($m = 63.2$, median = 65.6, range = 5.1 to 100).

Among the Indigenous participants who were asked about their participation in cultural interventions, they most commonly endorsed receiving help or guidance from an Elder or traditional healer ($n = 53$, 52.5% of sample), going on nature walks ($n = 53$, 52.5% of sample), and use of traditional medicines ($n = 53$, 52.5% of sample). Other highly endorsed cultural activities (calculated when participants indicated moderate or strong engagement) included smudging ($n = 50$, 49.5% of sample), engaging in cultural dances or pow wow ($n = 50$, 49.5% of sample), use of prayer ($n = 49$, 48.5% of sample), and engaging in talking or healing circles ($n = 49$, 48.5% of sample). The hypothesis that participants with high ACE scores would report significantly lower hope, belonging, meaning, and purpose scores (as measured by the NWA) was assessed by bivariate Pearson's correlations. Individual ACEs from both the client intake form ($n = 141$) and self-reported ($n = 71$) were examined, however correlations between these variables and hope (intake ACE $r = 0.035$; total ACE $r = 0.080$), belonging (intake ACE $r = 0.018$; total ACE $r = -0.025$), meaning (intake ACE $r = 0.093$; total ACE $r = 0.029$), and purpose (intake ACE $r = 0.114$; total ACE $r = -0.261$) showed small, non-significant effects.

Objective Four: Residential School Attendance and ACEs

Five participants indicated they had a history of residential school attendance. Of this sample, the mean age of these participants was 47.4 ($sd = 8.01$, range 36 to 57). When the mean number of ACEs were calculated for this sample, mean ACEs was 4.25 ($sd = 2.62$, range 2 to 8). When parental history of residential school attendance was examined, of a total of 110 parents, 31 (28.1%) had attended a residential school (14 mothers and 17 fathers). Of 122 grandparents, 47 (38.5%) had attended a residential school (25 women and 22 men). The hypothesis that intergenerational residential school attendance would be associated with higher participant ACE scores was not supported.

Discussion

The aim of the current study was to explore the relationship between individual ACE scores and health outcomes, to contextualize such experiences within intergenerational experiences of ACEs, health outcomes, residential school attendance, and child welfare involvement for First Nation people seeking substance use treatment from a First Nations-led treatment facility. As expected, reported ACEs in this sample were higher than previously reported ACE scores for Canadian and Indigenous samples, with a mean ACE score of participants as 5.22 and median as 5.0. Parent RSA was not associated with higher participant ACE scores.

Given robust relationships between ACEs and chronic disease prevalence, substance use, and mental health (Felitti et al., 1998), high ACE scores among participants in our study may have implications on broader health outcomes and psychological functioning, including individual response to substance use treatment, as well as co-morbid challenges associated with chronic disease management. The prevalence of chronic diseases in our sample was slightly higher than national averages (Public Health Agency of Canada, 2017), particularly for kidney disease (28% of our sample compared to 10.6% national prevalence) and stroke (7.3% of our sample compared to 2.7% of all Canadians). When mean ACE scores were calculated for samples who endorsed kidney disease, intentional self-harm, diabetes, and respiratory diseases, mean ACE scores were all greater than or equal to five, and all but the diabetes sample was greater than the total participant average of ACE scores. Such findings support previous data regarding the health disparities of Indigenous people in Canada (Gracey & King, 2009; Reading & Wien, 2009; McQuaid et al., 2017).

Rates of self-reported mental disorder diagnoses were also higher among our study sample when compared to national prevalence averages in Canada, on all categories of disorders. Notably, a diagnosis of MDD or an anxiety disorder was endorsed by over 50% of participants, as compared to national averages of approximately 8% for MDD and 12% for an anxiety disorder, with similar trends for a diagnosis of PTSD (28% of sample when compared to 10% of a national sample). When samples were segregated by specific diagnosis, mean ACE scores for those diagnosed with an anxiety disorder, SUD, LD, PTSD, PD, ED, or FASD were above the mean average of ACEs within the entire study sample. Those reporting a diagnosis of FASD reported the highest mean number of ACEs, with an average of 6.33 ACEs within this sample. These high co-morbidities among those with substance use and additional mental health diagnoses suggest that those with increased ACEs may be particularly susceptible to concurrent mental health difficulties and require an increased level of care. Given that the causal mechanism of FASD is maternal alcohol use while pregnant, it is likely that higher ACE scores for those participants with FASD diagnoses in this sample illuminate an intergenerational transmission of alcohol use concerns, and subsequent concerns affiliated with parenting capacity while engaging in problematic substance use.

Among those who reported a history of family residential school attendance, mean ACE scores were higher for those who reported a family member who attended residential school. Endorsement rates of residential school attendance were higher than in previous research samples, which found approximately 10 percent of participants endorsed parental or self-attendance (Kaspar, 2014), as compared to 28% of parents and 39% of grandparents in our sample. Such high rates within this sample, when compared to national samples, may indicate greater experiences of adversity and experiences of intergenerational effects for First Nation individuals currently in treatment for substance use. Similar to

recommendations from Wilk et al.'s (2017) scoping review of relationships between health and residential school attendance, results from our study must be appropriately contextualized within broader social determinants of health contributing to the development of disease. Given increased health disparities experienced among First Nations communities, intersectional experiences of living in poverty, experiencing unstable housing, and having reduced access to educational and employment opportunities can exacerbate the effect of ACEs and contribute to decreased health outcomes (Reading & Wien, 2009). Despite the absence of significance within our analyses, results continue to depict higher rates of adversity among our sample participants and their families.

Study Limitations and Future Directions

There are some limitations of the current study with respect to how ACEs were operationalized and measured, as approaches describing when and how to measure ACEs within public health remain disputed in the broader literature. For example, no studies to date have validated the ACE measure with First Nations populations. Unfortunately, our study focused on clients within a First Nations-led treatment center rather than solely on Indigenous clients due to the small sample size. This will be a goal of future research studies, which will allow us to conduct more robust analyses describing these relationships within a strictly Indigenous sample. As such, the results from the current study are not generalizable to any specific First Nation community.

In addition, we compared high and low ACE groups (classified using a cut-point score of four) of the point prevalence of some variables in the current study. Roberta Anda, a co-principal investigator of the original ACE study (Felitti et al., 1998) and colleagues in 2020, emphasized that no arbitrary score should be used as a cut-point for clinical decision-making. Although high ACE scores can be a crude measure of exposure to biomarkers of stress experienced across a lifespan, it does not account for severity and frequency of ACE exposure. In sum, not all ACEs have equivalent effects on health for individuals, and as such, there are no definitive cut-points to contrast low or high ACE exposure (Anda et al., 2020). Similar to previous ACE studies, we did not account for the severity and chronicity of ACE exposure within study analyses.

To understand how ACEs predict health outcomes at an individual level, diverse assessment approaches to ACEs are needed. Currently, the ACE framework is a simplified way to conceptualize sophisticated relationships between early life exposure to adversity and subsequent pathways to chronic illness. This framework may not capture experiences that are more frequently experienced by First Nations individuals or are more prevalent in First Nations communities. Thus, the ACE framework may not be culturally-relevant in capturing health outcomes within these populations. The preliminary use of a predetermined ACE framework remains a useful first step, however existing assessment approaches may need to be expanded to recognize individual differences within populations. Currently, ACE research uses a top-down approach to assessing and measuring adversity in childhood. The ten predetermined ACEs originally conceptualized by Felitti et al. (1998) and Dube et al. (2001) are typically used in ACE studies, with occasional expansion or extraction of these variables depending on research interest and available data. Given the robust relationship of these ACEs observed at a population level, the next steps are warranted to compare these data with those extracted at an individual level using a bottom-up approach.

We respectfully propose a bottom-up approach for future ACE assessment that may allow individuals to independently identify their own ACEs outside of the previously

contrived ACE categories. By allowing individuals to independently generate a list of relevant traumatic events that have occurred in their own lives, complete with a self-reported rating of both severity and chronicity, we can generate ACE test items at an individual level. This approach could allow individuals to rate events that they feel have been particularly impactful in their life and contrast these events to current health outcomes. It can also generate a broader list of ACEs that can be analyzed for commonalities across individuals to develop a list of ACE categories that are particularly pertinent for various population groups, such as Indigenous heritage, age categories, and genders.

Although it is likely that many of the current ACEs would be endorsed by individuals, it is possible that other items not frequently discussed in ACE literature are also identified, and specific relationships between ACEs and health may be better understood for First Nations individuals seeking treatment for substance use. Similar to how any mental health intervention is culturally and contextually adapted to meet the needs of diverse communities (Perera et al., 2020), relevant theoretical models of ACEs used with First Nations communities must do the same. Although the current ACE model has been used with First Nations communities, it may not currently incorporate common or culturally-specific experiences shared among First Nations. The way the model is used in both clinical and research settings, including how ACEs are assessed, must be tailored to meet the needs of First Nation communities (Toombs et al., 2021). Further research can explore how such processes can do so within a substance use treatment setting.

Conclusion

This study has documented preliminary prevalence rates of ACE scores within a predominantly Indigenous sample of clients seeking substance use treatment. ACE scores were higher than national averages and previous data collected with Indigenous samples (Radford et al., 2021). We provided preliminary descriptive analyses relating ACEs to health outcomes for Indigenous people. However, not all study hypotheses relating to experiences of ACEs among physical and mental health outcomes were supported. It is likely that larger sample size may increase our statistical ability to detect differences among groups in the future. Findings show that although the gap between Indigenous and non-Indigenous health disparities is closing, there remain segments of this population who are particularly disadvantaged and experience a disproportionate frequency of these ailments. Based on study results, those experiencing chronic health difficulties co-morbid with clinical levels of problematic substance use are likely to experience a higher burden of health, including higher rates of chronic disease, lower mental health outcomes, and higher risk factors of disease. To improve ongoing best-treatment options for those seeking substance use treatment, continued assessment of broader aspects of health and wellbeing is required, including the balance of physical, emotional, spiritual, and mental health and wellbeing across a lifespan.

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Declarations

Conflict of Interest The authors declare no competing interests.

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