The Cedar Project: exploring the role of colonial harms and childhood maltreatment on HIV and hepatitis C infection in a cohort study involving young Indigenous people who use drugs in two Canadian cities

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ABSTRACT

Objective This study examined associations between childhood maltreatment, colonial harms and sex/drug-related risks for HIV and hepatitis C virus (HCV) infection among young Indigenous people who use drugs.

Design The Cedar Project is a cohort involving young Indigenous people who use drugs in British Columbia (BC), Canada. Indigenous collaborators, collectively known as the Cedar Project Partnership, govern the entire research process.

Setting Vancouver is a large city on the traditional territory of the Coast Salish peoples. Prince George is a mid-sized city, on the traditional territory of Lheidli T’enneh First Nation.

Participants 420 participants completed the Childhood Trauma Questionnaire and returned for follow-up from 2003 to 2016.

Primary/secondary outcome measures Primary outcomes were HIV and HCV infection over the study period. Secondary outcomes included sex and substance use-related risks.

Results Prevalence of childhood maltreatment was 92.6% experienced any maltreatment; 73.4% experienced emotional abuse; 62.6% experienced physical abuse; 60.3% experienced sexual abuse; 69.5% experienced emotional neglect and 79.1% experienced physical neglect. We observed significant associations between childhood maltreatment and apprehensions into residential schools and foster care. All maltreatment types were associated with higher odds of sex/substance use-related risks; sexual abuse was associated with higher odds of HCV infection (adjusted OR: 1.67; 95% CI 1.05 to 2.66; p=0.031).

Conclusions Findings reflect high prevalence of childhood maltreatment and their associations with HIV/HCV risk and HCV infection. Public health prevention and treatment initiatives must be trauma informed and culturally safe to support healing, health, and well-being.

INTRODUCTION

The vibrant health of Indigenous peoples has been sustained for thousands of years through relational interdependence of family, community and nation. An intrinsic part of relational wellness is the sacredness of children and their vital role in cultural continuity. These foundations of health and well-being have been essential to resilience of Indigenous peoples in the face of historical and contemporary colonial harms from legislation and policies that have deliberately targeted Indigenous social, political and familial systems. Colonialism continues to be
at the root of health and social disparities between Indigenous and non-Indigenous people in Canada with consequences for health across the life course. Indigenous leaders remain concerned that a key driver of disparities related to HIV/hepatitis C virus (HCV) infection is disproportionate numbers of Indigenous children who experience childhood maltreatment and family separation. Furthermore, concurrent experiences of childhood maltreatment are common and contribute to a complex experience that may compound negative stress-coping later in life. In the absence of meaningful reconciliation and structural interventions as well as continued child apprehensions, some young Indigenous people turn to substance use to self-medicate emotional and psychological sequelae of colonial harms and family violence, which in turn can lead to risk of HIV and HCV infection. According to Canadian surveillance data from 2016, Indigenous people make up less than 5% of the population in Canada, yet 21.2% of HIV diagnoses were among Indigenous people. Furthermore, between 2002 and 2008, estimated HCV incidence was 4.7-fold higher among Indigenous people than non-Indigenous people. Injection drug use is the primary exposure category for both HIV/HCV infection among Indigenous people, compared with sexual exposure among non-Indigenous people.

The 2008 Canadian Incidence Study of Child Abuse and Neglect reported that substantiated childhood maltreatment investigations were five times higher for Indigenous families than non-Indigenous families. Furthermore, concurrent experiences of childhood maltreatment are common and contribute to a complex experience that may compound negative stress-coping later in life. In the absence of meaningful reconciliation and structural interventions as well as continued child apprehensions, some young Indigenous people turn to substance use to self-medicate emotional and psychological sequelae of colonial harms and family violence, which in turn can lead to risk of HIV and HCV infection. According to Canadian surveillance data from 2016, Indigenous people make up less than 5% of the population in Canada, yet 21.2% of HIV diagnoses were among Indigenous people. Furthermore, between 2002 and 2008, estimated HCV incidence was 4.7-fold higher among Indigenous people than non-Indigenous people. Injection drug use is the primary exposure category for both HIV/HCV infection among Indigenous people, compared with sexual exposure among non-Indigenous people.

METHODS

The Cedar Project (Cedar) methods have previously been described in detail. In brief, Cedar is a prospective cohort involving 788 young Indigenous people who use drugs in Vancouver and Prince George, British Columbia. Vancouver is a large city in southern BC, on the traditional territory of the Coast Salish peoples. Prince George is a mid-sized city in the northern interior of BC, on the traditional territory of Lheidli T’enneh First Nation. Participants were eligible if they self-identified as having Indigenous ancestry, including First Nations, Aboriginal, Métis, Inuit, Status and non-Status Indians; were between 14–30 years old; had smoked or injected illicit drugs (other than marijuana) in the month before enrolment; and provided their written informed consent. Saliva screens (Oralscreen, Avitar Onsite Diagnostics)
were used to confirm drug use. Since 2003, participants have returned every 6 months to complete interviewer-administered questionnaires and provide venous blood samples which are tested for HIV and HCV status. This analysis included data collected from 2003 to 2016.\footnote{15}

**Patient and public involvement**

Since 2003, the Cedar Project Partnership, an independent body of Indigenous elders, leaders, health/social service experts and scholars, has governed the entire Cedar research process. The Partnership ensures respect for self-determining ethical principles and Indigenous knowledge. The Partnership aims to meet every season to define research questions; review study protocols; address ethics concerns; interpret emergent results and review/approve manuscripts. Decisions are based on consensus and Indigenous voices are privileged.

**Funding**

This work was supported by Canadian Institutes of Health Research grant number (FDN-148 376).

**MEASURES**

**Childhood maltreatment**

Beginning in 2011, participants were given the one-time option to complete the Childhood Trauma Questionnaire (CTQ).\footnote{16} The CTQ is a widely used retrospective and self-reported 28-item inventory measuring five types of childhood maltreatment: emotional abuse, physical abuse, sexual abuse, emotional neglect and physical neglect. Answers were endorsed on a 5-point Likert-type scale according to the frequency of experiences (never true to very often true). For descriptive frequencies, we presented subscale scores within maltreatment severity quantiles: ‘none or minimal’ (sexual abuse subscale does not have a minimal category), ‘low to moderate’, ‘moderate to severe’ and ‘severe to extreme’.\footnote{16} As in other studies, for comparative analysis and multivariable models, we dichotomised subscales into two categories: none or minimal (0) and low to extreme (1).\footnote{12} Therefore, maltreatment was considered present if a participant said ‘yes’ to any severity category from low to extreme. To create a variable that measured the number of distinct maltreatments reported by a participant, we summed the number of ‘yes’ answers across all five maltreatment types.\footnote{5} The number of maltreatments experienced ranged from zero to five and was treated as a continuous variable in the analyses. The OR may be interpreted as the likelihood of an outcome occurring for each incremental increase in the number of maltreatments experienced. We previously validated the CTQ with Cedar participants.\footnote{10}

**Colonial harms**

We used two indicators of colonial harm that represent two eras of state-based apprehensions of Indigenous children, including having a parent who was taken into residential school (no or unsure/yes) and having been taken into the child welfare system (foster care) (no/yes).

**Sociodemographic covariates**

Sociodemographic covariates included: biological sex (male/female); baseline location (Prince George/Vancouver); sexual identity (lesbian, gay, bisexual, transgender, queer, Two-Spirit/straight); education (high school/2 high school); relationship status (single/in a relationship).

**Outcome variables**

Primary outcome variables included HIV serostatus and HCV antibody-positive serostatus. Secondary outcomes were time-varying variables related to the previous 6-month period and included sex work (no/yes), inconsistent condom use with regular or casual partner (no/yes), sexual assault (no/yes), sexually transmitted infection (STI) (no/yes), any injection drug use (no/yes), ≥ daily cocaine injection (no/yes), ≥ daily opiate injection (no/yes), binge injection (no/yes), rig sharing (no/yes) and needing help to inject (no/yes). Regular partners were defined as sexual relationships lasting ≥ 23 months, and casual partners were those lasting <3 months. STIs were self-reported chlamydia, genital warts, gonorrhoea, herpes, syphilis or others.

**Participants**

In total, 788 participants were recruited between 2003 and 2016, and of those, 420 completed the CTQ. Among those participants, 383 (91.2%) returned for at least one follow-up interview and were included in regression analyses. Participants had a median number of 8.0 (IQR: 4.0–13.0) visits.

**Statistical analysis**

Each type of childhood maltreatment was compared by residential school and foster care using χ² tests. Multi-variable generalised estimating equations (GEE) estimated effects of childhood maltreatment on adverse time-varying health-related outcomes. Analyses were carried out with R statistical software V.3.6.0\footnote{16} using the ‘geepack’ package.\footnote{19} Models were fit using a binomial GEE models with logit link, robust sandwich variance estimation and assuming an exchangeable working correlation structure. Associations between the CTQ subscales and study outcomes were tested in unadjusted and adjusted (multivariable) models controlling for potential confounders, including sex, location and age. We did not adjust for colonial harms because we do not consider those variables to be confounders but rather as part of the causal pathway. Temporally speaking, parental residential school attendance always occurs prior to participants’ childhood maltreatment experiences. Foster care could have occurred before, after and in between participants’ childhood maltreatment experiences. CTQ subscales had a range of missing data between 3.5% and 5.2%. Data missing from longitudinal outcomes ranged from 1.4% to 6.3% of observations. Available-case analysis...
was undertaken and no imputation was conducted for missing data.

RESULTS
Baseline characteristics
Frequencies of demographic characteristics, colonial harms and childhood maltreatment experiences are reported in Table 1. Mean age at baseline was 24 years old; 55.2% participants were women; 52.4% were based in Prince George, 47.6% were based in Vancouver; 82.7% had not graduated high school and 77.8% were single (Table 1). Overall, 48.4% reported that at least one parent had been taken into residential school, and 70.6% had been taken into foster care. In total, 34 (8.2%) and 119 (29.5%) were living with HIV and HCV, respectively.

Maltreatment experiences
Frequencies of maltreatment experiences are reported in Table 1. Emotional abuse was experienced by 73.4% of participants, among whom 37.9% had severe to extreme experiences. Physical abuse was experienced by 62.6% of participants, among whom 41% had severe to extreme experiences. Sexual abuse was experienced by 60.3% of participants, among whom 42% had severe to extreme experiences. Emotional neglect was experienced by 69.5% of participants, among whom 20.7% had severe to extreme experiences. Physical neglect was experienced by 79.1% of participants, among whom 43.2% had severe to extreme experiences. Overall, 92.4% of participants had experienced childhood maltreatment, and many (35%, n=135) had experienced all five different types of maltreatment.

Childhood maltreatment and colonial harms
Table 2 displays comparisons of colonial harms by childhood maltreatment subscales among Cedar participants. A significantly higher proportion of participants who had at least one parent who attended residential school compared with participants whose parents did not attend, or who were unsure if their parents attended residential school, had been sexually abused (66.3% vs 55.1%, respectively; p=0.022). Significantly higher proportions of participants who had been taken into foster care compared with those who were never in foster care reported emotional abuse (77.1% vs 64.1%, respectively; p=0.007), sexual abuse (64.2% vs 51.3%, respectively; p=0.016) and physical neglect (82.3% vs 71.7%, respectively; p=0.017). A marginally higher proportion of participants who had been physically abused had been taken into foster care compared to those who were not taken into foster care (65.5% vs 55.7%, respectively; p=0.063).

Childhood maltreatment and HIV/HCV infection
Results from unadjusted and adjusted GEE models examining the associations between childhood maltreatment and HIV and HCV infection are displayed in Table 3. In the adjusted GEE models, participants who had experienced

| Variable                           | N (%) | Missing N (%) |
|------------------------------------|-------|---------------|
| Mean age (SD)                      | 24.0  | 1 (0.2)       |
| Biological sex                     |       |               |
| Male                               | 188 (44.8) | 0 (0.0)     |
| Female                             | 232 (55.2) |          |
| Baseline location                  |       |               |
| Prince George                      | 220 (52.4) | 0 (0.0)     |
| Vancouver                          | 200 (47.6) |          |
| Sexual identity                    |       |               |
| LGBTQ2                             | 53 (12.7) | 2 (0.5)      |
| Straight                           | 365 (87.3) |          |
| Baseline education                 |       |               |
| Less than high school              | 340 (82.7) | 9 (2.1)     |
| High school education or higher    | 71 (17.3) |          |
| Relationship status                |       |               |
| Single                             | 311 (77.8) | 20 (4.8)    |
| In relationship                    | 89 (22.2) |          |
| Parents taken into residential school|   |               |
| No/unsured                         | 215 (51.6) | 3 (0.7)      |
| At least one parent attended       | 202 (48.4) |          |
| Ever taken into foster care        |       |               |
| No                                 | 123 (29.4) | 1 (0.2)      |
| Yes                                | 296 (70.6) |          |
| Emotional abuse severity           |       |               |
| None or minimal                    | 106 (26.6) | 22 (5.2)    |
| Low to moderate                    | 81 (20.4) |          |
| Moderate to severe                 | 60 (15.1) |          |
| Severe to extreme                  | 151 (37.9) |          |
| Physical abuse severity            |       |               |
| None or minimal                    | 152 (37.4) | 13 (3.1)    |
| Low to moderate                    | 39 (9.6) |          |
| Moderate to severe                 | 49 (12.0) |          |
| Severe to extreme                  | 167 (41.0) |          |
| Sexual abuse severity              |       |               |
| None                               | 159 (39.8) | 20 (4.8)    |
| Low to moderate                    | 27 (6.8) |          |
| Moderate to severe                 | 46 (11.5) |          |
| Severe to extreme                  | 168 (42.0) |          |
| Emotional neglect severity         |       |               |
| None                               | 123 (30.4) | 15 (3.6)    |
| Low to moderate                    | 133 (32.8) |          |

Continued
sexual abuse had significantly greater odds of HCV infection over the study period compared with participants who had not been sexually abused (adjusted OR (aOR): 1.67; 95% CI 1.05 to 2.66; p=0.031) (table 3). There was a marginally significant association between the number of maltreatment types experienced by participants and HCV infection (aOR: 1.13; 95% CI 0.99 to 1.28; p=0.073).

**Childhood maltreatment and sex-related risk factors**

Results from unadjusted and adjusted GEE models examining associations between childhood maltreatment and recent sex-related experiences are displayed in table 3. In the adjusted GEE models, participants who had been sexually abused were more likely to be involved in sex work (aOR: 1.88; 95% CI 1.12 to 3.16; p=0.017). Physical abuse (aOR: 1.66; 95% CI 1.21 to 2.28; p=0.002) and the number of maltreatment types experienced (aOR: 1.13; 95% CI 0.99 to 1.28; p=0.073) were significantly associated with inconsistent condom use. Sexual abuse (aOR: 1.36; 95% CI 0.98 to 1.89; p=0.070), emotional neglect (aOR: 1.36, 95% CI 0.97 to 1.89; p=0.074) and physical neglect (aOR: 1.39, 95% CI 0.96 to 2.02, p=0.085) were marginally associated with inconsistent condom use. Participants who had been emotionally abused (aOR: 2.09; 95% CI 1.10 to 3.98; p=0.024) or sexually abused (aOR: 1.94; 95% CI 1.17 to 3.23; p=0.010) were significantly more likely to report having an STI. There was a marginally significant association between physical abuse and having an STI (aOR: 1.52; 95% CI 0.94 to 2.48; p=0.090). Participants who experienced emotional abuse were marginally more likely to have been sexually assaulted (aOR: 1.80, 95% CI 0.95 to 3.41, p=0.071), and those who were sexually abused were significantly more likely to have been sexually assaulted (aOR: 1.93; 95% CI 1.07 to 3.48; p=0.028).

### Table 1

| Variable                          | N (%) | Missing N (%) |
|----------------------------------|-------|---------------|
| Moderate to severe               | 65 (16.0) |               |
| Severe to extreme                | 84 (20.7) |               |
| Physical neglect severity        |       |               |
| None or minimal                  | 84 (20.8) | 17 (4.0)      |
| Low to moderate                  | 59 (14.6) |               |
| Moderate to severe               | 86 (21.3) |               |
| Severe to extreme                | 174 (43.2) |              |
| Number of maltreatment types     | 0     | 29 (7.6%)     |
| experienced                      | 1     | 36 (9.4%)     |
|                                 | 2     | 49 (12.8%)    |
|                                 | 3     | 76 (19.8%)    |
|                                 | 4     | 58 (15.1%)    |
|                                 | 5     | 135 (35.2%)   |
| HIV seropositive                 | 34 (8.2) | 7 (1.7)       |
| HCV seropositive                 | 119 (29.5) | 17 (4.0)     |
| *Proportions shown were obtained after excluding missing values. HCV, hepatitis C virus; LGBTQ2, lesbian, gay, bisexual, transgender, queer, Two-Spirit.*

### Table 2

|                                   | Parents taken into residential school | Ever taken into foster care |
|-----------------------------------|--------------------------------------|----------------------------|
|                                   | No/unsure | Yes | Total | P value | No | Yes | Total | P value |
| Emotional abuse                   |           |     |       |         |     |     |       |         |
| None or minimal                   | 58 (27.9) | 47 (25.0) | 105 (26.5) | 0.516 | 42 (35.9) | 64 (22.9) | 106 (26.7) | 0.007 |
| Low to extreme                    | 150 (72.1) | 141 (75.0) | 291 (73.5) |       | 75 (64.1) | 216 (77.1) | 291 (73.5) |       |
| Physical abuse                    |           |     |       |         |     |     |       |         |
| None or minimal                   | 85 (41.1) | 66 (33.5) | 151 (37.4) | 0.116 | 54 (44.3) | 98 (34.5) | 152 (37.4) | 0.063 |
| Low to extreme                    | 122 (58.9) | 131 (66.5) | 253 (62.6) |       | 68 (55.7) | 186 (65.5) | 254 (62.6) |       |
| Sexual abuse                      |           |     |       |         |     |     |       |         |
| None                              | 93 (44.9) | 64 (33.7) | 157 (39.5) | 0.022 | 57 (48.7) | 101 (35.8) | 158 (39.6) | 0.016 |
| Low to extreme                    | 114 (55.1) | 126 (66.3) | 240 (60.5) |       | 60 (51.3) | 181 (64.2) | 241 (60.4) |       |
| Emotional neglect                 |           |     |       |         |     |     |       |         |
| None or minimal                   | 62 (29.5) | 59 (30.7) | 121 (30.1) | 0.792 | 39 (32.8) | 84 (29.5) | 123 (30.4) | 0.511 |
| Low to extreme                    | 148 (70.5) | 133 (69.3) | 281 (69.9) |       | 80 (67.2) | 201 (70.5) | 281 (69.9) |       |
| Physical neglect                  |           |     |       |         |     |     |       |         |
| None or minimal                   | 51 (24.6) | 33 (17.0) | 84 (20.9) | 0.061 | 34 (28.3) | 50 (17.7) | 84 (20.9) | 0.017 |
| Low to extreme                    | 156 (75.4) | 161 (83.0) | 317 (79.1) |       | 86 (71.7) | 232 (82.3) | 318 (79.1) |       |
Table 3  Unadjusted and adjusted outcomes associated with childhood maltreatment (none or minimal vs low to extreme) among Cedar Project participants (n=383)

|                          | Emotional abuse | Physical abuse | Sexual abuse |
|--------------------------|----------------|---------------|--------------|
|                          | OR 95% CI      | P value       | AOR 95% CI   | P value | OR 95% CI | P value | AOR 95% CI | P value | OR 95% CI | P value | AOR 95% CI | P value | OR 95% CI | P value |
| HIV/HCV infection        |                |               |              |         |           |         |             |         |           |         |             |         |           |         |
| HIV positive serostatus* | 0.86 0.48 to 1.62 | 0.41 to 1.47 | 0.406       |         | 0.84 0.48 to 1.48 | 0.41      | 0.16 0.66 to 2.06 | 0.615   | 0.85 0.46 to 1.59 | 0.614 |
| HCV positive serostatus† | 1.46 0.91 to 2.36 | 0.79 to 2.16 | 0.293       |         | 1.37 0.90 to 2.11 | 0.84 to 2.07 | 2.09 1.36 to 3.23 | 0.001   | 1.67 1.05 to 2.66 | 0.031 |
| Sexual vulnerabilities   |                |               |              |         |           |         |             |         |           |         |             |         |           |         |
| Sex work                 | 1.91 1.12 to 3.28 | 0.92 to 2.74 | 0.100       |         | 1.16 0.76 to 1.78 | 0.70 to 1.70 | 2.65 1.62 to 4.33 | <0.001  | 1.88 1.12 to 3.16 | 0.017 |
| Inconsistent condom use with regular/casual partner | 1.53 1.08 to 2.16 | 1.00 to 2.02 | 0.052       |         | 1.70 1.24 to 2.33 | 1.21 to 2.28 | 1.50 1.09 to 2.06 | 0.001   | 1.36 0.98 to 1.89 | 0.070 |
| Sexual assault           | 1.95 1.02 to 3.73 | 0.95 to 3.41 | 0.071       |         | 1.21 0.70 to 2.08 | 0.67 to 2.05 | 2.20 1.19 to 4.08 | 0.012   | 1.93 1.07 to 3.48 | 0.028 |
| STI                      | 2.45 1.30 to 4.61 | 1.10 to 3.98 | 0.024       |         | 1.69 1.04 to 2.76 | 0.94 to 2.48 | 2.05 1.26 to 3.31 | 0.004   | 1.94 1.17 to 3.23 | 0.010 |
| Injection drug use related vulnerabilities |                |               |              |         |           |         |             |         |           |         |             |         |           |         |
| Any injection drug use   | 1.47 0.97 to 2.21 | 0.94 to 2.25 | 0.092       |         | 1.18 0.82 to 1.69 | 0.83 to 1.75 | 1.54 1.08 to 2.20 | 0.017   | 1.29 0.87 to 1.90 | 0.204 |
| Daily or more injection cocaine | 1.47 0.67 to 3.25 | 0.67 to 2.88 | 0.385       |         | 1.61 0.84 to 3.08 | 0.85 to 3.01 | 2.73 1.34 to 5.55 | 0.006   | 2.48 1.26 to 4.86 | 0.008 |
| Daily or more injection opiates | 1.20 0.76 to 1.89 | 0.66 to 1.75 | 0.763       |         | 1.11 0.74 to 1.65 | 0.71 to 1.63 | 1.27 0.86 to 1.89 | 0.228   | 0.96 0.62 to 1.48 | 0.860 |
| Binge injection          | 1.51 0.90 to 2.53 | 0.98 to 2.74 | 0.058       |         | 1.68 1.06 to 2.67 | 1.15 to 2.95 | 1.96 1.26 to 3.04 | 0.003   | 1.91 1.19 to 3.06 | 0.007 |
| Sharing rigs             | 2.00 0.90 to 4.45 | 0.80 to 3.84 | 0.161       |         | 1.22 0.67 to 2.20 | 0.60 to 1.94 | 1.77 0.99 to 3.19 | 0.055   | 1.77 0.90 to 3.47 | 0.099 |
| Need help to inject      | 1.61 0.97 to 2.69 | 0.88 to 2.57 | 0.138       |         | 0.96 0.61 to 1.50 | 0.59 to 1.45 | 1.22 0.80 to 1.96 | 0.361   | 1.05 0.66 to 1.67 | 0.839 |
|                          |                |               |              |         |           |         |             |         |           |         |             |         |           |         |
| HIV/HCV infection        |                |               |              |         |           |         |             |         |           |         |             |         |           |         |
| HIV positive serostatus* | 1.58 0.83 to 3.17 | 0.78 to 3.07 | 0.245       |         | 0.75 0.40 to 1.44 | 0.33 to 1.25 | 0.14 0.64 to 1.31 | 0.538   | 0.87 0.63 to 1.20 | 0.393 |
| HCV positive serostatus† | 1.17 0.74 to 1.84 | 0.64 to 1.66 | 0.902       |         | 1.31 0.79 to 2.18 | 0.66 to 1.91 | 1.12 0.99 to 1.27 | 0.077   | 1.13 0.99 to 1.28 | 0.073 |
| Sexual vulnerabilities   |                |               |              |         |           |         |             |         |           |         |             |         |           |         |
| Sex work                 | 1.18 0.73 to 1.90 | 0.69 to 1.81 | 0.649       |         | 1.41 0.84 to 2.35 | 0.84 to 2.35 | 1.16 1.02 to 1.31 | 0.028   | 1.10 0.97 to 1.25 | 0.145 |
| Inconsistent condom use with regular/casual partner | 1.39 0.99 to 1.94 | 0.97 to 1.89 | 0.074       |         | 1.44 0.99 to 2.10 | 0.96 to 2.02 | 1.17 1.07 to 1.29 | 0.001   | 1.16 1.06 to 1.27 | 0.002 |
| Sexual assault           | 1.30 0.72 to 2.34 | 0.71 to 2.27 | 0.417       |         | 1.14 0.63 to 2.08 | 0.60 to 1.94 | 1.13 0.96 to 1.32 | 0.135   | 1.10 0.94 to 1.27 | 0.226 |

Continued
Childhood maltreatment and substance use

Unadjusted and adjusted GEE models for the associations between childhood maltreatment and recent substance use-related risks are displayed in Table 3. In the adjusted GEE models, there was a marginally significant association between the number of maltreatment types experienced and injecting any drug (aOR: 1.11; 95% CI 1.00 to 1.24; p=0.058). Participants who were sexually abused were 2.48 times more likely to inject cocaine daily or more (aOR: 2.48; 95% CI 1.26 to 4.86; p=0.008). Participants who had been physically abused (aOR: 1.84; 95% CI 1.15 to 2.95; p=0.011), sexually abused (aOR: 1.91; 95% CI 1.19 to 3.07; p=0.007) or physically neglected (aOR: 1.89; 95% CI 1.01 to 3.52; p=0.047) had significantly higher odds of binge injection drug use. With each additional maltreatment experience, participants' odds of binge injection drug use increased by 1.24 (95% CI 1.08 to 1.41; p=0.003). There was a marginally significant association between emotional neglect and injecting any drug (aOR: 1.64; 95% CI 0.98 to 2.74; p=0.058). Emotional neglect was associated with decreased odds of sharing rigs (aOR: 0.58; 95% CI 0.32 to 1.03; p=0.064).

**DISCUSSION**

This study reaffirms that experiences of childhood maltreatment are deeply harmful experiences in the life course, contributing to a cascade of consequences including problematic substance use, sex, and drug-related risks. We also suggest that emotional neglect is associated with decreased likelihood of sharing injection equipment, highlighting the importance of implementing Canada's TRC's 94 Calls to Action, which demand support for Indigenous children and families. These results are consistent with previous findings and support the need for ongoing efforts to support Indigenous children and families.

**Table 3 Continued**

| Emotional Neglect | Physical Neglect | Number of Maltreatments Experienced |
|-------------------|------------------|-----------------------------------|
| **Injection drug use related vulnerabilities** | **Injection drug use related vulnerabilities** | **Injection drug use related vulnerabilities** |
| STI | OR 95% CI | P value | AOR 95% CI | P value | OR 95% CI | P value |
| 0.88 | 0.54 to 1.42 | 0.600 | 0.84 | 0.53 to 1.32 | 0.450 | 1.44 | 0.76 to 2.74 | 0.268 | 1.36 | 0.71 to 2.62 | 0.349 | 1.14 | 0.99 to 1.30 | 0.062 | 1.11 | 0.97 to 1.27 | 0.139 |
| **Daily or more injection cocaine** | **Daily or more injection opioids** | **Binge injection** | **Sharing rigs** | **Need help to inject** |
| OR 95% CI | OR 95% CI | OR 95% CI | OR 95% CI | OR 95% CI |
| 1.20 | 0.82 to 1.77 | 0.352 | 1.20 | 0.80 to 1.79 | 0.384 | 1.33 | 0.85 to 2.06 | 0.207 | 1.28 | 0.80 to 2.06 | 0.298 | 1.13 | 1.02 to 1.26 | 0.021 | 1.11 | 1.00 to 1.24 | 0.058 |
| 1.66 | 0.85 to 3.26 | 0.140 | 1.59 | 0.83 to 3.08 | 0.165 | 1.50 | 0.60 to 3.77 | 0.387 | 1.48 | 0.61 to 3.56 | 0.382 | 1.15 | 0.95 to 1.40 | 0.152 | 1.13 | 0.94 to 1.35 | 0.188 |
| 1.01 | 0.66 to 1.56 | 0.957 | 0.97 | 0.62 to 1.52 | 0.894 | 1.13 | 0.70 to 1.83 | 0.617 | 1.05 | 0.63 to 1.74 | 0.865 | 1.06 | 0.94 to 1.19 | 0.365 | 1.01 | 0.89 to 1.14 | 0.860 |
| 1.29 | 0.79 to 2.11 | 0.306 | 1.35 | 0.83 to 2.11 | 0.231 | 1.84 | 1.00 to 3.38 | 0.051 | 1.89 | 1.01 to 3.52 | 0.047 | 1.23 | 1.07 to 1.43 | 0.005 | 1.24 | 1.08 to 1.44 | 0.003 |
| 0.58 | 0.32 to 1.03 | 0.064 | 0.53 | 0.30 to 0.93 | 0.027 | 1.93 | 0.81 to 4.59 | 0.135 | 1.83 | 0.77 to 4.39 | 0.174 | 1.08 | 0.92 to 1.26 | 0.371 | 1.05 | 0.89 to 1.23 | 0.561 |
| 0.96 | 0.61 to 1.50 | 0.844 | 0.92 | 0.59 to 1.45 | 0.720 | 1.11 | 0.66 to 1.85 | 0.699 | 1.06 | 0.64 to 1.76 | 0.828 | 1.05 | 0.92 to 1.19 | 0.489 | 1.02 | 0.89 to 1.17 | 0.757 |

*Includes the last study visit for participants that remained HIV seronegative over the study period or the first study visit where participants tested HIV seropositive.
†Includes the last study visit for participants that remained HCV seronegative over the study period or the first study visit where participants tested HCV seropositive.

AOR, adjusted OR; HCV, hepatitis C virus; STI, sexually transmitted infection.
coping to younger generations. Higher proportions of Cedar participants who were second-generation residential school survivors had experienced sexual abuse, and higher proportions of those who had been taken into foster care reported emotional and sexual abuse and physical neglect. Indigenous leaders and Elders have pointed to the failure of the Canadian justice system to respond to the intergenerational impacts of colonial violence. Indigenous legal scholars have been clear that reconciliation efforts must involve reviving ancestral systems of governance that build community capacity to support Indigenous families. On a global scale, policymakers must acknowledge that child apprehension systems in Canada, Australia and the USA have failed Indigenous families and are associated with long-term health-related harms including death and HIV and HCV infection. These systems are based on imposed colonial values/laws, removing children from their families without any meaningful support for prevention or healing. As advocated by Indigenous leaders and scholars, priorities should include legislation that supports Indigenous governments’ autonomy to assert jurisdictional authority over the welfare of their own children including child welfare laws, policies and practice.

Childhood maltreatment and HCV infection
This study suggests that sexual abuse is a risk factor for HCV infection among Cedar participants with a marginal association between the number of maltreatments experienced with HCV infection. To our knowledge, this is the first time a study has reported this association and this finding may have implications for delivery of HCV care. While legal and harm reduction strategies aiming to curb the HIV and HCV epidemics among people who use drugs in British Columbia have made encouraging progress, they often fall short as a result of their focus on changing individual risk behaviours rather than addressing systemic/structural barriers and facilitators to health and healing. For example, though newly developed highly effective and tolerated HCV treatments are publicly funded in Canada, Indigenous people are less likely to engage in HCV care. While legal and harm reduction strategies aiming to curb the HIV and HCV epidemics among people who use drugs in British Columbia have made encouraging progress, they often fall short as a result of their focus on changing individual risk behaviours rather than addressing systemic/structural barriers and facilitators to health and healing. For example, though newly developed highly effective and tolerated HCV treatments are publicly funded in Canada, Indigenous people are less likely to engage in HCV care.22 and more likely to die without ever accessing HCV care.23 Barriers such as experiences of stigma, discrimination and lack of cultural safety in healthcare settings dissuade many Indigenous people who use drugs from engaging into primary healthcare and lifesaving treatment programmes. For clinicians supporting Indigenous patients living with HCV, our finding suggests the possible history of sexual abuse and complex trauma should be explored and addressed through provision of publicly funded trauma-informed care.

Childhood maltreatment and sex-related risks
Cedar participants who experienced sexual abuse were more likely to report high-frequency cocaine injection. Those who had been emotionally abused, physically abused, sexually abused or physically neglected were more likely to report bingeing with injection drug use. With each additional type of maltreatment experienced, the odds of inconsistent condom use increased. Participants who experienced emotional abuse were more likely to report an STI. Emotional abuse and sexual abuse were associated with sexual assault. Few studies have addressed multiple types of maltreatment and sexual vulnerability, however research has highlighted sexual abuse survivors’ feelings of powerlessness and low self-esteem, contributing to decreased self-efficacy to negotiate protected sex. As evidenced by previous research, HIV prevention interventions and treatment programming must be cognizant of the mediating effect that childhood maltreatment has on young people’s self-efficacy to refuse unwanted sexual activity, seek balanced power dynamics in sexual relationships and negotiate condom use. Moreover, control over Indigenous people’s bodies has been a focus of the Canadian state, including medical, social, religious and judicial systems. This continues to affect Indigenous people’s sexual health and safety by exacerbating existing traumas and contributing to revictimisation. Indigenous women in Canada, USA and Australia face excessive predation and violence, yet are provided little protection or justice. Our study suggests that young Indigenous people who have experienced childhood maltreatment and who use drugs require tailored interventions that address the impacts of complex trauma on sexual well-being.

Childhood maltreatment and substance use-related risks
Cedar participants who were sexually abused were more likely to report high-frequency cocaine injection. Those who had been emotionally abused, physically abused, sexually abused or physically neglected were more likely to report bingeing with injection drug use. With each additional type of maltreatment experienced, the odds of inconsistent condom use increased. Cedar participants who reported emotional neglect were less likely to report needle sharing, possibly related to the effect of emotional neglect on social isolation in adulthood. Associations between high-risk and high-intensity substance use with HIV and HCV infection are well established, especially high-frequency cocaine and binge injection drug use. It is deeply concerning that though relationships between childhood maltreatment and substance use leading to HIV/HCV risk have been well established, and despite tremendous innovation in harm reduction over the past 15 years, we have been unable to interrupt these harmful pathways to support well-being.
through conventional means. Taken together, with associations identified in this study between colonial harms and childhood maltreatment, it seems clear that ongoing imposition of colonial laws, systems and institutions undermine Indigenous families, contributing to self-medication and creating risk of infectious disease. Where Cedar participants’ experiences differ from established understandings of substance use is the role of ongoing colonial harms impeding access to prevention and healing programming. In this context, substance use represents a way to cope with the effects of colonial harms. Indigenous leaders have called for responses to substance use that address the roots of wholistic well-being, including strengthening foundations of family, identity and culture, in addition to harm reduction programmes that help people remain safe while using. In particular, trauma and addiction interventions that blend Indigenous ways of knowing and healing with western approaches to positive stress-coping have had encouraging results.

This study’s findings support the need for such interventions to specifically address the role of childhood trauma in high-intensity injection drug use among young Indigenous people.

Comparisons to other studies
Few studies addressing childhood maltreatment among people who use drugs have involved Indigenous participants. Proportions of Cedar participants who reported severe childhood maltreatment are similar or higher than in a cross-sectional study involving 676 ethnically diverse men and women who used drugs in San Antonio, USA and in a cross-sectional study involving 85 adults (15% Indigenous) who used opiates in Vancouver, British Columbia. Severity of emotional, physical and sexual abuse among Cedar participants was higher than in a cross-sectional study involving 254 American Indian women accessing primary care in the USA and higher than another cross-sectional study involving 91 Aboriginal/Torres Strait Islander youths in the juvenile justice system in New South Wales, Australia.

LIMITATIONS
Cedar uses self-reported data from a nonprobabilistic sample. While we cannot rule out selection bias and its impact, we are confident that our recruitment methods and rigorous eligibility criteria ensured that the sample was approximately representative of Indigenous young people who use drugs in Vancouver and Prince George. There was potential for recall bias, socially desirable reporting and misclassification of exposure and outcome variables (except for HIV and HCV serostatus). Nevertheless, Cedar’s long-term relationships with participants and Indigenous governance have fostered trust in the research process. The measures of colonial harms (parents being taken into residential school and being taken into foster care) do not capture the full extent of colonial harms experienced by Cedar participants. We could not determine the temporality of childhood maltreatment and being taken into foster care; considerable evidence from Cedar and elsewhere indicates that multiple apprehensions and all forms of maltreatment are common within the child welfare system. The maltreatment types and outcomes were specified a priori and were likely to correlate with one another; as such, correcting for multiple testing would have imposed too great of a reduction in power for these explorations. Nevertheless, our results should be interpreted with caution and viewed as forming a basis for future investigations. Despite these limitations, we believe that this study provides new and important epidemiological evidence regarding health outcomes associated with childhood maltreatment.

Taken together, these findings have implications for all fields of health that aim to support the wellness of Indigenous people who use drugs, including primary healthcare, harm reduction, drug/alcohol treatment, mental health services and HIV and HCV prevention and treatment. Indigenous experts have long argued for adoption of Indigenous-led healthcare models that take into account the whole person, including mental, emotional, physical and spiritual well-being. Such strength-based and culturally safe case management may be effective in facilitating access to HIV and HCV care while supporting engagement with healing resources. Our findings suggest that it is important to consider reports of childhood maltreatment among young Indigenous people who use drugs within the lens of past and ongoing colonial harms, as they continue to be a negative determinant of health for Indigenous families. Health professionals in Canada must understand their unique and pivotal role of health for Indigenous families. Health professionals in Canada must understand their unique and pivotal role of health for Indigenous families. Health professionals in Canada must understand their unique and pivotal role of health for Indigenous families.
Correction notice  This article has been corrected since it was first published. Some textual errors has been corrected.

Acknowledgements The authors are indebted to the Cedar Project participants for continuing to share their stories. They extend special thanks to members of the Cedar Project Partnership for their conviction and for holding the research team accountable to the voices of young Indigenous people. The authors also thank the Elders who supported this study for continued wisdom and guidance. The authors are grateful to past and present study staff who bring tremendous care and energy to this work.

Contributors Partnership contributed to study conception and design; interpretation of results; Indigenous research methods and cultural safety in study protocols and procedures; critical revision of the manuscript for intellectual content and accuracy especially related to: child welfare policies and legislation; Indigenous family health and wellness; and culture and healing. VT contributed to study conception and design; data collection; interpretation of results; critical revision of the manuscript for intellectual content and accuracy, ensuring study recommendations are relevant to young Indigenous people who use drugs. DZ contributed to study data analysis; interpretation of results; critical revision of the manuscript for intellectual content and accuracy related to statistical methods and interpretations. EMY contributed to study conception and design; interpretation of results; critical revision of the manuscript for intellectual content and accuracy related to infectious and chronic diseases, health equity, and transformative change in healthcare. MS and PMS contributed to funding acquisition; study conception and design; supervision and oversight; interpretation of results; manuscript development and review for intellectual content and accuracy related to HIV/HCV epidemiology and health policy. All authors gave approval for the final version of the manuscript and agreed to be accountable for all aspects of the work.

Funding The Cedar Project is supported by Canadian Institutes of Health Research grant number [FDN – 148 376].

Competing interests None declared.

Patient and public involvement Patients and/or the public were involved in the design, or conduct, or reporting, or dissemination plans of this research. Refer to the Methods section for further details.

Patient consent for publication Not required.

Ethics approval The University of British Columbia/Prairie Health Care Research Ethics Board approved the study. Reporting of this study conforms to the STROBE statement.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement No data are available. The Cedar Project (Cedar) cohort study data is protected and governed by the Cedar Project Partnership, an independent body of Indigenous Elders, leaders, and public health and social services experts. The Partnership considers the data to be not just numbers, but the voices and lived experiences of their young people, their relations. The Partnership ensures that Cedar researchers meet ethical standards set out by the University of British Columbia REB as well as the Tri-Council Policy Statement for Ethical Research Involving Humans, with a special focus on Section 9 pertaining to Indigenous peoples in Canada. Under our Research Agreement with the Partnership, we are not permitted to share or distribute Cedar data publicly and only Cedar researchers who have signed confidentiality agreements and been assigned a research mentor are permitted to work with Cedar data. All research questions, analyses, and outputs are strictly vetted via the Partnership. For these reasons, open access to Cedar data is not possible. Nevertheless, we welcome academic queries and conversations about Cedar research via the corresponding author.

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