



Association between Childhood Physical Abuse, Unprotected Receptive Anal Intercourse and HIV Infection among Young Men Who Have Sex with Men in Vancouver, Canada

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Abstract

Introduction: The association between childhood sexual abuse and HIV risk among men who have sex with men (MSM) is well established. However, no studies have examined the potential impact of other forms of childhood maltreatment on HIV incidence in this population.

Methods: We explored the impact of child physical abuse (CPA) on HIV seroconversion in a cohort of gay/bisexual men aged 15 to 30 in Vancouver, Canada. Cox proportional hazard models were used, controlling for confounders.

Results: Among 287 participants, 211 (73.5%) reported experiencing CPA before the age of 17, and 42 (14.6%) reporting URAI in the past year. After a median of 6.6 years follow-up, 16 (5.8%) participants HIV-seroconverted. In multivariate analysis, CPA was significantly associated with HIV seroconversion (adjusted hazard ratio [AHR]=4.89, 95% confidence interval (CI): 1.65–14.48), after controlling for potential confounders.

Conclusion: Our study uncovered a link between childhood physical violence and HIV incidence. Results highlight an urgent need for screening of young gay and bisexual men for histories of violence, and social and structural supports to prevent HIV transmission in this population.

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Introduction

In high-resource settings, men who have sex with men (MSM) continue to be disproportionately affected by HIV compared to other risk groups [1]. Recent estimates suggest that MSM account for 61% of new HIV infections in the United States (US) [2]; 45% of new infections in Canada [3] and 43% of HIV infections in the World Health Organization (WHO) European region [4]. Young MSM (YMSM) have particularly elevated rates of HIV incidence

in North America [5,6,7]. Between 2008 and 2010, HIV incidence among MSM aged 13–24 years in the US grew by 22%, compared to 12% in the general MSM population. In light of this emerging epidemiological pattern, there is an urgent need to better understand the factors fuelling HIV incidence among YMSM.

High risk sexual behaviours and new HIV infections among MSM have been linked to the experience of childhood maltreatment [8], defined by the US Centers for Disease Control as the

'physical or psychological/emotional mistreatment of children' [9]. Lesbians and gay men, bisexuals, and heterosexuals reporting same-sex sexual partners have increased odds of having experienced childhood maltreatment [10]. Studies examining this relationship among gay and bisexual men have tended to focus on the role of childhood sexual abuse (CSA), and have uncovered strong associations between CSA and unprotected anal intercourse [11,12,13,14,15,16], transactional sex [11,14], frequent casual sex [13,14,17,18,19,20] and HIV-positive serostatus [11,13,14, 15,17,21]. Similar findings have been observed in other populations including a random sample of youths seen consecutively at public health clinics in 10 US cities [22], a population-based study of adults who participated in a telephone survey in Washington State [23], and women participating in the Women's Interagency HIV Study (WIHS) collaborative project [24].

However, research has demonstrated that victims of childhood maltreatment tend to experience multiple forms of abuse and neglect [25,26], which individually and collectively incur adverse mental and physical health outcomes [27,28,29,30,31,32,33,34]. Apart from CSA, little is known about the potential impact of other forms of childhood maltreatment on HIV risk behaviour and transmission among MSM [9,35]. We therefore sought to examine the potential relationship between childhood physical abuse (CPA), understood as *physical aggression directed at a child by an adult that is intended to cause feelings of intimidation, pain, injury, or other physical suffering and bodily harm* [34], URAI and HIV incidence in a prospective cohort of young HIV-negative gay or bisexual men.

Methods

Ethics Statement

In Canada, formal legislation regarding the age at which a young person is still considered a child does not exist. As such, there are no legal guidelines to limit or guide this research. Instead, working with the local Research Ethics Board, our group and others at the BC Centre for Excellence in HIV/AIDS have developed the following protocols. First, given that some youth may be living away from their parents, some youth involved in the study can be considered 'emancipated minors'. These youth assume adult responsibilities, because they are not living with parents or guardians and are managing their own affairs. Nevertheless, despite this reality, every effort was made to seek consent from parents or guardians if available.

If a youth aged 16–18 years agrees to give informed assent to participate and the parent/guardian refuses to give consent, the subject was not be enrolled in the study. If a parent/guardian gives informed consent and the youth refuses to assent, the subject was not be enrolled in the study. When the parent/guardian does give informed consent, the researcher will carefully evaluate whether or not the youth him/herself really wants to participate in the study and fully understands the risks and discomforts that might be associated with participation. Subjects with major mental impairment and who seem incapable of providing informed consent or assent and who are unable to comply with study requirements were also excluded.

Written informed consent was obtained in advance for all sources of research materials. All study procedures were approved by the Providence Health Care (PHC)/University of British Columbia (UBC) Research Ethics Board.

Study Sample: The Vanguard Project

Between May 1995 and May 2002, a purposive sample of HIV seronegative MSM in Vancouver, British Columbia participated in a prospective open cohort study, the Vanguard Project, of HIV

incidence and risk behaviours. Eligible participants were aged 18 to 30 years at study enrolment, lived in the Greater Vancouver region, had not previously received an HIV-seropositive test result, and self-identified as gay or bisexual [36,37]. At enrolment and during annual follow-up study visits, participants completed a questionnaire eliciting information about their socio-demographic status, sexual and drug use behaviours, and healthcare utilization patterns, and underwent HIV testing (including pre-and post-test HIV counselling). Open-ended referrals to health services were routinely offered to participants. Written informed voluntary consent for both the questionnaire and the HIV testing was obtained from participants according to the protocol approved by the University of British Columbia Research Ethics Board. Participants were compensated \$20 per visit.

Variable Selection

Outcome variable. The primary outcome variable of interest was HIV seroconversion. For individuals testing seropositive at baseline, a validated serological testing algorithm for recent HIV seroconversion was used to ascertain whether infection was recently acquired or not [38]. A total of 31 individuals were removed from the analysis at baseline. HIV incidence for remaining participants was quantified as the number of new infections divided by the total person-time under observation from baseline to HIV seroconversion. Person-time was calculated as the interval between enrolment and the most recent follow-up visit for participants who did not seroconvert. For seroconverters, person-time was calculated as the interval between enrolment and the date at which an HIV-positive test result was first detected.

Explanatory variable. The primary explanatory variable of interest was CPA. Participants were asked whether they had experienced physical abuse before the age of 17 (yes vs. no), defined as an action that resulted in actual or potential harm "*from an interaction or neglect by a parent or person in a position of responsibility, power or trust... [as a] single or repeated incident. [resulting in] bruises and welts, bleeding, burns and scalds, broken bones and poisonings that may or may not leave visible signs*". Participants were asked to describe the nature of the abuse, by checking all that applied from a reference list of potential kinds of abuse (being hit, spanked, beaten, kicked, slugged, choked, shoved, burned, slapped, beat with an object, other or none). Participants were prompted to identify individuals who perpetrated the acts of violence, by checking all that applied from a reference list (father, mother, step father/mother, relative, person known to family, stranger, foster parent, prefer not to answer, other). Individuals were additionally questioned about the frequency of the acts using a 6 point scale (ranging from *happened once to happened a lot*), with a provision not to answer.

Secondary explanatory variables hypothesized to confound the relationship between CPA and HIV seroconversion were selected based on findings from previous literature on childhood maltreatment and HIV risk [8]. Socio-demographic variables included: age (continuous); sexual identity (gay/homosexual, bisexual, transgender, other); Aboriginal ancestry (yes vs. no); stable housing (yes vs. no), defined as living in a hotel, rooming house, jail, hospital, shelter, hostel or no fixed address in the past year; education (> high school vs. ≤high school graduation); employment (yes vs. no); history of CSA (yes vs. no), defined as an experience of non-consensual sex, including molestation, rape and sexual assault, and additionally as "*sexual behaviour between a child and an adult or between children when one is significantly older than the other, and has greater power or uses coercion... [including] touching breasts, buttocks, and genitals, whether the victim is fully dressed or undressed; exhibitionism; pornography; fellatio, cunnilingus, and penetration of the anus with sexual organs or an object*". Substance use variables included injection drug use ever (yes vs.

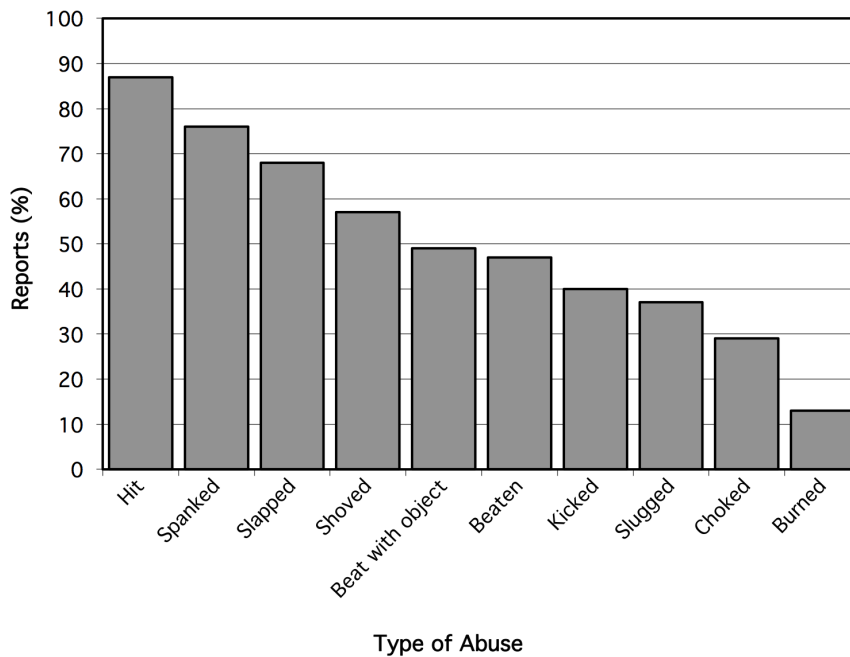


Figure 1. Types of childhood physical abuse reported by young HIV-negative gay and bisexual men in Vancouver, Canada (n = 287).
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no); Alcohol dependency was defined using the CAGE, which identified participants as alcohol dependent if they answered “yes” to two or more of CAGE’s four questions [39]. Mental health variables considered in this analysis included self-esteem (continuous), measured using the Rosenberg Self-Esteem Scale (continuous) [40]; diagnosis of a mental health disorder by a doctor, counsellor or psychiatrist in the past year (yes *vs.* no); suicidal ideation in the past year (yes *vs.* no). Sexual risk behaviour variables included number of casual sexual partners in the past year (continuous), defined as men with whom participants had sex for a period of less than once a month, including one night stands; transactional sex in the past year (yes *vs.* no), defined as exchange of sex for money, drugs, goods, clothing, shelter or protection; and URAI with partner of known or unknown HIV sero-positivity in the past year (yes *vs.* no). All potential explanatory variables were collected at baseline from the Vanguard Project survey.

Statistical Analysis

Of the total 863 participants recruited into the Vanguard Project, we restricted our analysis to the 287 (33.0%) men who completed the eighth and final version of the self-administered survey in 2002, as these were the only surveys containing questions regarding history of CPA. As a first step, bivariate analyses were performed on the study sample at the baseline interview, stratified by CPA. Pearson’s Chi-Square tests were used to compare categorical variables. In instances where counts were small (five or less), the Fisher’s Exact Test was used. Continuous variables were compared using Wilcoxon Rank Sum Test.

A Cox Proportional Hazard model was constructed to determine the association between CPA and HIV sero-conversion during follow-up, controlling for potential confounders. The multivariable model was built using an adaptation of methods described by Greenland and colleagues [41,42]. This manual backward stepwise approach involved first fitting a full model, including all explanatory variables, and noting the value of the coefficient associated with CPA. Reduced models were then

constructed, each removing one secondary explanatory variable from the full set. Comparing the value of the coefficient for CPA in the full model and each of the reduced models, secondary variables were removed corresponding to the smallest relative change in the coefficient for CPA. This iterative process continued until the maximum change of the value for CPA from the full model exceeded 5%. The intent of this model building strategy was to retain secondary variables in the final multivariate model with greater relative influence on the relationship between CPA and HIV sero-conversion. This technique has been previously applied in studies HIV-positive individuals to estimate the independent relationship between a hypothesized predictor variable and a clinical outcome [43,44].

Results

Among the total 287 participants, the median age at baseline was 31 years (range: 28–34). A total of 76 (26.5%) of the study participants reported experiencing physical abuse before the age of 17, and a total of 16 (5.8%) HIV seroconverted over the study period.

Figure 1 describes the proportion of CPA reported by participants by type of abuse. Being hit 66 (86.8%), and spanked 58 (76.3%) were most commonly reported, followed by being slapped 52 (68.4%), shoved 43 (56.6%), beaten with an object 37 (48.7%), beaten 36 (47.4%), kicked 30 (39.5%), slugged 28 (36.8%), choked 22 (29.0%) and burned 10 (13.2%). Qualitative answers provided in the “other” category included: being isolated in attics, called names, being cut, thrown into walls, thrown, hit with baseball bat; tied up as punishment, and beer bottle thrown at the head from moving car. Among participants, 28 (37.8%) responded that physical abuse occurred ‘occasionally’, 16 (21.6%) reported it occurred ‘rarely’, and 15 (20.3%) indicated it occurred ‘often’.

Figure 2 describes the proportion of CPA by type of perpetrator. Perpetrators most commonly reported included fathers (60.5%), mothers (36.8%) and male relatives (15.8%).

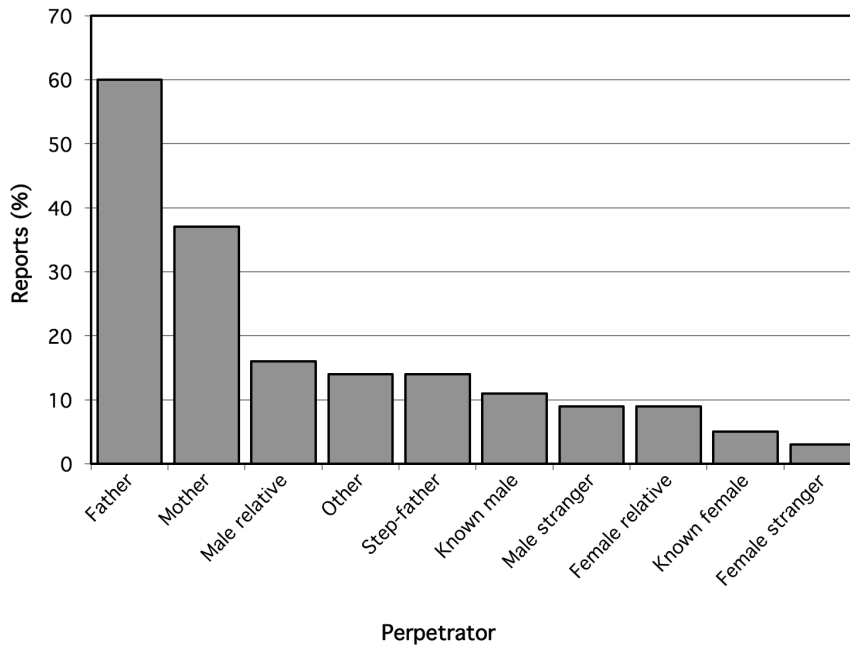


Figure 2. Perpetrators of childhood physical abuse reported by young HIV-negative gay and bisexual men in Vancouver, Canada (n = 287).

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Table 1 describes factors associated with CPA among study participants in bivariate analyses. Participants with a history of CPA were significantly more likely to be younger; of Aboriginal ancestry; have less than high school education; be unemployed; have ever used injection drugs; report a history of CSA; have ever thought about suicide; have engaged in transactional sex; had URAI in the last year; and to have HIV seroconverted over the study period ($p \leq 0.05$).

Table 2 reports factors found to be independently associated with time to HIV seroconversion in Cox proportional hazards model. Participants reporting a history of physical abuse before the age of 17 years (adjusted hazard ratio [AHR] = 4.89, 95%CI: 1.65 – 14.48), URAI in the past year with a partner of HIV-positive or unknown serostatus (AHR = 6.73, 95%CI: 2.48 – 18.28); and less than a high school education (AHR = 6.41, 95%CI: 2.29–17.93) had significantly higher risk of HIV seroconversion.

Discussion

We found that almost one third of YMSM in this sample experienced CPA before the age of 17. After a median 6.6 years of follow-up, young men who reported a history of CPA at baseline were almost seven times more likely to HIV seroconvert, compared to those who did not experience CPA, after controlling for potential confounders. Our results suggest that CPA, together with known risk factors for URAI [45,46,47,48,49], should be addressed as part of a comprehensive public health effort to prevent HIV acquisition among young gay and bisexual men.

The burden of CPA in this sample of YMSM is within the range of prevalence estimates reported by the general population in Europe and North America [50,51]. Our findings that YMSM with lower educational attainment and who were unemployed were significantly more likely to report CPA are also consistent with other studies [51,52,53,54]. We found that YMSM with histories of physical abuse were more likely to have also experienced sexual abuse, building on evidence that victims of

childhood maltreatment tend to experience multiple forms abuse and neglect [25,26]. Our finding that YMSM with histories of physical abuse were more likely to experience suicidal ideation, injection drug use and transactional sex highlight the long term biological and behavioural impacts of childhood maltreatment in this population.

Childhood maltreatment, including physical abuse, has been associated with adverse neurobiological changes in brain structure and function, and shown to have a dose-response relationship with the incidence of mental health disorders, somatic disturbances, substance use, adverse sexual behaviours and intimate partner violence in adulthood [55]. CPA has been associated with increased likelihood of post-traumatic stress disorder, major depression, anxiety and suicidal ideation in the general population [27,28,29,30,31,32,33,34,56,57]. Studies among gay and bisexual men have found that childhood maltreatment explains up to 20% of relative excess of suicidality, depression and substance use in this population [58].

Most research evaluating the behavioural effects of childhood maltreatment among MSM has focused on the role of sexual abuse. Consistent with these studies, our findings identified that YMSM with histories of abuse were more likely to report illicit drug use, alcohol dependency [11,13,14,17,19,20,21], and transactional sex [11,14,59]. Collectively, these findings point towards the need to engage young gay and bisexual men in mental health, harm reduction and social support services in order to mitigate the long term health and behavioural impacts of childhood physical violence.

Our finding that URAI was significantly associated with both CPA and HIV seroconversion suggests that this may have been the primary causal pathway, and is consistent with clinical and epidemiological literature describing predominant risk factors of HIV transmission among MSM [1,60]. While previous research has found that MSM with a history of sexual abuse have significantly greater odds of engaging in unprotected anal intercourse, and of being infected with HIV [8], our results are

Table 1. Bivariable analysis of factors associated with childhood physical abuse (CPA) among young HIV-negative gay and bisexual men in Vancouver, Canada (n = 287).

Characteristic	No history of CPA n = 211 (73.5%)	History of CPA n = 76 (26.5%)	p - value
Age at study enrolment			
Median, IQR	32 (29–35)	31 (27–33)	0.016
Sexual identity			
Gay/homosexual	64 (30.3)	22 (28.9)	0.992
Bisexual	57 (27.0)	20 (26.3)	
Transgender	58 (27.5)	22 (28.9)	
Other	32 (15.2)	12 (15.8)	
Ethnicity			
Aboriginal	4 (1.9)	11 (14.7)	<0.001
White	163 (78.4)	55 (73.3)	
Other	41 (19.7)	9 (12.0)	
Stable housing			
No	10 (4.7)	9 (11.8)	0.055
Yes	201 (95.3)	67 (88.2)	
High school education or greater			
No	14 (6.8)	12 (16.2)	0.033
Yes	191 (93.2)	62 (83.8)	
Employed			
No	27 (13)	20 (27.8)	0.006
Yes	180 (87.0)	52 (72.2)	
Injection drug use			
No	202 (96.2)	64 (85.3)	0.003
Yes	8 (3.8)	11 (14.7)	
Alcohol dependence			
No	158 (76.0)	51 (71.8)	0.527
Yes	50 (24.0)	20 (28.2)	
Childhood Sexual Abuse			
No	177 (83.9)	40 (52.6)	<0.001
Yes	34 (16.1)	36 (47.4)	
Rosenberg self-esteem score			
Median, IQR	33 (30–37)	32 (28–35)	0.076
Mental health diagnosis			
No	170 (81.3)	60 (82.2)	0.999
Yes	39 (18.7)	13 (17.8)	
Ever thought about Suicide			
No	188 (89.5)	54 (73.0)	0.001
Yes	22 (10.5)	20 (27.0)	
Number of casual sexual partners			
Median, IQR	2 (0–10)	3 (1–6)	0.929
Transactional sex			
No	177 (83.9)	42 (56.0)	<0.001
Yes	34 (16.1)	33 (44.0)	
Unprotected anal receptive intercourse			
No	186 (88.2)	58 (77.3)	0.035
Yes	25 (11.8)	17 (22.7)	
HIV Sero-conversion			
No	201 (97.6)	61 (84.7)	<0.001
Yes	5 (2.4)	11 (15.3)	

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Table 2. Bivariable and multivariable analysis of factors associated with time to HIV seroconversion among young HIV-negative gay and bisexual men in Vancouver, Canada (n = 287).

Characteristic	Unadjusted Hazard Ratio (95% CI)	p – value	Adjusted Hazard Ratio (95% CI)	p – value
Age at study enrolment	1.39 (1.03–1.87)	0.029		
Per decade increase				
Stable housing	0.17 (0.05–0.63)	0.007		
No vs. yes				
High school education or greater	8.49 (3.07–23.49)	<0.001	6.41 (2.29–17.93)	<0.001
No vs. yes				
Employed	0.29 (0.10–0.85)	0.024		
No vs. yes				
Injection drug use	2.03 (0.26–15.76)	0.497		
No vs. yes				
Alcohol dependence	1.03 (0.33–3.20)	0.959		
No vs. yes				
Childhood sexual abuse	2.07 (0.75–5.71)	0.159		
No vs. yes				
Childhood physical abuse	7.20 (2.50–20.77)	<0.001	4.89 (1.65–14.48)	0.004
No vs. yes				
Rosenberg self-esteem score	0.98 (0.89–1.09)	0.732		
Mental health diagnosis	1.25 (0.35–4.44)	0.729		
No vs. yes				
Symptoms of depression	0.96 (0.84–1.11)	0.607		
No vs. yes				
Number of casual sexual partners	1.01 (0.99–1.02)	0.212		
Per partner increase				
Transactional sex	3.53 (1.31–9.52)	0.013		
No vs. yes				
Unprotected anal receptive intercourse	8.21 (3.06–22.07)	<0.001	6.73 (2.48–18.28)	<0.001
No vs. yes				

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novel in that they highlight the importance of childhood physical violence, over sexual abuse, as a predictor of HIV seroconversion. Heuristic models describing the potential pathways between CSA and HIV risk behaviours among MSM have identified five inter-related mediators: personal motivations, coping responses, sexual scripts, risk appraisal and interpersonal factors [16,19,61]. A recent mediation model has identified salient pathways linking CSA and unprotected anal intercourse in a large sample of MSM [61]. While mediation analyses were outside the scope of this study, evaluation of our results in conjunction with this empirically-derived heuristic model suggests that CPA may have placed YMSM in this cohort at increased risk of URAI and HIV-seroconversion by sequentially affecting their: i) motivation (i.e. decreasing self-esteem, increasing depressive mood) ii) cognitive and behavioural coping strategies (i.e. increased substance use); iii) risk appraisal (i.e. reducing concern with contraction of HIV); and ultimately iv) HIV risk behaviour (i.e. increasing transactional sex, URAI). Additional studies are needed to examine the pathways through which childhood maltreatment predisposes to risk behaviours and HIV infection.

Our finding that both CPA and HIV seroconversion were significantly associated with attaining less than a high school education suggests that education level may have a modifying

effect on the relationship between childhood violence and HIV seroconversion among YMSM, and poses a potential opportunity for screening and intervention within the school setting.

Our findings are relevant to public health initiatives promulgating integrated approaches to sexual health for MSM, and provide evidence to inform normative guidance for improving the sexual health of gay, bisexual and other MSM [62]. They point towards an urgent need for enhanced screening of YMSM for histories of physical violence, and for improved mental health, harm reduction and social-structural supports to prevent HIV acquisition in this population. Research has shown that exposure to multiple forms of childhood abuse can have a compounding impact on substance use and risk sexual behaviours in adulthood, and suggest that addressing all forms of childhood maltreatment, rather than specific ones, is important to mitigate these adverse effects [63]. Group cognitive-behavioural interventions, such as prolonged exposure, coping skills training, and stress management have shown to improve the psychological functioning and health outcomes of HIV-positive individuals that have experienced childhood trauma and post-traumatic stress disorder (PTSD) [64]. Among HIV-positive individuals with histories of childhood abuse, interventions targeting PTSD have shown to be particularly effective for strengthening coping mechanisms and minimizing

psychiatric symptoms [65,66] that may place individuals at increased risk of adverse health outcomes. Community education and sensitization are essential to de-stigmatize and normalize disclosure of childhood maltreatment among MSM, and to facilitate appropriate health seeking behaviour in this population. Future operational research should evaluate the potential role of different educational and mental health interventions for mitigating the adverse impacts of CPA on risk of HIV transmission, and clarify the potential role of traumatic CPA experiences as barriers to HIV treatment uptake, adherence and optimal outcomes [66,67,68,69].

This study has several strengths and limitations that warrant consideration. Because participants were not randomly selected, and participants without incomplete follow-up were excluded from analysis, study findings cannot be generalized to all young gay and bisexual men in British Columbia or to other settings. Because survey data were self-reported, this study may have been susceptible to recall bias. Studies have found that victims of childhood sexual and physical abuse often forget or repress their traumatic memories [70]. This may have led to under-reporting of abuse, and thus conservative prevalence estimates of CSA and CPA in our study sample. Survey data may have additionally been prone to social desirability bias. The baseline survey was administered in the 1990s, during which time public awareness and stigma around sexual and physical abuse may have prevented participants from responding truthfully. Prevalence estimates of CPA in our study sample are significantly lower than recent estimates from large population-based samples of gay and bisexual men [71]. Common to all survival analyses, the censoring of participants who were either event-free or lost to follow-up may have led to an underestimation of true time to event. The

modeling approach controlled for several mental health variables that have been hypothesized to be on the causal pathway between abuse and HIV incidence, and may have therefore underestimated true effect size. Failure to account for unobserved and unknown confounders may have resulted in residual confounding, potentially introducing bias into effect estimates.

Conclusion

This work uncovered a link between childhood physical violence, URAI and HIV seroconversion among gay and bisexual men, and particularly among YMSM who constitute the fastest growing risk group for HIV incidence. Our findings highlight the long term effect of physical abuse on the health and wellbeing of MSM, and point towards an urgent need for enhanced screening of gay and bisexual men for histories of childhood violence, and for improved mental health, harm reduction and social-structural supports prevent HIV transmission in this vulnerable population.

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Author Contributions

Conceived and designed the experiments: AS AA DM RSH. Performed the experiments: SS RSH JM DM. Analyzed the data: AA AS KC DM JSGM RSH. Wrote the paper: AS AA JP AR CLM KC SS DM JSGM RSH.

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