





RESEARCH ARTICLE

# HIV and suicide risk across adolescence and young adulthood: an examination of socio-demographic, contextual and psychosocial risk factors for attempted suicide in a longitudinal cohort of ageing adolescents affected by HIV living in the New York City Area

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## Abstract

**Introduction:** As children become adolescents and young adults (AYA), their risk for attempting suicide increases dramatically, with chronic health conditions an important risk factor. This study examined correlates of suicidality across development in AYA living with perinatally acquired HIV (AYALPHIV) and those perinatally HIV-exposed but uninfected (AYAPHEU).

**Methods:** Data come from an ongoing longitudinal New York City-based study ( $N = 339$ ) with AYALPHIV and AYAPHEU interviewed every 12–18 months from 2003 to 2019 (mean enrolment age = 12 years; current mean age = 27 years). The Diagnostic Interview Schedule for Children (adolescent or young adult version) assessed psychiatric disorders and first-reported suicide attempt. Generalized estimating equations were used to examine associations between first-reported suicide attempt and socio-demographic, contextual and psychosocial correlates measured concurrently across six timepoints.

**Results:** At enrolment, 51% of participants were female, 72% heterosexual, 60% Black and 50% Latinx. Attempted suicide was significantly higher among AYALPHIV (27%, CI 21–33%) compared to AYAPHEU (16%, CI 10–22%), with an OR of 1.74 (CI 1.04–2.92) in a model adjusting for age. For AYALPHIV, anxiety (OR 2.66, CI 1.46–4.85), mood (OR 3.62, CI 1.49–8.81) and behaviour disorders (OR 5.05, CI 2.15–11.87) and past-year arrest (OR 3.05, CI 1.26–7.4), negative life events (OR 1.27, CI 1.11–1.46), city stress (OR 2.28, CI 1.46–3.57), pregnancy (OR 2.28, CI 1.08–4.81) and HIV stigma (OR 2.46, CI 1.27–4.75) were associated with increased odds of attempted suicide, while identifying as heterosexual (OR 0.27, CI 0.14–0.52), higher personal (OR 0.45, CI 0.26–0.80) and family self-concept (OR 0.36, CI 0.22–0.57) were protective. Interactions by HIV status and age were found: substance use was more strongly associated with attempted suicide among AYAPHEU than AYALPHIV, while negative life events and higher religiosity were more strongly associated with increased odds of attempted suicide among AYA  $\geq 19$  versus  $\leq 18$  years.

**Conclusions:** AYALPHIV compared to AYAPHEU faced unique risks for attempted suicide as they age into adulthood, with the highest risk among AYALPHIV experiencing HIV stigma or pregnancy and the highest risk among AYAPHEU with substance use. Assessing for suicide risk and correlates with attention to ageing can inform preventive interventions tailored to meet AYALPHIV and AYAPHEU needs.

**Keywords:** HIV; young adults; adolescents; HIV stigma; suicide; cohort studies

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## 1 | INTRODUCTION

Risk of attempting suicide increases dramatically as children become adolescents and young adults (AYA) (10–30 years) [1–5]. During this time, symptoms of mental illness and sub-

stance use often emerge [6], increasing the risk for suicidal thoughts and behaviours [7–12]. Social (e.g. racial, gender-based discrimination) [3, 13–18] and contextual (e.g. neighbourhood violence) [19–21] factors may also contribute to increased suicide risk among specific sub-groups of AYA, such

as sexual and racial minorities. Youth with chronic illnesses have shown higher suicidality in some studies [22], including AYA affected by HIV [23], yet, no studies to our knowledge have investigated proximal risk factors for suicidality among AYA affected by HIV as they age across this critical developmental period [24]. Given the staggering numbers globally of young people growing up with HIV or affected by maternal HIV [25, 26], understanding suicidality in this population is critical to informing much-needed evidence-based prevention interventions [27, 28], particularly because the history of attempted suicide is a strong predictor of later death by suicide [29–31].

During adolescence, identity development incorporates sexual, racial and ethnic identity, in the context of lived environments [32–37]. This process includes internalizing values and conceptualizing how identity may impact social experiences and life opportunities [35, 38]. Sexual and racial/ethnic minorities are at increased risk for suicidality because of identity-based discrimination, which has the strongest impact during adolescence and young adulthood [3, 13–18, 39]. For people living with HIV (PLWHIV), establishing an identity can be especially complex as they grapple with a stigmatized, chronic, transmittable infection [40, 41].

A recent systematic review and meta-analysis found that PLWHIV, median age 39 years, had a 100-fold higher risk of dying by suicide than people not living with HIV, with an even higher risk for people living with AIDS [42]. While risk factors for suicide in the general population of AYA are well documented [43–45], few studies have examined suicidality among AYA living with perinatally acquired HIV (AYALPHIV) [24] and those that have showed mixed results [46–50].

To further our understanding of predictors of suicide attempts, we examined longitudinal data (adolescence through young adulthood) from the Child and Adolescent Self-Awareness and Health study (CASA). CASA was informed by Social Action Theory (SAT) [51], which considers individual, social and contextual determinants of behavioural health outcomes. The objective of the current analysis was to identify proximal risk and protective socio-demographic, contextual and psychosocial factors associated with suicide attempts in AYALPHIV and AYA who were perinatally HIV-exposed but uninfected (AYAPHEU).

## 2 | METHODS

### 2.1 | Study population

CASA is an ongoing longitudinal cohort study, now in its 19th year, that includes AYALPHIV ( $n = 207$ ) and AYAPHEU ( $n = 133$ ) recruited from four New York City (NYC) medical centres between 2003 and 2008 when participants were ages 9–16 years (mean = 12). One AYAPHEU was excluded from the current analyses because they seroconverted during the study. Detailed methods have been described elsewhere [52, 53]. In brief, inclusion criteria were perinatal HIV exposure; cognitive capacity to complete interviews; English or Spanish-speaking; and caregiver with the legal capacity to sign consent for adolescent participation (AYA < 18 provided assent; those  $\geq 18$  years informed consent). Providers referred eligible clinical patients to the study; 93% of all participants approached

enrolled. The current analyses include data collected until 2019 from participants' psychosocial battery at six timepoints, with participants aged 21–32 years (mean = 27) at the most recent visit. Interviews were administered by trained research assistants and participants were compensated for time and travel expenses. The study was approved by the New York State Psychiatric Institute Institutional Review Board.

### 2.2 | Study measures

We selected risk and protective factors informed by SAT and identified by studies on adolescent suicide, HIV and mental health [7, 9–12, 22–24, 29, 47, 49, 54–67]. Unless otherwise indicated, variables for the following age-appropriate measures that had been used in other studies of PLWHIV and racially and ethnically diverse US populations were assessed at all timepoints. When applicable, we provide Chronbach's alpha as a measure of reliability (Table 1) [68, 69]. We then examined data on potential correlates of the first reported suicide attempt collected from the same timepoint as the report for those who endorsed a suicide attempt.

#### 2.2.1 | Suicidality

Suicidality was assessed at each visit using one item from the well-validated Diagnostic Interview Schedule for Children (DISC) [70] "Have you ever in your whole life tried to kill yourself or make a suicide attempt? (yes/no)." All participants who reported any suicidality, including intentions were evaluated for active suicidal ideation; no participants required being taken to the emergency room, although mental health treatment referrals were routinely made.

#### 2.2.2 | Socio-demographic factors

Socio-demographic variables at enrolment included sex (female/male), age, sexual orientation (heterosexual/not), perinatal HIV status (positive/negative), race and ethnicity, and history of pregnancy in self or partner.

#### 2.2.3 | Contextual factors

*Negative life events (measured at enrolment-FU3).* This measure consists of 18 negative events (e.g. parents divorced and death of family member) typically considered adverse childhood experiences [71], developed by one of the authors (CAM) and providers at a family-based HIV mental health programme for the target population [72, 73], with higher scores indicating more adverse life events. A total score was created and has been used in multiple papers [74–76].

*City Stress Inventory.* The 16-item City Stress Inventory assesses perceived neighbourhood stress, specifically urban stressors (e.g. witnessing drug deals and gang violence) appropriate for AYA with an eight grade reading level [77]. AYA reported how frequently they experienced these neighbourhood stressors in the past year using a 4-point scale [0 = never; 4 = often]. Higher scores indicated a higher level of neighbourhood stress.

*Recent arrest or incarceration (measured FU2-5).* A dichotomous variable was created based on AYA self-report of an arrest, spent time in jail or incarceration in the past year, with

**Table 1. Description of measures and timepoints collected in the longitudinal cohort of adolescents and young adults affected by HIV living in the New York City Area**

| Measure  | Scale name   | Measure age group  | Cronbach's $\alpha$                            | Enrol | FU1 | FU2 | FU3 | FU4 | FU5 |
|--|--|--|--|-------|-----|-----|-----|-----|-----|
| First attempted suicide  | The Diagnostic Interview Schedule for Children (adolescent or young adult version) (DISC) [70] | Administered by age (< 18 years received the child version, > 18 years received a slightly modified young adult version)                                   | NA   | X     | X   | X   | X   | X   | X   |
| Age, race/ethnicity, HIV status, sexual orientation, past year pregnancy | N/A  | All ages   | NA   | X     | X   | X   | X   | X   | X   |
| Recent arrest or incarceration   | Monitoring the Future [78]   | All ages   | NA   |       |     | X   | X   | X   | X   |
| Young adult negative life events   | Children's Life Events Inventory [72]; Life Events Questionnaire [75]                          | Developed with children ages 8–15 years [72], but items are appropriate for young adults and have been used in other studies of youth living with HIV [75] | NA <sup>a</sup>                                | X     | X   | X   | X   |     | X   |
| City stress  | City Stress Inventory (CSI) [77]   | Appropriate for those with an approximate eight-grade reading level [77]   | NA <sup>a</sup>                                | X     | X   | X   | X   | X   | X   |
| Religiosity  | Adapted from Monitoring the Future [78]  | All ages   | 0.77   | X     | X   | X   | X   | X   | X   |
| Self-concept   | Tennessee Self-Concept Scale [81]  | All ages   | Personal: 0.72<br>Family: 0.78<br>Social: 0.53 | X     | X   | X   | X   |     |     |
| Psychiatric disorder   | Diagnostic Interview Schedule for Children (DISC) [70]   | Administered by age (< 18 years received the child version, > 18 years received a slightly modified young adult version)                                   | NA   | X     | X   | X   | X   | X   | X   |
| HIV stigma   | Social Impact Scale [82], HIV Stigma Scale [147] (FU5)   | Appropriate for all ages. Before FU5, Social Impact Scale was only asked to PHIV who's caregivers disclosed youth knew about PHIV status.                  | 0.84   | X     | X   | X   | X   | X   | X   |

Abbreviation: FU, follow up.

<sup>a</sup>Chronbach's alpha computed at enrolment. The city stress index and life events scale both consist of items that are combined into an index following a formative measurement framework, in which the items are the cause of the construct rather than the effect, and therefore, do not follow a reflective measurement framework. Therefore, Chronbach's alpha is not appropriate for these measures [68,69].

items from Monitoring the Future, a well-validated measure of adolescent risk behaviour [78].

## 2.2.4 | Psychosocial factors

**Psychiatric disorders.** We assessed psychiatric disorders with the DISC, which has well-validated adolescent (< 18 years) and young adult (> 18 years) versions [79]. Symptoms experienced in the past year for the most common psychiatric diagnoses were assessed, adhering to the Diagnostic and Statistical Manual of Mental Disorders [80] diagnostic criteria. The following broad diagnostic categories were examined: mood disorders, anxiety disorders, behaviour disorders and substance use disorders.

**Religiosity.** Participants reported their religious affiliation, and, using 4-point Likert scales, past year frequency of participation in religious activities, belief in a higher power and the importance of religion or spirituality in their life appropriate for AYA [78]. A total religiosity score was created ranging from 0 to 18, with higher scores indicating higher religiosity (Cronbach's  $\alpha = 0.77$ ).

**Self-concept (enrolment-FU3).** Self-concept was measured using the Tennessee Self-Concept Scale:2 (TSCS:2), appropriate for AYA [81]. The TSCS:2 is composed of self-descriptive items, each answered on a 5-point Likert Scale (0 = not at all; 5 = very much); higher scores reflect better self-concept. We used three sub-scales: personal self-concept (e.g. "I'm a cheerful person" Cronbach's  $\alpha = 0.72$ ), family self-concept (e.g. "I am a member of a happy family" Cronbach's  $\alpha = 0.78$ ) and social self-concept (e.g. "I am a friendly person" Cronbach's  $\alpha = 0.53$ ).

**HIV stigma.** Among AYALPHIV, HIV stigma was assessed with the Social Impact Scale appropriate for AYA [82]. Using 18 items from a 4-point Likert-type scale, participants reported how much they agreed with statements concerning social rejection, isolation and internalized shame related to HIV (e.g. "I feel I need to keep my HIV a secret"), with higher scores indicating higher levels of HIV-related stigma (Cronbach's  $\alpha = 0.84$ ).

## 2.3 | Statistical analysis

Data were set in a long format with participants contributing multiple observations over time. Descriptive statistics were calculated and AYALPHIV and AYAPHEU participants were compared on enrolment socio-demographic and psychosocial variables. *T*-tests and chi-squared tests were used for continuous and categorical variables, respectively. Additionally, we plotted the cumulative incidence (1-Kaplan–Meier) of the time to first suicide attempt with age as the x-axis.

Given the rare outcome of suicide attempt and the use of repeated measures over time, we used logistic regression with generalized estimating equations (GEE) to individually estimate odds ratios (OR) and 95% confidence intervals (CI) for the association between each socio-demographic, contextual and psychosocial factor and having the first report of attempted suicide (binary outcome), adjusting for age at each survey round [83, 84]. Repeated observations were modelled using an independent working correlation matrix, but empirical standard errors were reported, which are robust to

the misspecification of the correlation structure. We examined these associations in the overall sample which included both AYALPHIV and AYAPHEU, and among AYALPHIV and AYAPHEU sub-groups. Overall sample models were additionally adjusted for HIV status (PHIV or PHEU), and HIV stigma was only examined among AYALPHIV. Similar to the way, censoring is handled in grouped proportional hazards model [85–87], for participants who ever reported a lifetime suicide attempt, observations were included in the model up until (and including) the observation in which a lifetime suicide attempt was first reported. We explored potential interactions by developmental stage by including an interaction term for ages 9–18 and 19 and older, and by PHIV-status by including a PHIV-status interaction term in analyses with the overall sample. Analyses were completed using SAS version 9.4 [88].

## 3 | RESULTS

At enrolment, 51% of participants were female ( $n = 172$ ), 72% heterosexual ( $n = 227$ ), 60% Black ( $n = 203$ ) and 50% Latinx ( $n = 170$ ); 11% were Black and Latinx ( $n = 36$ ) and two participants were neither Black nor Latinx with no significant differences between AYALPHIV and AYAPHEU (Table 2). Participants were followed for a mean of 8.5 years (minimum = 0 years [only enrolment], maximum = 15.9 years). The number of participants reporting attempted suicide increased from 15 (8 females and 7 males) at enrolment to 76 (37 females and 39 males) at the most recent visit. Participants were on average 19 years old (standard deviation = 4.4) at first reported suicide attempt.

Attempted suicide prevalence was significantly higher among AYALPHIV (27%, 95% CI 21–33%) compared to AYAPHEU (16%, 95% CI 10–22%,  $p = 0.02$ ) (Table 2). In the age-adjusted logistic marginal model accounting for participants' repeated observations, AYALPHIV had 1.74 times higher odds than AYAPHEU of ever attempting suicide (95% CI 1.04–2.92) (Table 3). Figure 1 shows the Kaplan–Meier cumulative incidence estimates of first suicide attempt among AYALPHIV and AYAPHEU in our sample. Based on these estimates, by the time a child reached 17 (the median age of all observations), the cumulative incidence of suicide attempt was 6% for AYAPHEU and 10% for AYALPHIV.

### 3.1 | Socio-demographic factors

In the age-adjusted and HIV status-adjusted logistic marginal models accounting for repeated observations, for the overall and AYALPHIV populations, those who identified as heterosexual had lower odds of attempted suicide compared to those who did not identify as heterosexual (Overall: OR = 0.3, 95% CI, 0.17–0.51; AYALPHIV: OR = 0.27, 95% CI 0.14–0.52). Frequencies of specific non-heterosexual identities were too small to examine separately.

### 3.2 | Contextual factors

For the overall sample and AYALPHIV group, contextual factors significantly associated with increased odds of attempted suicide were city stress (Overall: OR = 2.07, 95% CI 1.4–3.06; AYALPHIV: OR = 2.28, 95% CI 1.46–3.57; negative life events

**Table 2. Description of the overall cohort and AYA living with perinatally acquired HIV (AYALPHIV) and AYA who were perinatally HIV-exposed but uninfected (AYAPHEU) subgroups at enrolment**

| Variable                            | Overall sample<br>(N = 339) <sup>b</sup> |                             | AYALPHIV<br>(n = 206) |                             | AYAPHEU<br>(n = 133) |                             | Diff between<br>groups<br>p-value |
|-------------------------------------|--|-----------------------------|-----------------------|-----------------------------|----------------------|-----------------------------|-----------------------------------|
|                                     | n  | Mean (SD) or % <sup>b</sup> | n                     | Mean (SD) or % <sup>b</sup> | n                    | Mean (SD) or % <sup>b</sup> |                                   |
| Attempted suicide <sup>a</sup>      | 76                                       | 22% (18%, 27%)              | 55                    | 27% (21%, 33%)              | 21                   | 16% (10%, 22%)              | <b>0.02</b>                       |
| <i>Socio-demographic factors</i>    |  |                             |                       |                             |                      |                             |                                   |
| Sex                                 |  |                             |                       |                             |                      |                             | 0.91                              |
| Male                                | 167                                      | 49%                         | 102                   | 50%                         | 65                   | 49%                         |                                   |
| Female                              | 172                                      | 51%                         | 104                   | 50%                         | 68                   | 51%                         |                                   |
| Identifies as straight/heterosexual | 227                                      | 72%                         | 130                   | 69%                         | 97                   | 77%                         | 0.11                              |
| Black/African-American              | 203                                      | 60%                         | 131                   | 63.59%                      | 72                   | 54.14%                      | 0.08                              |
| Latinx                              | 170                                      | 50%                         | 99                    | 48.06%                      | 71                   | 53.38%                      | 0.34                              |
| Black and Latinx                    |  |                             |                       |                             |                      |                             |                                   |
| Age                                 | 339                                      | 12.58 (2.25)                | 206                   | 12.70 (2.16)                | 133                  | 12.38 (2.37)                | 0.19                              |

Abbreviations: AYALPHIV, adolescents and young adults living with perinatally acquired HIV; AYAPHEU, adolescents and young adults perinatally HIV-exposed but uninfected.

Bold indicates  $p < 0.05$ .

<sup>a</sup>Attempted suicide considers all survey rounds.

<sup>b</sup>Ns may not sum to total due to missing data. Percentages are of those with non-missing data. Percentages may not sum to 100 due to rounding.

(Overall: OR = 1.23, 95% CI 1.09–1.39; AYALPHIV: OR = 1.27, 95% CI 1.11–1.46); and having been arrested or spent time in jail in the past year (Overall: OR = 2.56, 95% CI 1.16–5.67; AYALPHIV: OR = 3.05, 95% CI 1.26–7.40).

### 3.3 | Psychosocial factors

Among the overall and AYALPHIV populations, higher personal self-concept (Overall: OR = 0.51, 95% CI 0.32–0.83; AYALPHIV: OR = 0.45, 95% CI 0.26–0.80) and family self-concept (Overall: OR = 0.39, 95% CI 0.26–0.59; AYALPHIV: OR = 0.36, 95% CI 0.22–0.57) were protective against attempted suicide. Overall, psychosocial factors associated with increased odds of attempted suicide included having any anxiety disorder (Overall: OR = 2.88, 95% CI 1.76–4.7); AYALPHIV: OR = 2.66, 95% CI 1.46–4.85; AYAPHEU: OR = 3.43, 95% CI 1.46–8.07); any mood disorder (Overall: OR = 4.39, 95% CI 2.29–8.41); AYALPHIV: OR = 3.62, 95% CI 1.49–8.81; AYAPHEU: OR = 5.88, 95% CI 2.33–14.88); or any behaviour disorder (Overall: OR = 4.70, 95% CI 2.39–9.23; AYALPHIV: OR = 5.05, 95% CI 2.15–11.87; AYAPHEU: OR = 4.06, 95% CI 1.35–12.17). For the overall and AYAPHEU populations, substance use disorder was associated with higher odds of attempted suicide and we found evidence of interaction by PHIV-status ( $p = 0.04$ ) with substance use as a greater risk factor for attempted suicide in the AYAPHEU group (Overall: OR = 2.60, 95% CI 1.49–4.73; AYAPHEU: OR = 5.83, 95% CI 2.23–15.29). No significant association was found in the AYALPHIV group.

Among AYALPHIV only, pregnancy and HIV stigma were associated with increased odds of attempted suicide. A unit increase in HIV stigma was associated with 2.46 times higher odds of attempted suicide (95% CI: 1.27–4.75). AYALPHIV who experienced pregnancy had 2.28 times higher odds of

attempted suicide compared to those who never experienced pregnancy (95% CI: 1.08–4.81). A gender-by-pregnancy interaction term was tested, as it was hypothesized that associations between pregnancy and attempted suicide would be higher for females; the interaction term was not significant ( $p = 0.90$ ).

### 3.4 | Interaction by PHIV status and developmental stage

Among older AYA ( $\geq 19$  years), each negative life event increased the odds of attempted suicide by a factor of 1.42 (95% CI: 1.15–1.76) with no significant association among younger AYA (OR = 1.13, 95% CI: 0.97–1.33) (interaction  $p$ -value = 0.09). Among older AYA, each unit increase in religiosity score increased the odds of attempted suicide by a factor of 1.60 (95% CI: 1.11–2.31), with no significant association among younger AYA (OR = 0.83, 95% CI: 0.54–1.28) (interaction  $p$ -value = 0.03).

## 4 | DISCUSSION

Adolescence and young adulthood is a high-risk period for attempting suicide [1–4], with AYALPHIV a particularly vulnerable group [49, 50]. The current findings extend the field, not only by providing additional evidence that AYALPHIV are at greater risk for suicide attempts across adolescence and into young adulthood than AYAPHEU peers [23, 49, 50], but also by showing proximal risk and protective factors for both groups as they age through this developmental period. For AYALPHIV, stigma and pregnancy were associated with attempted suicide and for AYAPHEU, substance use was a risk factor. Although our data suggest shared findings with other populations of AYA [67, 89–91], differences were identified

**Table 3. Associations between first report of attempted suicide and socio-demographic, structural and psychosocial factors for the overall cohort and within AYA living with perinatally acquired HIV (AYALPHIV) and AYA who were perinatally HIV-exposed but uninfected (AYAPHEU) subgroups**

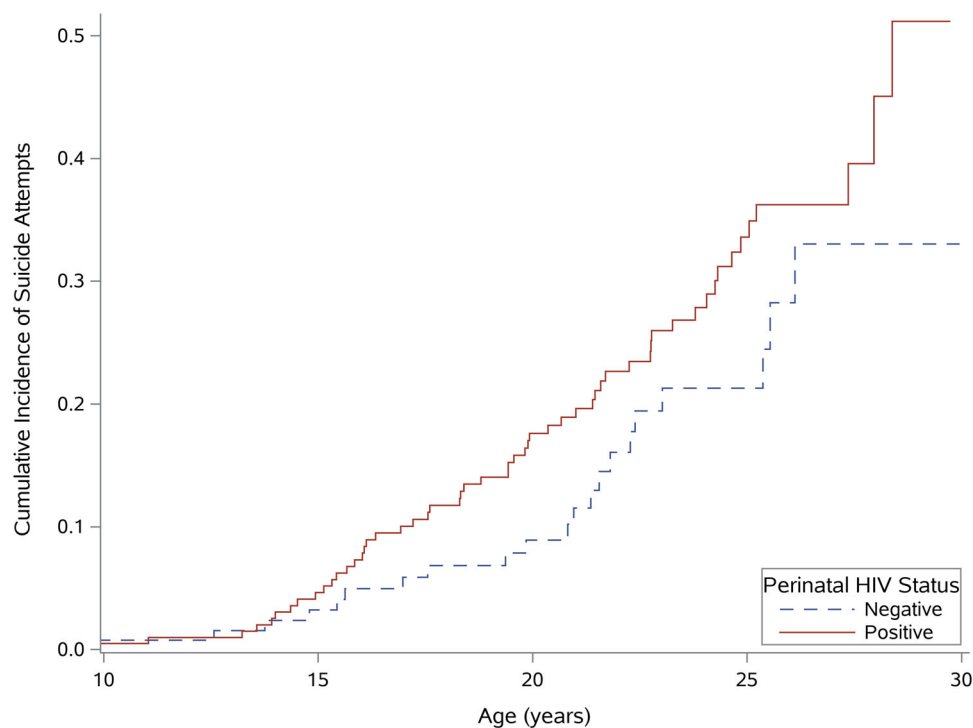
| Variable                              | Odds ratio (95% CI) <sup>a</sup>     |                                |                                       |
|---------------------------------------|--------------------------------------|--------------------------------|---------------------------------------|
|                                       | Overall                              | AYALPHIV                       | AYAPHEU                               |
| HIV status                            |                                      |                                |                                       |
| Positive                              | <b>1.74 (1.04, 2.92)</b>             |                                |                                       |
| Negative (ref)                        |                                      |                                |                                       |
| Socio-demographic factors             |                                      |                                |                                       |
| Sex                                   |                                      |                                |                                       |
| Male                                  | 0.8 (0.5, 1.28)                      | 0.74 (0.42, 1.3)               | 1.00 (0.4, 2.45)                      |
| Female (ref)                          |                                      |                                |                                       |
| Identifies as straight/heterosexual   |                                      |                                |                                       |
| Yes                                   | <b>0.30 (0.17, 0.51)</b>             | <b>0.27 (0.14, 0.52)</b>       | 0.37 (0.13, 1.04)                     |
| No (ref)                              |                                      |                                |                                       |
| Race                                  |                                      |                                |                                       |
| Black/African-American                | 1.12 (0.68, 1.82)                    | 1.28 (0.7, 2.32)               | 0.79 (0.33, 1.89)                     |
| Not Black/African-American (ref)      |                                      |                                |                                       |
| Ethnicity                             |                                      |                                |                                       |
| Latinx                                | 1.38 (0.86, 2.22)                    | 1.21 (0.69, 2.12)              | 2.02 (0.8, 5.07)                      |
| Not Latinx (ref)                      |                                      |                                |                                       |
| Ever experienced pregnancy            |                                      |                                |                                       |
| Yes                                   | 1.84 (0.98, 3.45)                    | <b>2.28 (1.08, 4.81)</b>       | 1.13 (0.35, 3.67)                     |
| No (ref)                              |                                      |                                |                                       |
| Structural factors                    |                                      |                                |                                       |
| Arrested/spent time in jail past year |                                      |                                |                                       |
| Yes                                   | <b>2.56 (1.16, 5.67)</b>             | <b>3.05 (1.26, 7.4)</b>        | 1.20 (0.14, 10.13)                    |
| No (ref)                              |                                      |                                |                                       |
| Negative life events                  | <b>1.23 (1.09, 1.39)</b>             | <b>1.27 (1.11, 1.46)</b>       | 1.08 (0.85, 1.36)                     |
| City Stress Inventory                 | <b>2.07 (1.4, 3.06)</b>              | <b>2.28 (1.46, 3.57)</b>       | 1.62 (0.74, 3.53)                     |
| Psychosocial factors                  |                                      |                                |                                       |
| Religiosity                           | 1.23 (0.93, 1.64)                    | 1.14 (0.82, 1.58)              | 1.52 (0.85, 2.72)                     |
| Personal self-concept                 | <b>0.51 (0.32, 0.83)</b>             | <b>0.45 (0.26, 0.8)</b>        | 0.68 (0.28, 1.64)                     |
| Family self-concept                   | <b>0.39 (0.26, 0.59)</b>             | <b>0.36 (0.22, 0.57)</b>       | 0.51 (0.24, 1.09)                     |
| Social self-concept                   | 1.10 (0.71, 1.72)                    | 1.19 (0.68, 2.07)              | 0.87 (0.45, 1.68)                     |
| DISC anxiety disorder                 |                                      |                                |                                       |
| Yes                                   | <b>2.88 (1.76, 4.7)</b>              | <b>2.66 (1.46, 4.85)</b>       | <b>3.43 (1.46, 8.07)</b>              |
| No (ref)                              |                                      |                                |                                       |
| DISC mood disorder                    |                                      |                                |                                       |
| Yes                                   | <b>4.39 (2.29, 8.41)</b>             | <b>3.62 (1.49, 8.81)</b>       | <b>5.88 (2.33, 14.88)</b>             |
| No (ref)                              |                                      |                                |                                       |
| DISC behaviour disorder               |                                      |                                |                                       |
| Yes                                   | <b>4.70 (2.39, 9.23)</b>             | <b>5.05 (2.15, 11.87)</b>      | <b>4.06 (1.35, 12.17)</b>             |
| No (ref)                              |                                      |                                |                                       |
| DISC substance disorder               |                                      |                                |                                       |
| Yes                                   | <b>2.60 (1.49, 4.73)<sup>b</sup></b> | 1.83 (0.89, 3.78) <sup>b</sup> | <b>5.83 (2.23, 15.29)<sup>b</sup></b> |
| No (ref)                              |                                      |                                |                                       |
| HIV-specific factors                  |                                      |                                |                                       |
| HIV stigma                            |                                      | <b>2.46 (1.27, 4.75)</b>       |                                       |

Abbreviations: AYALPHIV, adolescents and young adults living with perinatally acquired HIV; AYAPHEU, adolescents and young adults perinatally HIV-exposed but uninfected; DISC, Diagnostic Interview Schedule for Children [70].

<sup>a</sup>OR greater than 1 indicates a greater likelihood of attempted suicide. OR adjusted for age at each survey round and overall models were adjusted for PHIV status.

<sup>b</sup>Interaction by PHIV status was significant ( $p = 0.041$ ).

Bold indicates  $p < 0.05$ .



**Figure 1.** Kaplan–Meier cumulative incidence estimates of first suicide attempt among AYA living with perinatally acquired HIV (AYALPHIV) and AYA who were perinatally HIV-exposed but uninfected (AYAPHEU).

that suggest strategies for suicide prevention tailored for AYA affected by HIV.

The association between pregnancy (self or partner) and attempted suicide among AYALPHIV in our study is an important finding for preventive interventions. Prior studies suggest younger age among HIV-negative pregnant females is a risk factor for suicidality [91–95]. Adult women living with HIV have reported concerns regarding vertical HIV transmission, providing for a child while living with HIV, or fears of mortality [96–98], which may also be relevant to AYALPHIV of all genders. Future studies should examine the timing of pregnancy in this population and mental health effects, including suicidality.

Similar to studies with the general population, we found that non-heterosexual identity was significantly associated with attempted suicide in both AYALPHIV and AYAPHEU [3, 18]. Extensive research has demonstrated associations between sexual identity discrimination and poor mental health outcomes, with AYA sexual minorities being at the greatest risk for suicidality [3, 17, 18]. Further research could inform interventions by exploring how anti-LGBT discrimination might interact with feelings about growing up with HIV and negatively impact AYA social and emotional development.

We identified associations between attempted suicide and contextual factors, including recent arrests, city stress and negative life events in the full cohort, with negative life events having a stronger association with attempted suicide among those who were 19 or older. Interventions for older AYA may be able to stem the harm from exposure to negative life events [99, 100], yet to date, no programmes exist specifi-

cally tailored to AYA affected by HIV [27, 28]. Further, these contextual factors may be more salient for Black and Latinx AYA given that they are more likely [53] than White AYA to live in low-income neighbourhoods where negative life events (e.g. family member death, neighbourhood violence and recent arrest) have been associated with attempted suicide [19, 20, 101] and are more common as compared to higher-income neighbourhoods [21, 102–106]. Neighbourhood discrepancies by race and ethnicity are likely the result of systemic racism affecting housing and policing policies, the detrimental impact of which has been documented [64, 107–111]. Unfortunately, we could not examine racial differences as our participants were predominantly Black and Latinx. Additional research among ethnic and racial minorities affected by HIV and suicidality is needed.

Prior study of suicidality among AYA affected by HIV has found mixed results. Three cross-sectional studies (from England, Thailand and South Africa) found no differences in suicide risk between AYALPHIV versus those without HIV [46–48]. Conversely, our current and prior work in the United States [50] and a study in Rwanda [49] both found an increased risk of suicidality among AYALPHIV compared to AYA without HIV. Differences in the HIV epidemic and affected populations across nations [112–114], as well as cross-cultural differences, such as the impact of systemic discrimination on people with intersectional identities, including racial and ethnic minorities living with HIV in the United States, could explain the previously noted mixed findings internationally regarding HIV-status and adolescent suicidality [115–117].

As found in our study, stressful events can also lead to other negative developmental outcomes [21, 102–105], including mental illness, a known correlate of attempted suicide among AYA [7–12, 118]. Self-concept, related to mental health, is an important psychosocial factor that changes during adolescence and young adulthood. Although positive self-concept appears protective against suicidality in other populations, it has not been previously examined over time among AYALPHIV and AYAPHEU. We examined self-concept across different domains [81]. Consistent with international and US studies that suggest family processes influence suicidality among PLWHIV [58, 119], and among adolescents not affected by HIV [12, 66, 67, 120], higher levels of family self-concept were protective against attempted suicide among the overall sample and AYALPHIV. In addition, personal self-concept among the overall sample and AYALPHIV was protective, aligning with prior findings among HIV-negative youth [121, 122].

There were also psychosocial risk factors unique to AYAPHEU and AYALPHIV. Substance use was a risk factor for attempted suicide only among AYAPHEU, supporting prior studies that highlight AYAPHEU as a vulnerable group with unique risks that may require tailored interventions [41, 123, 124]. For AYALPHIV, HIV stigma was a risk factor for attempted suicide. Interestingly, as in our prior work among this cohort, we did not find significant associations between HIV stigma and suicide attempts [50]. Early data from our cohort suggested few participants told others about their HIV which might have limited exposure to stigma. This changed as young people aged, perhaps because of increased sexual behaviour, potentially resulting in more opportunities for stigmatizing experiences [37].

Notably, higher religiosity was associated with higher odds of attempted suicide among AYA over 18 years of age, yet in previous CASAH analyses, we found that religiosity was protective against attempted suicide in earlier adolescence. The changing direction of this association warrants further study and suggests that as our cohort ages, religiosity may shift from a neutral or protective factor to a risk factor for attempted suicide. This changing dynamic between religiosity and attempted suicide as our cohort ages may reflect changes in sexuality, stigmatizing experiences or family dynamics, and corresponds with prior mixed findings from studies of suicide and religiosity in the general population [125, 126].

The longitudinal design of the current study was a strength, allowing us to examine our aims as our cohort transitioned into adolescence and young adulthood. Our use of standardized and validated measures, including the DISC, to assess mental health and attempted suicide was another strength [70, 127, 128].

There were also limitations. Larger samples, including participants in other countries, would be helpful in detecting more nuanced group differences and moderators of our findings, particularly larger samples of AYAPHEU. Additionally, our study did not include an HIV-unexposed cohort, thus, limiting the ability to examine the impact of perinatal HIV exposure or familial HIV on suicidality. Over a lifetime, approximately 4.6% of US adults attempt suicide [129], although according to a systematic review, the proportion may be as high as 3.1–8.8% among adolescents in the United States [130], with

an international study including 90 countries noting a range of 10–15% [131]. Both AYAPHEU and AYALPHIV appear to have an elevated risk of attempted suicide compared to HIV-unaffected populations. Furthermore, as has been noted in previous work, AYALPHIV have had better access to mental health services through their ongoing HIV care systems than AYAPHEU [53, 132], potentially minimizing group differences. In addition, our findings may not be generalizable to AYALPHIV and AYAPHEU living outside NYC. However, NYC is one of the epicentres of the United States. HIV epidemic among women and children, with 22% of US paediatric HIV cases from NYC; moreover, the demographics of CASAH participants are similar to those reported in national studies of AYALPHIV and AYAPHEU [53, 133–135]. Further, our results align with prior studies in sub-Saharan Africa that suggest the importance of mental health in understanding suicidality among youth affected by HIV [24, 47, 49, 60].

## 5 | CONCLUSIONS

Adolescence and young adulthood is a critical period when the risk for attempted suicide rises precipitously [1–4]. We found that as our cohort aged, several socio-demographic, contextual and psychosocial factors placed AYA at increased risk for suicidality and that only a higher self-concept was protective. More negative life events and religiosity appeared to increase the risk of attempted suicide for participants over 18 years. Specific risks for attempted suicide for AYALPHIV were HIV stigma and pregnancy, with substance use a risk for attempted suicide among AYAPHEU. There is an urgent need to meet the needs of AYA affected by HIV and highlighting these risks for healthcare providers could be a needed first step towards preventive interventions [27, 28].

In the context of the COVID-19 pandemic, we suspect the risk of suicidality for this cohort and other AYA affected by HIV may increase. Even before COVID, the multifaceted impact of HIV, poverty and racism contributed to high rates of behavioural health problems, health disparities and among AYALPHIV, low rates of viral suppression [136–139], with few available evidence-based interventions to support behavioural health or HIV treatment adherence [27, 28]. The disproportionate burden of COVID-19 on Black and Latinx communities in the United States, and global COVID-related barriers to treatment among PLWHIV, may exacerbate behavioural health problems and limit access to services for chronic health conditions, such as HIV and psychiatric disorders, thus potentially contributing to increased risk for suicidality among AYA affected by HIV [111, 140–146].

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## COMPETING INTERESTS

The authors declare that they have no competing interests.

## AUTHORS' CONTRIBUTIONS

CM, LL, LK, CAM and CD performed the research. CAM, EJA, AW and CD designed the research study. CD managed the data. PWF contributed essential diagnostic tools and expertise. AL analysed the data. AW and EJA assisted in recruiting participants. PK, CM and BHS wrote a first draft of the manuscript. RNR, NN, CAM, EJA, AW and PWF wrote key sections of the manuscript and provided critical comments and insights. All authors contributed to interpreting the final results, reviewing and revising, and all authors have approved the final manuscript.

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## DATA AVAILABILITY STATEMENT

Due to privacy and ethical concerns the data cannot be made available because of the sensitivity of the HIV data, and the relatively small sample and ease of identifying people if a few demographics are known.

## REFERENCES

1. Nock MK, Green JG, Hwang I, McLaughlin KA, Sampson NA, Zaslavsky AM, et al. Prevalence, correlates, and treatment of lifetime suicidal behaviour among adolescents: results from the National Comorbidity Survey Replication Adolescent Supplement. *JAMA Psychiatry*. 2013;70(3):300–10.
2. Cha CB, Franz PJ, Guzmán EM, Glenn CR, Kleiman EM, Nock MK. Annual Research Review: Suicide among youth – epidemiology, (potential) etiology, and treatment. *J Child Psychol Psychiatry*. 2018;59(4):460–82.
3. Fish JN, Rice CE, Lanza ST, Russell ST. Is young adulthood a critical period for suicidal behaviour among sexual minorities? Results from a US national sample. *Prev Sci*. 2019;20(3):353–65.
4. Han B, Kott PS, Hughes A, McKeon R, Blanco C, Compton WM. Estimating the rates of deaths by suicide among adults who attempt suicide in the United States. *J Psychiatr Res*. 2016;77:125–33.
5. Bonnie RJ, Stroud C, Breiner H. Young adults in the 21st century. National Academies Press (US); 2015.
6. Kessler RC, Amminger GP, Aguilar-Gaxiola S, Alonso J, Lee S, Ustün TB. Age of onset of mental disorders: a review of recent literature. *Curr Opin Psychiatry*. 2007;20(4):359–64.
7. McLoughlin AB, Gould MS, Malone KM. Global trends in teenage suicide: 2003–2014. *QJM*. 2015;108(10):765–80.
8. Feng CX, Waldner C, Cushon J, Davy K, Neudorf C. Suicidal ideation in a community-based sample of elementary school children: a multilevel and spatial analysis. *Can J Public Health*. 2016;107(1):e100–5. doi:10.17269/cjph.107.5294
9. May AM, Klonsky ED, Klein DN. Predicting future suicide attempts among depressed suicide ideators: a 10-year longitudinal study. *J Psychiatr Res*. 2012;46(7):946–52.
10. Melhem NM, Porta G, Oquendo MA, Zelazny J, Keilp JG, Iyengar S, et al. Severity and variability of depression symptoms predicting suicide attempt in high-risk individuals. *JAMA Psychiatry*. 2019;76(6):603–13.
11. Geoffroy MC, Orri M, Girard A, Perret LC, Turecki G. Trajectories of suicide attempts from early adolescence to emerging adulthood: prospective 11-year follow-up of a Canadian cohort. *Psychol Med*. 2021; Aug;51(11):1933–43. <https://doi.org/10.1017/S0033291720000732>

12. Dugas E, Low NCP, Rodríguez D, Burrows S, Contreras G, Chaiton M, et al. Early predictors of suicidal ideation in young adults. *Can J Psychiatry*. 2012;57(7):429–36.
13. Pachter LM, Coll CG. Racism and child health: a review of the literature and future directions. *J Dev Behav Pediatr*. 2009;30(3):255–63.
14. Nyborg VM, Curry JF. The impact of perceived racism: psychological symptoms among African American boys. *J Clin Child Adolesc Psychol*. 2003;32(2):258–66.
15. Trent M, Dooley DG, Dougé J, SECTION ON ADOLESCENT HEALTH; COUNCIL ON COMMUNITY PEDIATRICS; COMMITTEE ON ADOLESCENCE. The impact of racism on child and adolescent health. *Pediatrics*. 2019;144(2):1–14.
16. Xiao Y, Cerel J, Mann JJ. Temporal trends in suicidal ideation and attempts among US adolescents by sex and race/ethnicity, 1991–2019. *JAMA Netw Open*. 2021;4(6):e2113513.
17. Layland EK, Exten C, Mallory AB, Williams ND, Fish JN. Suicide attempt rates and associations with discrimination are greatest in early adulthood for sexual minority adults across diverse racial and ethnic groups. *LGBT Health*. 2020;7(8):439–47.
18. Luk JW, Goldstein RB, Yu J, Haynie DL, Gilman SE. Sexual minority status and age of onset of adolescent suicide ideation and behaviour. *Pediatrics*. 2021;148(4):e2020034900.
19. Wang Y, Sareen J, Afifi TO, Bolton SL, Johnson EA, Bolton JM. Recent stressful life events and suicide attempt. *Psychiatr Ann*. 2012;42(3):101–8. doi:<https://doi.org.ezproxy.cul.columbia.edu/10.3928/00485713-20120217-07>
20. Polanco-Roman L, Gomez J, Miranda R, Jeglic E. Stress-related symptoms and suicidal ideation: the roles of rumination and depressive symptoms vary by gender. *Cognit Ther Res*. 2016;40(5):606–16.
21. Warner TD, Settersten RA. Why neighbourhoods (and how we study them) matter for adolescent development. *Adv Child Dev Behav*. 2017;52:105–52.
22. Barnes AJ, Eisenberg ME, Resnick MD. Suicide and self-injury among children and youth with chronic health conditions. *Pediatrics*. 2010;125(5):889–95.
23. Kreniske P, Mellins CA, Dolezal C, Korich R, Leu CS, Wiznia A, et al. Sounding the alarm: perinatally HIV-infected youth more likely to attempt suicide than their uninfected cohort peers. *J Adolesc Health*. 2019;65(5):702–5.
24. Vreeman RC, McCoy BM, Lee S. Mental health challenges among adolescents living with HIV. *J Int AIDS Soc*. 2017;20(S3):21497.
25. Joint United Nations Programme on HIV/AIDS (UNAIDS). 2020 UNAIDS Estimates. 2020 [cited 2022 January 19]. <https://aidsinfo.unaids.org/>
26. Slogrove AL, Powis KM, Johnson LF, Stover J, Mahy M. Global estimates of children HIV exposed and uninfected in the evolving HIV epidemic: 2000 to 2018. *Lancet Glob Health*. 2020;8(1):e67–75.
27. Bhana A, Kreniske P, Pather A, Abas MA, Mellins CA. Interventions to address the mental health of adolescents and young adults living with or affected by HIV: state of the evidence. *J Int AIDS Soc*. 2021;24(S2):e25713.
28. Bhana A, Abas MA, Kelly J, Pinxteren M van, Mudekunya LA, Pantelic M. Mental health interventions for adolescents living with HIV or affected by HIV in low- and middle-income countries: systematic review. *BJPsych Open*. 2020;6(5):1–15.
29. Shaffer D, Gould MS, Fisher P, Trautman P, Moreau D, Kleinman M, et al. Psychiatric diagnosis in child and adolescent suicide. *Arch Gen Psychiatry*. 1996;53(4):339–48.
30. Borges G, Nock MK, Abad JMH, Hwang I, Sampson NA, Alonso J, et al. Twelve-month prevalence of and risk factors for suicide attempts in the World Health Organization World Mental Health Surveys. *J Clin Psychiatry*. 2010;71(12):1617–28.
31. Glenn CR, Nock MK. Improving the short-term prediction of suicidal behaviour. *Am J Prev Med*. 2014;47(3):S176–80.
32. Gottlieb G. Probabilistic epigenesis. *Dev Sci*. 2006;10(1):1–11.
33. Cycles of contingency: developmental systems and evolution. MIT Press; 2001.
34. Bronfenbrenner U. The ecology of human development. Harvard University Press; 1979.
35. Umaña-Taylor AJ, Quintana SM, Lee RM, Deborah Rivas-Drake, Moin Syed, Eleanor Seaton, et al. Ethnic and racial identity during adolescence and into young adulthood: an integrated conceptualization. *Child Dev*. 2014;85(1):21–39.
36. Hall WJ, Dawes HC, Plocek N. Sexual orientation identity development milestones among lesbian, gay, bisexual, and queer people: a systematic review and meta-analysis. *Front Psychol*. 2021;12:753954.
37. Kang E, Mellins CA, Kim W, Curtis Dolezal, Christine Kindler, Cheng-Shiun Leu, et al. Navigating stigma trajectory and mental health among young adults living with perinatal HIV in New York City. *AIDS Behav*. 2021;25(11):3712–20.

38. Floyd FJ, Bakeman R. Coming-out across the life course: implications of age and historical context. *Arch Sex Behav*. 2006;35(3):287-96.
39. Geronimus AT. The weathering hypothesis and the health of African-American women and infants: evidence and speculations. *Ethn Dis*. 1992;2(3):207-21.
40. Remien RH, Stirratt MJ, Nguyen N, Robbins RN, Pala AN, Mellins CA. Mental health and HIV/AIDS: the need for an integrated response. *AIDS*. July 15, 2019;33(9):1411-20. <https://doi.org/10.1097/QAD.0000000000002227>
41. Mellins CA, Malee KM. Understanding the mental health of youth living with perinatal HIV infection: lessons learned and current challenges. *J Int AIDS Soc*. 2013;16:18593.
42. Wisnousky H, Lazzara N, Ciarletta M, Pelton M, Chinchilli VM, Ssentongo AE, et al. Rates and risk factors for suicidal ideation, suicide attempts and suicide deaths in persons with HIV: a protocol for a systematic review and meta-analysis. *BMJ Open*. 2021; Feb 5;11(2):e037154. <https://doi.org/10.1136/bmjopen-2020-037154>
43. Bilsen J. Suicide and youth: risk factors. *Front Psychiatry*. 2018;9:540.
44. Goldston DB, Daniel SS, Erkanli A, Beth A Reboussin, Andrew Mayfield, Patricia H Frazier, et al. Psychiatric diagnoses as contemporaneous risk factors for suicide attempts among adolescents and young adults: developmental changes. *J Consult Clin Psychol*. 2009;77(2):281.
45. Kirkcaldy BD, Siefen GR, Urkin J, Merrick J. Risk factors for suicidal behaviour in adolescents. *Minerva Pediatr*. 2006;58(5):443.
46. Copelyn J, Thompson LC, Le Prevost M, Hannah Castro, Kate Sturgeon, Katie Rowson, et al. Self-harm in young people with perinatal HIV and HIV negative young people in England: cross sectional analysis. *BMC Public Health*. 19(1): 1165.
47. Buckley J, Otwombe K, Joyce C, Given Leshabane, Stefanie Hornschuh, Khuthadzo Hlongwane, et al. Mental health of adolescents in the era of antiretroviral therapy: is there a difference between HIV-infected and uninfected youth in South Africa? *J Adolesc Health*. 2020;67(1):76-83.
48. Sudjaritruk T, Aурpibul L, Songtaweasin WN, Assawin Narkpongphun, Paul Thisayakorn, Tawalchaya Chotecharoentanon, et al. Integration of mental health services into HIV healthcare facilities among Thai adolescents and young adults living with HIV. *J Int AIDS Soc*. 2021;24(2):e25668.
49. Ng LC, Kirk CM, Kanyanganzi F, Mary C. Smith Fawzi, Vincent Sezibera, Evelyn Shema, et al. Risk and protective factors for suicidal ideation and behaviour in Rwandan children. *Br J Psychiatry*. 2015;207(3):262-8.
50. Kreniske P, Mellins CA, Dolezal C, Corey Morrison, Eileen Shea, Prudence W Fisher, et al. Predictors of attempted suicide among youth living with perinatal HIV infection and perinatal HIV-exposed uninfected counterparts. *JAIDS J Acquir Immune Defic Syndr*. December 1, 2021;88(4):348-55. <https://doi.org/10.1097/QAI.0000000000002784>.
51. Ewart CK. Social action theory for a public health psychology. *Am Psychol*. 1991;46(9):931-46.
52. Mellins CA, Brackis-Cott E, Leu CS, Katherine S Elkington, Curtis Dolezal, Andrew Wiznia, et al. Rates and types of psychiatric disorders in perinatally human immunodeficiency virus-infected youth and seroreverters. *J Child Psychol Psychiatry*. 2009;50(9):1131-8.
53. Abrams EJ, Mellins CA, Bucek A, Curtis Dolezal, Jeannette Raymond, Andrew Wiznia, et al. Behavioural health and adult milestones in young adults with perinatal HIV infection or exposure. *Pediatrics*. 2018;142(3):e20180938.
54. Bridge JA, Goldstein TR, Brent DA. Adolescent suicide and suicidal behaviour. *J Child Psychol Psychiatry*. 2006;47(3-4):372-94.
55. McMahon EM, Keeley H, Cannon M, Ella Arensman, Ivan J Perry, Mary Clarke, et al. The iceberg of suicide and self-harm in Irish adolescents: a population-based study. *Soc Psychiatry Psychiatr Epidemiol*. 2014;49(12):1929-35.
56. Nrugham L, Larsson B, Sund AM. Predictors of suicidal acts across adolescence: influences of familial, peer and individual factors. *J Affect Disord*. 2008;109(1-2):35-45.
57. Prinstein MJ, Nock MK, Simon V, Aikins JW, Cheah CSL, Spirito A. Longitudinal trajectories and predictors of adolescent suicidal ideation and attempts following inpatient hospitalization. *J Consult Clin Psychol*. 2008;76(1):92-103.
58. Lu HF, Sheng WH, Liao SC, Chang NT, Wu PY, Yang YL, et al. The changes and the predictors of suicide ideation and suicide attempt among HIV-positive patients at 6-12 months post diagnosis: a longitudinal study. *J Adv Nurs*. 2019;75(3):573-84.
59. Carrico AW, Johnson MO, Morin SF, Remien RH, Charlebois ED, Steward WT, et al. Correlates of suicidal ideation among HIV-positive persons. *AIDS*. 2007;21(9):1199-203.
60. Egbe CO, Dakum PS, Ekong E, Kohrt BA, Minto JG, Ticao CJ. Depression, suicidality, and alcohol use disorder among people living with HIV/AIDS in Nigeria. *BMC Public Health*. 2017;17(1):542.
61. Goldston DB, Molock SD, Whitbeck LB, Murakami JL, Zayas LH, Nagayama Hall GC. Cultural considerations in adolescent suicide prevention and psychosocial treatment. *Am Psychol*. 2008;63(1):14-31.
62. Canetto SS, Sakinofsky I. The gender paradox in suicide. *Suicide Life Threat Behav*. 2010;28(1):1-23.
63. Assari S, Moghani Lankarani M, Caldwell CH. Discrimination increases suicidal ideation in Black adolescents regardless of ethnicity and gender. *Behav Sci (Basel)*. 2017;7(4):1-10.
64. Oh H, Stickley A, Koyanagi A, Yau R, DeVlyder JE. Discrimination and suicidality among racial and ethnic minorities in the United States. *J Affect Disord*. 2019;245:517-23.
65. Polanco-Roman L, Anglin DM, Miranda R, Jeglic EL. Racial/ethnic discrimination and suicidal ideation in emerging adults: the role of traumatic stress and depressive symptoms varies by gender not race/ethnicity. *J Youth Adolesc*. 2019;48(10):2023-37.
66. Sourander A, Klomek AB, Niemelä S, Haavisto A, Gyllenberg D, Helenius H, et al. Childhood predictors of completed and severe suicide attempts: findings from the Finnish 1981 Birth Cohort Study. *Arch Gen Psychiatry*. 2009;66(4):398-406.
67. Tuisku V, Kiviruusu O, Pelkonen M, Karlsson L, Strandholm T, Marttunen M. Depressed adolescents as young adults — predictors of suicide attempt and non-suicidal self-injury during an 8-year follow-up. *J Affect Disord*. 2014;152-154:313-9.
68. Wei C, Eisenberg RE, Ramos-Olagastri MA, Wall M, Chen C, Bird HR, et al. Developmental psychopathology in a racial/ethnic minority group: are cultural risks relevant? *J Am Acad Child Adolesc Psychiatry*. 2017;56(12):1081-8.
69. Diamantopoulos A, Winkhofer HM. Index construction with formative indicators: an alternative to scale development. *J Market Res*. 2001;38(2):269-77.
70. Shaffer D, Fisher P, Lucas CP, Dulcan MK, Schwab-Stone ME. NIMH Diagnostic Interview Schedule for Children Version IV (NIMH DISC-IV): description, differences from previous versions, and reliability of some common diagnoses. *J Am Acad Child Adolesc Psychiatry*. 2000;39(1):28-38.
71. Felitti VJ, Anda RF, Nordenberg D, Williamson DF, Spitz AM, Edwards V, et al. Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults: the Adverse Childhood Experiences (ACE) Study. *Am J Prev Med*. 1998;14(4):245-58.
72. Mellins C, Havens J, Kang E. Child psychiatry service for children and families affected by the HIV epidemic. 1993.
73. Sarason IG, Johnson JH, Siegel JM. Assessing the impact of life changes: development of the Life Experiences Survey. *J Consult Clin Psychol*. 1978;46(5):932.
74. Kacanek D, Malee K, Mellins CA, Tassiopoulos K, Smith R, Grant M, et al. Exposure to violence and virologic and immunological outcomes among youth with perinatal HIV. *J Adolesc Health*. 2016;59(1):30-7.
75. Kang E, Mellins CA, Dolezal C, Elkington KS, Abrams EJ. Disadvantaged neighbourhood influences on depression and anxiety in youth with perinatally acquired human immunodeficiency virus: how life stressors matter. *J Community Psychol*. 2011;39(8):956-71.
76. Mutumba M, Bauermeister JA, Elkington KS, Bucek A, Dolezal C, Leu CS, et al. A prospective longitudinal study of mental health symptoms among perinatally HIV-infected and HIV-exposed but uninfected urban youths. *J Adolesc Health*. 2016;58(4):460-6.
77. Ewart CK, Suchday S. Discovering how urban poverty and violence affect health: development and validation of a Neighbourhood Stress Index. *Health Psychol*. 2002;21(3):254.
78. Johnston LD, O'Malley PM, Bachman JG, Schulenberg JE. Monitoring the Future national survey results on drug use, 1975-2011. Volume II: college students and adults ages 19-50. Institute for Social Research, University of Michigan; 2012.
79. Shaffer D, Fisher P, Dulcan MK, Davies M, Piacentini J, Schwab-Stone ME, et al. The NIMH Diagnostic Interview Schedule for Children Version 2.3 (DISC-2.3): description, acceptability, prevalence rates, and performance in the MECA study. *J Am Acad Child Adolesc Psychiatry*. 1996;35(7):865-77.
80. Psychiatry.org - DSM. [Cited 2022 June 24]. <https://psychiatry.org/443/psychiatrists/practice/dsm>
81. Fitts WH, Roid GH. *Tennessee Self Concept Scale*. Counselor Recordings and Tests. Nashville, TN; 1964.
82. Fife BL, Wright ER. The dimensionality of stigma: a comparison of its impact on the self of persons with HIV/AIDS and cancer. *J Health Soc Behav*. 2000;41(1):50-67.
83. Willett JB, Singer JD. How long did it take? Using survival analysis in educational and psychological research. In: L. Collins, J. Horn (Eds) *Best methods for the analysis of change: recent advances, unanswered questions, future directions*. American Psychological Association; 1991. pp. 310-27.

84. Schumacker RE, Denson KB. *Interpreting significant discrete-time periods in survival analysis*. 1994 [cited 2022 June 22]. <https://eric.ed.gov/?q=Discrete+AND+event+AND+simulation&id=ED383767>
85. Berger M, Schmid M. Semiparametric regression for discrete time-to-event data. *Stat Model*. 2018;18(3-4):322-45.
86. Moustaki I, Steele F. Latent variable models for mixed categorical and survival responses, with an application to fertility preferences and family planning in Bangladesh. *Stat Model*. 2005;5(4):327-42.
87. Tutz G, Schmid M. *Modeling discrete time-to-event data*. Springer; 2016.
88. SAS 9.4 Software Overview for the Customer. [Cited 2022 June 25]. <http://support.sas.com/software/94/>
89. Shain B. Suicide and suicide attempts in adolescents. *Pediatrics*. 2016;138(1):e20161420.
90. Miché M, Hofer PD, Voss C, Meyer AH, Gloster AT, Beesdo-Baum K, et al. Specific traumatic events elevate the risk of a suicide attempt in a 10-year longitudinal community study on adolescents and young adults. *Eur Child Adolesc Psychiatry*. 2020;29(2):179-86.
91. Gelaye B, Kajeepeta S, Williams MA. Suicidal ideation in pregnancy: an epidemiologic review. *Arch Womens Ment Health*. 2016;19(5):741-51.
92. Kim JJ, La Porte LM, Saleh MP, Allweiss S, Adams MG, Zhou Y, et al. Suicide risk among perinatal women who report thoughts of self-harm on depression screens. *Obstet Gynecol*. 2015;125(4):885-93.
93. Gandhi SG, Gilbert WM, McElvy SS, El Kady D, Danielson B, Xing G, et al. Maternal and neonatal outcomes after attempted suicide. *Obstet Gynecol*. 2006;107(5):984-90.
94. Li J, Imam SZ, Jing Z, Wang Y, Zhou C. Suicide attempt and its associated factors amongst women who were pregnant as adolescents in Bangladesh: a cross-sectional study. *Reprod Health*. 2021;18(1):71.
95. Musyimi CW, Mutiso VN, Nyamai DN, Ebuenyi I, Ndeti DM. Suicidal behaviour risks during adolescent pregnancy in a low-resource setting: a qualitative study. *PLoS One*. 2020;15(7):e0236269.
96. Rodriguez VJ, Mandell LN, Babayigit S, Manohar RR, Weiss SM, Jones DL. Correlates of suicidal ideation during pregnancy and postpartum among women living with HIV in rural South Africa. *AIDS Behav*. 2018;22(10):3188-97.
97. Zewdu LB, Reta MM, Yizgaw N, Tamirat KS. Prevalence of suicidal ideation and associated factors among HIV positive perinatal women on follow-up at Gondar town health institutions, Northwest Ethiopia: a cross-sectional study. *BMC Pregnancy Childbirth*. 2021;21:42.
98. Knettel BA, Mwamba RN, Minja L, Goldston DB, Boshe J, Watt MH, et al. Exploring patterns and predictors of suicidal ideation among pregnant and postpartum women living with HIV in Kilimanjaro, Tanzania. *AIDS*. 2020;34(11):1657-64.
99. Jones CM, Merrick MT, Houry DE. Identifying and preventing adverse childhood experiences: implications for clinical practice. *JAMA*. 2020;323(1):25-6.
100. Olds DL, Eckenrode J, Henderson CR Jr, Kitzman H, Powers J, Cole R, et al. Long-term effects of home visitation on maternal life course and child abuse and neglect: fifteen-year follow-up of a randomized trial. *JAMA*. 1997;278(8):637-43.
101. Bryson WC, Piel J, Thielke SM. Arrest and non-fatal suicide attempts among men: analysis of survey data from the National Survey on Drug Use and Health. *BMC Psychiatry*. 2021;21(1):537.
102. Leventhal T, Brooks-Gunn J. The neighbourhoods they live in: the effects of neighbourhood residence on child and adolescent outcomes. *Psychol Bull*. 2000;126(2):309-37.
103. Cutrona CE, Wallace G, Wesner KA. Neighbourhood characteristics and depression: an examination of stress processes. *Curr Dir Psychol Sci*. 2006;15(4):188-92.
104. Burke NJ, Hellman JL, Scott BG, Weems CF, Carrion VG. The impact of adverse childhood experiences on an urban pediatric population. *Child Abuse Negl*. 2011;35(6):408-13.
105. Truong KD, Ma S. A systematic review of relations between neighbourhoods and mental health. *J Ment Health Policy Econ*. 2006;9(3):137-54.
106. Firebaugh G, Acciai F. For Blacks in America, the gap in neighbourhood poverty has declined faster than segregation. *Proc Natl Acad Sci USA*. 2016;113(47):13372-7.
107. Churchwell K, Elkind MSV, Benjamin RM, Carson AP, Chang EK, Lawrence W, et al. Call to action: structural racism as a fundamental driver of health disparities: a presidential advisory from the American Heart Association. *Circulation*. 2020;142(24):e454-68.
108. Mestic A, Franklin L, Cansever A, Potter F, Sharma A, Knopov A, et al. The relationship between structural racism and Black-White disparities in fatal police shootings at the state level. *J Natl Med Assoc*. 2018;110(2):106-16.
109. Armenta A. Racializing crimmigration: structural racism, colorblindness, and the institutional production of immigrant criminality. *Sociol Race Ethn*. 2017;3(1):82-95.
110. Kruger DJ, De Loney EH. The association of incarceration with community health and racial health disparities. *Prog Community Health Partnersh*. 2009;3(2):113-21.
111. Millett GA, Jones AT, Benkeser D, Baral S, Mercer L, Beyrer C, et al. Assessing differential impacts of COVID-19 on black communities. *Ann Epidemiol*. 2020;47:37-44.
112. Vermund SH, Leigh-Brown AJ. The HIV epidemic: high-income countries. *Cold Spring Harb Perspect Med*. 2012;2(5):a007195.
113. Shao Y, Williamson C. The HIV-1 epidemic: low- to middle-income countries. *Cold Spring Harb Perspect Med*. 2012;2(3):a007187.
114. Kilmarx PH. Global epidemiology of HIV. *Curr Opin HIV AIDS*. 2009;4(4):240-6.
115. Bowleg L, Rio-González AM del, Holt SL, Pérez C, Massie JS, Mandell JE, et al. Intersectional epistemologies of ignorance: how behavioural and social science research shapes what we know, think we know, and don't know about U.S. Black men's sexualities. *J Sex Res*. 2017;54(4-5):577-603.
116. Turan JM, Elafros MA, Logie CH, Banik S, Turan B, Crockett KB, et al. Challenges and opportunities in examining and addressing intersectional stigma and health. *BMC Med*. 2019;17(1):7.
117. Jackson-Best F, Edwards N. Stigma and intersectionality: a systematic review of systematic reviews across HIV/AIDS, mental illness, and physical disability. *BMC Public Health*. 2018;18(1):919.
118. Macalli M, Navarro M, Orri M, Tournier M, Thiébaud R, Côté SM, et al. A machine learning approach for predicting suicidal thoughts and behaviours among college students. *Sci Rep*. 2021;11(1):11363.
119. Musisi S, Kinyanda E. Emotional and behavioural disorders in HIV seropositive adolescents in urban Uganda. *East Afr Med J*. 2009;86(1):16-24.
120. Matlin SL, Molock SD, Tebes JK. Suicidality and depression among African American adolescents: the role of family and peer support and community connectedness. *Am J Orthopsychiatry*. 2011;81(1):108-17.
121. Taylor PJ, McDonald J, Smith M, Nicholson H, Forrester R. Distinguishing people with current, past, and no history of non-suicidal self-injury: shame, social comparison, and self-concept integration. *J Affect Disord*. 2019;246:182-8.
122. Wong AE, Dirghangi SR, Hart SR. Self-concept clarity mediates the effects of adverse childhood experiences on adult suicide behaviour, depression, loneliness, perceived stress, and life distress. *Self Identity*. 2019;18(3):247-66.
123. Bather JR, Williams PL, Broadwell C, Smith R, Patel K, Garvie PA, et al. Racial/ethnic disparities in longitudinal emotional-behavioural functioning among youth born to women living with HIV. *J Acquir Immune Defic Syndr*. 2021;87(3):889-98.
124. Cluver LD, Orkin M, Gardner F, Boyes ME. Persisting mental health problems among AIDS-orphaned children in South Africa. *J Child Psychol Psychiatry*. 2012;53(4):363-70.
125. Lawrence RE, Oquendo MA, Stanley B. Religion and suicide risk: a systematic review. *Arch Suicide Res*. 2016;20(1):1-21.
126. Gearing RE, Alonzo D. Religion and suicide: new findings. *J Relig Health*. 2018;57(6):2478-99.
127. Asarnow J, McArthur D, Hughes J, Barbery V, Berk M. Suicide attempt risk in youths: utility of the Harkavy-Asnis suicide scale for monitoring risk levels. *Suicide Life Threat Behav*. 2012;42(6):684-98.
128. Goldston DB. Assessment of suicidal behaviours and risk in children and adolescents. *National Institute of Mental Health (NIMH); 2000*.
129. Kessler RC, Borges G, Walters EE. Prevalence of and risk factors for lifetime suicide attempts in the National Comorbidity Survey. *Arch Gen Psychiatry*. 1999;56(7):617-26.
130. Nock MK, Borges G, Bromet EJ, Cha CB, Kessler RC, Lee S. Suicide and suicidal behaviour. *Epidemiol Rev*. 2008;30(1):133-54.
131. Campisi SC, Carducci B, Akseer N, Zasowski C, Szatmari P, Bhutta ZA. Suicidal behaviours among adolescents from 90 countries: a pooled analysis of the global school-based student health survey. *BMC Public Health*. 2020;20(1):1102.
132. Smith R, Huo Y, Tassiopoulos K, Rutstein R, Kapetanovic S, Mellins C, et al. Mental health diagnoses, symptoms, and service utilization in US youth with perinatal HIV infection or HIV exposure. *AIDS Patient Care STDS*. 2019;33(1):1-13.
133. Hall HI, Song R, Rhodes P, Prejean J, An Q, Lee LM, et al. Estimation of HIV incidence in the United States. *JAMA*. 2008;300(5):520-9.
134. Moore RD. Epidemiology of HIV infection in the United States: implications for linkage to care. *Clin Infect Dis*. 2011;52(Suppl 2):S208-13.
135. Xia Q, Shah D, Gill B, Torian LV, Braunstein SL. Continuum of care among people living with perinatally acquired HIV infection in New York City, 2014. *Public Health Rep*. 2016;131(4):566-73.

136. Millett GA. New pathogen, same disparities: why COVID-19 and HIV remain prevalent in U.S. communities of colour and implications for ending the HIV epidemic. *J Int AIDS Soc.* **2020**;23(11):e25639.
137. Mellins CA, Malee KM. Understanding the mental health of youth living with perinatal HIV infection: lessons learned and current challenges. *J Int AIDS Soc.* **2013**;16.
138. Remien RH, Stirratt MJ, Nguyen N, Robbins R, Pala A, Mellins C. Mental health and HIV/AIDS: the need for an integrated response. *AIDS.* **2019**;33(9):1411-20.
139. Abrams EJ, Mellins CA, Bucek A, Dolezal C, Raymond J, Wiznia A, et al. Behavioural health and adult milestones in young adults with perinatal HIV infection or exposure. *Pediatrics.* **2018**;142(3):e20180938.
140. Ponticello M, Mwanga-Amumpaire J, Tshemereirwe P, Nuwagaba G, King R, Sundararajan R. "Everything is a mess": how COVID-19 is impacting engagement with HIV testing services in rural southwestern Uganda. *AIDS Behav.* **2020**;24(11):3006-9.
141. Pierre G, Uwizeza A, Dzinamarira T. Attendance to HIV antiretroviral collection clinic appointments during COVID-19 lockdown. A single center study in Kigali, Rwanda. *AIDS Behav.* **2020**;24(12):3299-301.
142. Kalichman SC, Eaton LA, Berman M, Kalichman MO, Katner H, Sam SS, et al. Intersecting pandemics: impact of SARS-CoV-2 (COVID-19) protective behaviours on people living with HIV, Atlanta, Georgia. *J Acquir Immune Defic Syndr.* **2020**;85(1):66-72.
143. Sun S, Hou J, Chen Y, Lu Y, Brown L, Operario D. Challenges to HIV care and psychological health during the COVID-19 pandemic among people living with HIV in China. *AIDS Behav.* **2020**;24(10):2764-5.
144. Sun Y, Li H, Luo G, Meng X, Guo W, Fitzpatrick T, et al. Antiretroviral treatment interruption among people living with HIV during COVID-19 outbreak in China: a nationwide cross-sectional study. *J Int AIDS Soc.* **2020**;23(11):e25637.
145. Beyrer C, Adimora AA, Sullivan PS, Fields E, Mayer KH. Ending HIV in the USA: integrating social determinants of health – authors' reply. *Lancet.* **2021**;398(10302):743.
146. Sprague C, Simon SE. Ending HIV in the USA: integrating social determinants of health. *Lancet.* **2021**;398(10302):742-3.
147. Berger BE, Ferrans CE, Lashley FR. Measuring stigma in people with HIV: psychometric assessment of the HIV stigma scale. *Res Nurs Health.* **2001**;24(6):518-29.