Impact of adverse childhood experiences on women's psychosocial and HIV-related outcomes and early child development in their offspring

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Abstract

Adverse childhood experiences (ACEs) may have a critical influence on adult outcomes and subsequent offspring development, but few data have explored the effects of ACEs in low-resource settings where the burdens of childhood adversity and HIV are high. Among mothers living with HIV in Cape Town, we examined the effects of ACEs on maternal psychosocial and HIV-related outcomes, as well as early child development in their offspring aged 36–60 months. The World Health Organization's Adverse Childhood Experiences International Questionnaire was used to measure maternal report of ACEs, and the Ages & Stages Questionnaire to screen for developmental delays in their offspring. Among 353 women (median age: 32 years), 84% reported ≥ 1 ACEs. Increased report of ACEs was strongly associated with depressive symptoms, hazardous alcohol use, intimate partner violence, and self-reported suboptimal adherence to antiretroviral therapy. These associations were driven by more severe childhood experiences, including abuse, neglect, and exposure to collective violence. Among 255 women who reported on their child's development, maternal ACEs were associated with poorer socioemotional development. These data suggest that childhood adversity has long-term effects on maternal outcomes as well as their children's socioemotional development, and point to ACEs that might be targeted for screening and intervention.

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Conflicts of interest
No conflicts of interest declared.

Keywords

Adverse childhood experiences; mental health; HIV; early child development; South Africa

Introduction

Pregnant and postpartum women living with HIV (WLHIV) are a vulnerable population, with high levels of poor psychosocial and HIV-related outcomes. In South Africa, where the antenatal HIV prevalence is around 30% (Woldesenbet et al., 2019), depression, alcohol use and intimate partner violence are commonly reported (Davis et al., 2017). In addition, suboptimal adherence to antiretroviral therapy (ART) and elevated HIV viral load are well-documented concerns during pregnancy and postpartum in this setting (Matthews et al., 2020; Rotheram-Borus et al., 2019; Woldesenbet et al., 2020). Notably, poor maternal psychosocial and HIV-related outcomes frequently co-occur, and both negatively influence outcomes among their offspring. In South African children, high levels of developmental delay have been observed (Donald et al., 2019; le Roux et al., 2018), exacerbating intergenerational cycles of adversity.

To inform intervention development, factors associated with poor maternal and child outcomes must be identified. Adverse childhood experiences (ACEs), defined as potentially traumatic events that occur during the first 18 years of life, have received little attention in low-resource settings. These events include childhood abuse and neglect, family dysfunction, and experience of bullying, community violence, and collective violence (World Health Organization, 2015). Studies from high-income settings suggest that ACEs can lead to a trajectory which includes adverse experiences during adulthood (LaNoue et al., 2012; Mersky et al., 2018), as well as subsequent adult mental health problems such as poor mental well-being (Hughes et al., 2016) and depression or psychological distress (Hughes et al., 2017; Lee & Chen, 2017; Merrick et al., 2017). Further, ACEs have been associated with experiencing violence during adulthood (Hughes et al., 2017), including intimate partner violence (IPV; Gartland et al., 2016; McMahon et al., 2015), as well as increased substance use (Hughes et al., 2017; Lee & Chen, 2017; Merrick et al., 2017).

Other research from high-income settings has focussed on ACEs among pregnant and postpartum women specifically. Studies from these settings suggest that ACEs may be associated with depression in this population (Gartland et al., 2016; McDonnell & Valentino, 2016; Mersky & Janczewski, 2018; Schury et al., 2017) and may have additional adverse effects on women's offspring. Maternal ACEs have been associated with poor parenting practices during adulthood (Fuchs et al., 2015) as well as poor mother-infant bonding (Farré-Sender et al., 2018). Further, research from high-income settings suggests that maternal ACEs may be associated with infant developmental difficulties (Folger et al., 2018; Racine et al., 2018) and poor socioemotional functioning (Madigan et al., 2017; McDonnell & Valentino, 2016) including internalizing and externalizing problems (Plant et al., 2018).

As noted above, there are few data exploring the effects of ACEs on maternal and child outcomes in low- and middle-income countries such as South Africa, despite the high burden of childhood adversity in these settings (Manyema et al., 2018; Richter et al., 2018;

Shields et al., 2008), with the potential for significant mental health problems. In addition, few studies have explored the impact of ACEs on HIV-related outcomes during adulthood, including adherence to ART and HIV viral suppression. The limited available evidence suggests that childhood trauma is associated with suboptimal adherence to ART among adults living with HIV in the United States (Pence et al., 2012) and in Tanzania (Whetten et al., 2013). As noted above, postpartum WLHIV are a particularly vulnerable population, and additional data to explore the effects of ACEs on a wide range of outcomes in low-resource settings may inform interventions to break intergenerational cycles of adversity.

Using data from an intervention study evaluating strategies for delivering HIV care in Cape Town, South Africa, we examined the associations between maternal report of ACEs and maternal psychosocial and HIV-related health outcomes among mothers with young children, as well as the effect of reported ACEs on early child development in their offspring. Specifically, we hypothesised that an increasing number of ACEs would be associated with (i) maternal depression, experience of IPV and alcohol use; (ii) suboptimal self-reported ART adherence and elevated HIV viral load; and (iii) poor early child development in their offspring.

Materials and methods

Pregnant WLHIV were recruited as part of the MCH-ART study, which evaluated strategies for delivering HIV care and treatment services during pregnancy and the postpartum period (ClinicalTrials.gov NCT01933477). The design, methods and primary outcomes of the study have been previously described (Myer et al., 2016; Myer et al., 2018). Briefly, pregnant women aged 18 years or older were enrolled at a large primary care clinic in the former township of Gugulethu. This low socioeconomic community is characterised by high levels of poverty and HIV, with an antenatal HIV prevalence of around 30% (Myer et al., 2015). Women who were eligible to initiate ART were followed through delivery; and women who opted to breastfeed were followed through 18 months postpartum as part of an intervention study. Women followed as part of the intervention study (n=471) were contacted again to complete one additional study visit with the child born during the study between 36–60 months postpartum in order to assess longer term effects of the intervention (Mogoba et al., 2019); viral load outcomes at 12 months postpartum did not differ by attendance at the additional study visit (Phillips et al., 2020). All women provided written informed consent prior to participation, and the study was approved by the University of Cape Town's Faculty of Health Sciences Human Research Ethics Committee and by the Institutional Review Board of the Columbia University Medical Center.

Measures

This analysis uses data from the 36–60 month postpartum visit, which was conducted separately from any routine maternal or child care. While they were followed during pregnancy for the MCH-ART study, women had self-reported the date on which they initiated ART, and gestation was assessed using ultrasound. At the 36–60 month postpartum visit, women completed a battery of questionnaires drawing on Social Action Theory (Ewart, 1991; Traube et al., 2011), as well as a child developmental assessment. In addition,

women underwent phlebotomy for HIV viral load testing (Abbott RealTime HIV-1) conducted by the South African National Health Laboratory Service. All questionnaires and the child developmental assessment were translated into isiXhosa, the predominant local language, and were back-translated into English to ensure accuracy (Preciago & Henry, 1997). Questionnaires included an assessment of demographic characteristics, and a composite socioeconomic status score was calculated based on maternal educational attainment, current employment status, housing type and access to household resources in order to assess relative levels of disadvantage in this sample.

The World Health Organization's Adverse Childhood Experiences International Questionnaire (ACE-IQ) was used to assess maternal report of ACEs prior to the age of 18 years. This tool has been field tested globally, including in South Africa, and an adapted version has been found to perform well among mothers in the United States (Murphy et al., 2014). The questionnaire assesses ACEs across 13 categories: childhood abuse (physical, emotional and sexual) and neglect (physical and emotional), family dysfunction (experience of mental illness or substance abuse in the household, imprisonment of household member(s), violence against household member(s), or parental death/separation), and experience of bullying, community violence, and collective violence (World Health Organization, 2015). The total number of categories in which women reported experiencing childhood adversity were summed for a maximum of 13, as recommended in the original development of the tool (World Health Organization, 2015).

Psychosocial outcomes of interest included depressive symptoms, hazardous alcohol use, and IPV. The Edinburgh Postnatal Depression Scale [EPDS; Cronbach's alpha (α)=0.90] was used to measure self-reported depressive symptoms during the past week. Each of the 10 items were assessed on a frequency scale ranging from 0 to 3 and items were summed for a maximum score of 30, with a score of 13 used to suggest elevated depressive symptoms (Cox et al., 1987). This tool has been validated for use among postpartum women in South Africa (Lawrie et al., 1998). The Alcohol Use Disorders Identification Test-Consumption (AUDIT-C; α=0.85) was used to assess hazardous alcohol use during the past 12 months. The 3 items of this scale assess the frequency of any alcohol use and binge drinking, respectively, as well as the quantity of alcohol consumed when drinking; each item was scored between 0 and 4 and a score of 3 was used to indicate hazardous drinking (Bush et al., 1998; Bradley et al., 2003). The AUDIT has been validated among adults living with HIV in South Africa (Myer et al., 2008). The World Health Organization's Violence Against Women questionnaire (α=0.96), which has been validated in South Africa (Dunkle et al., 2003), was used to assess psychological, physical and sexual IPV experienced during the past 12 months (Garcia-Moreno et al., 2005). In analyses, we categorised women as reporting any versus no violence. HIV-related outcomes of interest included self-reported ART adherence and HIV viral load. We defined suboptimal ART adherence as report of missed doses on 1 day during the past 30 days, and 2 days in sensitivity analyses. Elevated viral load was defined as 50 copies/mL, and 1000 copies/mL in sensitivity analyses.

The Ages & Stages Questionnaire: Third Edition (ASQ-3) was used to measure child development (Squires & Bricker, 2009). This standardised, parent-reported assessment was

designed to screen for developmental delays across 5 domains: communication, gross motor, fine motor, problem solving and personal-social functioning. Scores in each domain range from 0 to 60, with higher scores indicating better development. In addition, scores can be categorised as normal development or as falling within established cut-offs which suggest that the child should be monitored (1–2 standard deviations below the mean) or below the cut-off for suspected delay (2 standard deviations below the mean; Squires & Bricker, 2009). This tool has been found to be feasible in and applicable to the South African context (Hsiao et al., 2017; van Heerden et al., 2017). The Ages & Stages Questionnaire-Socioemotional (ASQ-SE) was used to assess infant socioemotional development across a range of behaviours (Squires et al., 2015). Items on this parent-reported tool are summed, with higher scores indicating higher levels of maladaptive socioemotional development and established cut-offs suggestive of risk. The Ages & Stages tools include assessments of whether the child can perform certain tasks and were thus only administered to mothers who attended the study visit with their child, while all other measures were administered regardless of child attendance at the visit.

Data analysis

Data were analysed using Stata 14 (StataCorp Inc, College Station, Texas, USA). Reported ACEs, maternal psychosocial and HIV-related outcomes, and child developmental scores were summarised using frequencies and proportions for categorial variables, or medians with interquartile ranges (IQRs) for continuous variables. We used multivariable logistic regression models to examine the associations between ACEs and each maternal psychosocial and HIV-related outcome, using the threshold values described above. For each domain of the ASQ-3 and ASQ-SE, we explored the associations between maternal ACEs and child developmental outcomes in their offspring in both linear and logistic regression models, using total scores and the cut-off scores described above. Throughout, we examined maternal report of ACEs using the sum of ACE categories reported, and present results for a one-category increase in reported ACEs. In exploratory analyses of excess risk, we explored the impact of individual ACEs on each maternal outcome by calculating the prevalence difference between women reporting versus not reporting each ACE (prevalence among women reporting the ACE minus prevalence among those not reporting the ACE).

Results

A total of 353 women (median age: 32.1 years) attended the study visit, and 266 women were accompanied by their child (median age: 44.0 months). Table 1 presents maternal and child characteristics, maternal psychosocial and HIV-related outcomes, and child developmental outcomes. Overall, the majority of women reported low levels of educational attainment and 38% reported a married/cohabiting relationship status; approximately half of women were employed, and half lived in informal housing. A total of 4% of mothers reported elevated depressive symptoms during the past week; 4% and 14% reported experiencing IPV and hazardous alcohol use, respectively, during the past 12 months. After all initiating the local first-line ART regimen during pregnancy, women had been on ART for a median of 47.4 months, and suboptimal adherence and elevated viral load were common: 29% of women reported missing ART dose(s) during the past 30 days, and

44% had a viral load ⩾ 50 copies/mL. Report of missed doses was strongly associated with elevated viral load (p<0.001).

Among the 87/353 women who attended the study visit without their child, 68% reported that their child does not live with them; 24% reported that their child was at home or elsewhere; and 8% reported that their child had died. Eleven additional children were excluded from the analysis of child development: 9 mothers completed the incorrect questionnaire for the child's age, and 2 children were receiving intensive developmental and physical support for severe, diagnosed developmental delay due to reasons other than maternal ACEs. Compared to those whose children did not attend the study visit or who were excluded from analysis, mothers of children included in this analysis were less likely to be employed and to live in informal housing and were somewhat more likely to report that the child was their first child; no differences in reported ACEs were observed. Of the 255 children who were included in analyses, 49% were male, 13% were born <37 weeks gestation, and 19% were the first child born to their mother. Almost all children included currently lived with their mother. Across the five domains of the ASQ-3 assessment, median scores were within the normative range overall, but 19% and 15% of children scored below the normal range for fine motor and problem solving, respectively. Using the ASQ-SE assessment, 3% of children scored above threshold for socioemotional risk.

Maternal report of ACEs

Overall, 84% of mothers reported having experienced one or more ACEs, with mothers reporting a median of 2 (IQR: 1–3). The most commonly reported ACEs were parental separation/death and experience of community violence, each reported by 52% of women. Emotional and physical neglect were reported by 22% and 6% of women, respectively, and reports of abuse were less common (physical: 7%; emotional: 6%; sexual: 4%). Report of household dysfunction was higher, with 13% reporting witnessing violence within the household, and 9% and 13% reporting that a household member abused substances or was incarcerated, respectively. Figure 1 presents the prevalence of each reported ACE, as well as the median number of ACEs experienced among women reporting each ACE versus those not reporting the ACE. These data suggest that women who report having experienced less common but more severe experiences report higher levels of cumulative adversity overall. For example, the median number of ACEs reported among women who have experienced abuse or collective violence, which are relatively uncommon experiences, is significantly higher than among those who have not experienced each of these ACEs.

Impact of ACEs on maternal and child outcomes

Table 2 presents the associations between ACEs and maternal and child outcomes. The total number of ACEs reported was strongly associated with women's psychosocial outcomes in both unadjusted models and after adjustment for maternal age, socioeconomic status and relationship status: after adjustment, each additional ACE category was associated with a higher odds of elevated depressive symptoms [odds ratio (OR): 1.68; 95% confidence interval (CI): 1.33–2.12], hazardous alcohol use (OR: 1.20; 95% CI: 1.03–1.40) and past year IPV (OR: 1.40; 95% CI: 1.12–1.75). Similarly, the total number of ACEs was associated with report of suboptimal adherence (OR: 1.25; 95% CI: 1.10–1.43), although

the association with elevated viral load was weaker (OR: 1.11; 95% CI: 0.98–1.26); results were consistent when suboptimal adherence was defined as missed ART dose(s) on 2 days, and elevated viral load as 1000 copies/mL.

We observed no significant associations between maternal ACEs and child development in the domains of communication, gross motor, fine motor, problem solving or personal-social functioning in either logistic regression models using thresholds for developmental delay or linear regression models using continuous developmental scores. However, the total number of ACEs was associated with maternal report of maladaptive socioemotional development: when examining continuous socioemotional scores, each additional ACE category was associated with increased report of maladaptive development [regression coefficient (β): 1.57; 95% CI: 0.04–3.10], independent of maternal age and socioeconomic status, and infant gender and age; consistent results were observed in logistic regression models examining child socioemotional risk using threshold values.

Finally, we explored the associations between report of individual ACEs and maternal psychosocial and HIV-related outcomes, examining the excess risk of these outcome among women reporting each ACE versus those not reporting the ACE (Figure 2a and 2b). Overall, the experiences that appear to be the primary drivers of poor psychosocial and HIV-related outcomes in this sample include physical and emotional abuse, physical and emotional neglect, and exposure to collective violence.

Discussion

This novel study sought to examine the associations between maternal report of ACEs and maternal psychosocial and HIV-related outcomes among WLHIV in South Africa, as well as the effect of reported ACEs on early child development in their offspring. Our findings suggest that the negative trajectory initiated by ACEs may include effects that persist into adulthood in this population, with additional effects on the early child development of the next generation. Specifically, the total number of ACEs experienced was strongly associated with adverse maternal psychosocial outcomes and self-reported suboptimal ART adherence, although the association with elevated HIV viral load was weaker. Furthermore, maternal ACEs were associated with higher reported levels of maladaptive socioemotional development in their offspring.

The proportion of women reporting 1 ACEs (84%) is consistent with other estimates among general populations of young adults in South Africa (Manyema et al., 2018) and women in the United States (Mersky et al., 2018). A meta-analysis of studies from mostly high- and middle-income countries has reported that 57% of participants report having experienced 1 ACEs, with a range between 33–78% (Hughes et al., 2017); report of 1 ACEs in this sample is thus on the higher end of this spectrum. Over half of mothers reported experiencing parental separation or death, and we hypothesise that these high levels may reflect the history of HIV treatment in South Africa, where more than a decade of limited or no ART devastated families. In addition, 52% of mothers reported experiencing community violence, consistent with the staggering levels of violence in Cape Town and other areas of South Africa (Richter et al., 2018; Shields et al., 2008). The high levels

of emotional neglect reported (22%) are consistent with reports from young adults in Johannesburg, South Africa (Manyema et al., 2018). These levels of adversity are a clear public health crisis which, in the absence of widespread community-level change, will continue to affect subsequent generations of South African children. Change will require a multi-sectoral approach, including the involvement of the health system, law enforcement, and social development agencies.

The adverse effects of ACEs on mental health have been well-documented in high-income settings (Gartland et al., 2016; Hughes et al., 2016; Lee & Chen, 2017; McDonnell & Valentino, 2016; Merrick et al., 2017; Mersky & Janczewski, 2018; Schury et al., 2017), with additional evidence that ACEs affect adherence to ART among adults living with HIV (Pence et al., 2012). Here, we demonstrated consistent effects in a sample of women from a low-resource setting with a high burden of HIV. Given the high levels of ACEs observed, these adverse impacts are a major public health concern. Notably, the more severe, less common forms of adversity, which occurred among mothers who reported a higher number of ACEs overall (Schilling et al., 2008), appeared to be the primary drivers of adverse outcomes in this sample, suggesting a need for additional screening for more severe but less common experiences. Given that women in this population routinely access antenatal and HIV care, services are well placed to screen for high impact experiences and to support families and communities (Black et al., 2017; Woods-Jaeger et al., 2018). This will require a focus on increasing healthcare provider and community expertise in identifying and addressing early adversity.

Although maternal ACEs were not associated with maternal report of their offspring's development in most domains, we argue that ACEs may have other harmful effects alongside the effects on their offspring's socioemotional development in these settings. In particular, poor maternal mental health and HIV-related outcomes may have detrimental impacts on other aspects of child development which, coupled with growing up in a low-socioeconomic environment where levels of violence are high, may increase the vulnerability of this group (Walker et al., 2007; Walker et al., 2011). In the absence of community-level interventions to reduce the prevalence of ACEs, these children will likely experience many of the same early-life adversities as their mothers, perpetuating intergenerational cycles of trauma.

Our findings should be interpreted in light of several limitations. These data arise from a peri-urban setting in South Africa in the context of a research study and may not be generalisable to other settings. Maternal ACEs were self-reported retrospectively, as is the case with the majority of ACEs research, but the potential for social desirability and recall bias should be considered. The low prevalence of the more severe ACEs led to wide confidence intervals when examining the effect of individual ACEs on outcomes, and may have reduced our power to detect significant effects. In addition, more common but less severe ACEs may have a larger population-level impact. Our outcome variables were predominantly based on self-report and are subject to reporting bias, but we used validated tools to assess both maternal mental health and child developmental outcomes in their offspring. Importantly, their children's developmental outcomes were assessed via maternal report using a screening tool, rather than a clinician assessment. Finally, 1 in 4

mothers did not attend the study visit with their child. As such, our findings regarding child developmental outcomes are based on a subset of mothers who differed in terms of some socioeconomic factors as well as number of previous pregnancies, both of which may affect child developmental outcomes, although no differences were observed in reported ACEs.

Despite some limitations, these findings are notable in demonstrating long-term effects of childhood adversity on a range of outcomes, including maternal psychosocial and HIV-related outcomes, as well as socioemotional development among their offspring. While the majority of research on ACEs has been conducted in high-income countries, these findings arise from a low-resource setting where women and children face significant challenges. Considering the high prevalence of ACEs in this population and the long-term negative impacts on a range of maternal and child outcomes, interventions to prevent and to provide support to those who have experienced ACEs are urgently needed to break intergenerational cycles of adversity, and future research which explores possible mediators and modifiers of the effects observed may guide intervention development.

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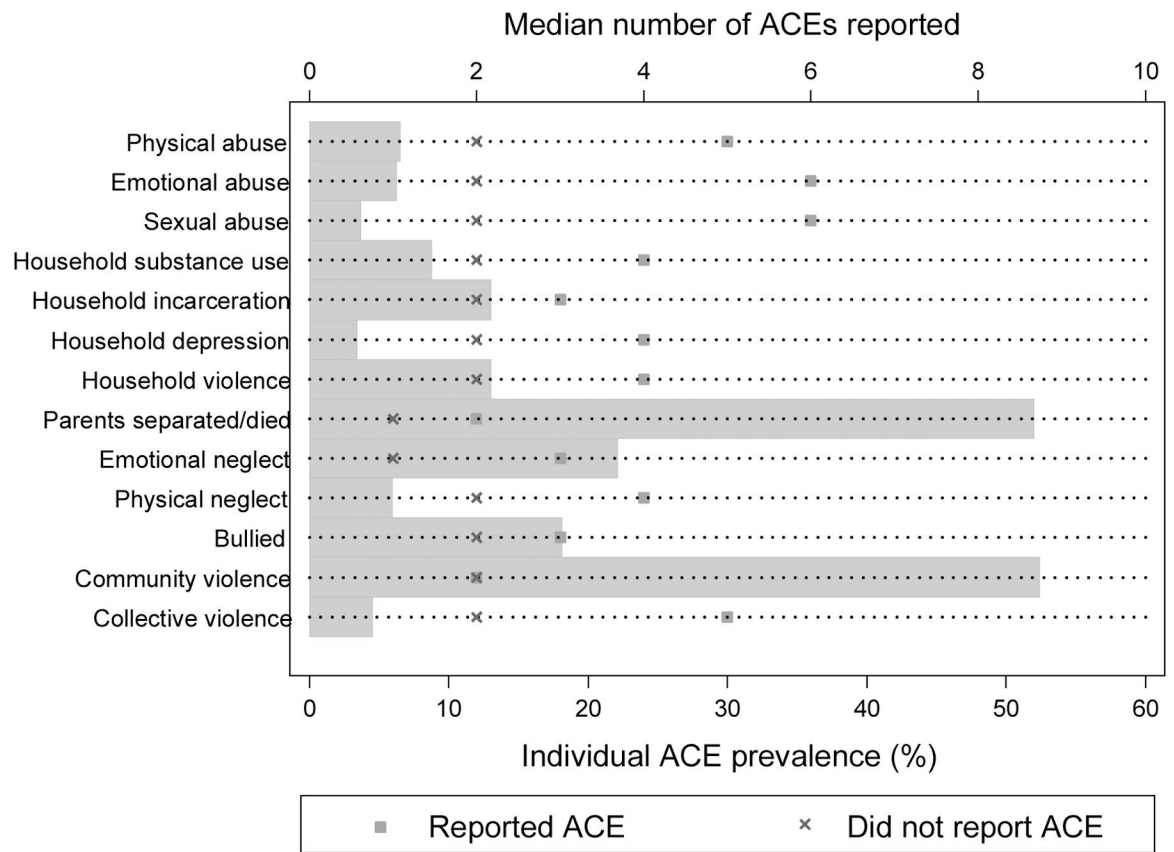
Figure 1.
Reported adverse childhood experiences (ACEs): grey bars indicate the proportion of women who reported each ACE, with the prevalence indicated on the bottom axis; markers indicate the median number of ACE categories reported among women reporting each individual ACE versus those not reporting the ACE, with the median number of categories indicated on the top axis.
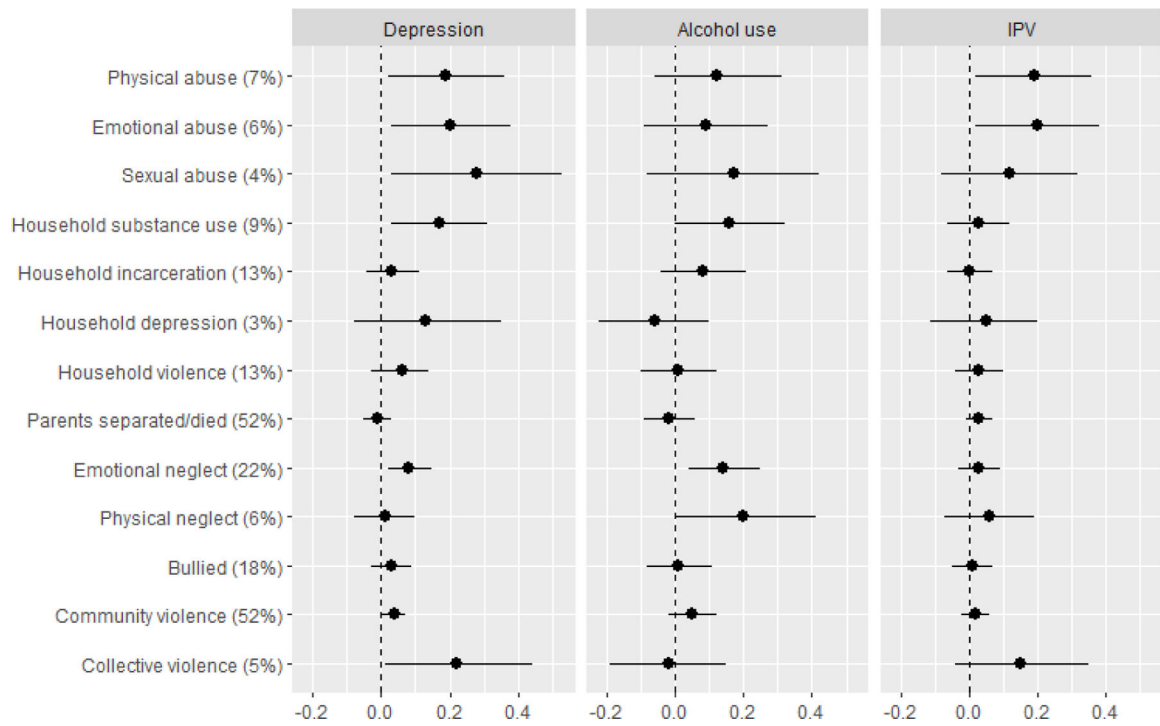
Figure 2a.

Prevalence difference for each of depression, hazardous alcohol use and intimate partner violence (IPV), reflecting the excess risk of each outcome among women reporting each adverse childhood experience (ACE) versus those not reporting the ACE[1]
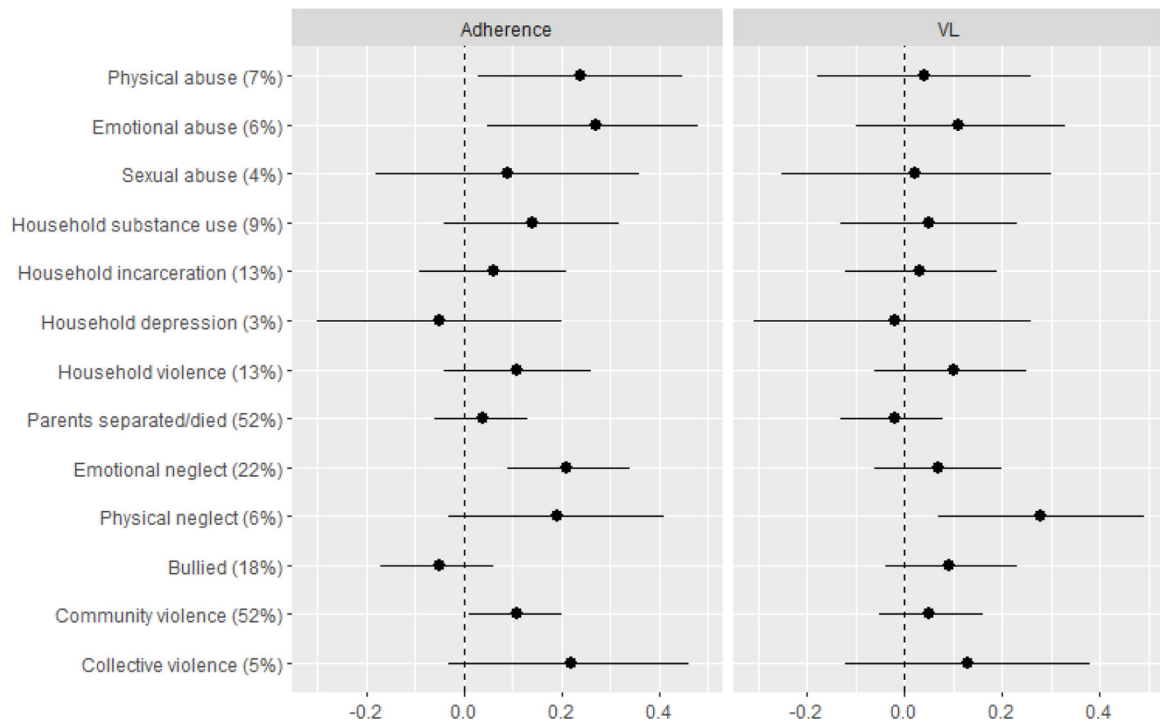
Figure 2b.

Prevalence difference for each of suboptimal adherence (missed dose(s) on   1 days during the past 30 days) and elevated viral load (VL   50 copies/mL), reflecting the excess risk of each outcome among women reporting each adverse childhood experience (ACE) versus those not reporting the ACE[1]

[1] Prevalence of each ACE reported in brackets.

Table 1

Maternal and child characteristics, maternal psychosocial and HIV-related outcomes, and child developmental outcomes

Variable	Total sample – n (%)
Maternal characteristics (n=353)	
Median [IQR] age in years	32.1 [28.6, 36.2]
Educational attainment	
Less than secondary	260 (74)
Completed secondary/any tertiary	93 (26)
Employed	170 (48)
Informal housing	168 (48)
Married and/or cohabiting	134 (38)
Median [IQR] months postpartum	44.0 [41.6, 46.5]
Median [IQR] months since antiretroviral therapy (ART) initiation	47.4 [45.3, 49.9]
Maternal psychosocial outcomes (n=353)	
Median [IQR] depressive symptoms score (Edinburgh Postnatal Depression Scale; EPDS)	0 [0, 1]
Elevated depressive symptoms during the past week (score 13)	13 (4)
Median [IQR] alcohol consumption score (Alcohol Use Disorders Identification Test – Consumption; AUDIT-C)	0 [0, 1]
Hazardous alcohol use during the past 12 months (score 3)	51 (14)
Any intimate partner violence during the past 12 months	14 (4)
Maternal HIV-related outcomes (n=353)	
Missed antiretroviral therapy dose(s) on 1 day during the past 30 days	104 (29)
Missed antiretroviral therapy doses on 2 days during the past 30 days	91 (26)
HIV viral load 50 copies/mL	153 (44)
HIV viral load 1000 copies/mL	123 (35)
Birth and infant characteristics (n=255) [1]	
Median [IQR] age in months	44.3 [41.6, 46.7]
Child born in study was mother's first child	48 (19)
Median [IQR] gestational age at delivery in weeks	39 [38, 40]
Preterm delivery (<37 weeks)	34 (13)
Male	126 (49)
Currently lives with mother	246 (96)
Child development using the Ages & Stages screening tool (n=255) [2]	
Median [IQR] communication score	60 [60, 60]
Communication delay	10 (4)
Median [IQR] gross motor score	60 [50, 60]
Gross motor delay	21 (8)
Median [IQR] fine motor score	50 [40, 50]

Variable	Total sample – n (%)
Fine motor delay	49 (19)
Median [IQR] problem solving score	55 [45, 60]
Problem solving delay	38 (15)
Median [IQR] personal-social score	60 [55, 60]
Personal-social delay	18 (7)
Median [IQR] socioemotional score	25 [10, 35]
Socioemotional risk	7 (3)

[1] Restricted to children who were included in the child development analysis;

[2] Higher scores indicate better development in all domains except socioemotional, where higher scores indicate higher levels of maladaptive development.

Table 2

Associations between maternal adverse childhood experiences (ACEs) and (A) maternal psychosocial and HIV-related outcomes in logistic regression models, and offspring development in (B) logistic and (C) linear regression models.

(A) Maternal psychosocial and HIV-related outcomes (n=353)	Unadjusted OR [95% CI][1]	P-value	Adjusted OR [95% CI][2]	P-value
Psychosocial outcomes				
Elevated depressive symptoms during the past week	1.68 [1.35, 2.11]	<0.001	1.68 [1.33, 2.12]	<0.001
Hazardous alcohol use during the past 12 months	1.21 [1.04, 1.40]	0.012	1.20 [1.03, 1.40]	0.019
Intimate partner violence during the past 12 months	1.42 [1.15, 1.76]	0.001	1.40 [1.12, 1.75]	0.003
HIV-related outcomes				
Missed antiretroviral therapy dose(s) on 1 day during the past 30 days	1.24 [1.09, 1.41]	0.001	1.25 [1.10, 1.43]	0.001
HIV viral load 50 copies/mL	1.11 [0.98, 1.25]	0.089	1.11 [0.98, 1.26]	0.086

(B) Offspring developmental delay in logistic regression models (n=255)	Unadjusted OR [95% CI]	P-value	Adjusted OR [95% CI]	P-value
Communication delay	0.84 [0.54, 1.29]	0.427	0.84 [0.55, 1.30]	0.443
Gross motor delay	0.75 [0.54, 1.06]	0.101	0.77 [0.57, 1.05]	0.099
Fine motor delay	1.01 [0.85, 1.19]	0.952	1.01 [0.85, 1.19]	0.943
Problem solving delay	1.05 [0.88, 1.25]	0.608	1.08 [0.89, 1.31]	0.419
Personal-social delay	0.80 [0.57, 1.12]	0.195	0.82 [0.59, 1.13]	0.226
Socioemotional risk	1.47 [1.12, 1.92]	0.005	1.57 [1.15, 2.14]	0.004

(C) Offspring development in linear regression models (n=255)[4]	Unadjusted β [95% CI][3]	P-value	Adjusted β [95% CI]	P-value
Communication score	−0.02 [−0.58, 0.53]	0.934	−0.05 [−0.60, 0.51]	0.869
Gross motor score	0.29 [−0.27, 0.85]	0.308	0.31 [−0.25, 0.87]	0.276
Fine motor score	0.24 [−0.61, 1.08]	0.584	0.16 [−0.68, 1.00]	0.710
Problem solving score	−0.33 [−1.09, 0.44]	0.400	−0.46 [−1.18, 0.26]	0.213
Personal-social score	0.04 [−0.52, 0.60]	0.881	0.05 [−0.50, 0.59]	0.864
Socioemotional score	1.52 [−0.02, 3.05]	0.052	1.57 [0.04, 3.10]	0.044

[1] OR: odds ratio for each additional ACE category reported; 95% CI: 95% confidence interval;

[2] Psychosocial models adjusted for maternal age, socioeconomic status and relationship status; HIV-related models additionally adjusted for time since antiretroviral therapy initiation; offspring development models adjusted for maternal age, socioeconomic status, infant gender and infant age;

[3] β: regression coefficient;

[4] Higher scores indicate better development in all domains except socioemotional, where higher scores indicate higher levels of maladaptive development.