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Psychosocial Adjustment in Ugandan Children: Coping With Human Immunodeficiency Virus Exposure, Lifetime Adversity, and Importance of Social Support

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Abstract

Cumulative lifetime adversity and social support were investigated as determinants of psychosocial adjustment (esteem, distress, hopefulness, positive outlook/future aspirations, and sense of purpose) over 12 months in 6–10-years-old HIV-infected, HIV-exposed uninfected and HIV-unexposed uninfected children from Uganda. Each determinant and psychosocial adjustment indicator was self-reported using standardized questionnaires administered at baseline, 6, and 12 months. Linear mixed effects models were used to relate time-varying lifetime adversity and social support to psychosocial adjustment over 12 months. Regardless of HIV status, higher adversity predicted lower esteem (coefficient b = *−2.98, 95% confidence interval (CI): [−4.62, −1.35]) and increased distress* (b =*3.96, 95% CI: [1.29, 6.62]) but was not associated with hopefulness, positive outlook or sense of purpose. Low social support predicted higher distress* (b =*9.05, 95% CI: [7.36, 10.73]), lower positive outlook* (b = *−10.56, 95% CI: [−2.34, −8.79]) and low sense of purpose* (b = *−9.90, 95% CI: [−11.44,*

−8.36]) over 12 months. Pragmatic interventions that enhance coping with adversity and provide emotional/instrumental support should be tested for effectiveness in promoting resilient psychosocial adjustment trajectory in vulnerable children. © *2020 Wiley Periodicals, Inc.*

Background

Millions of HIV-infected and HIV-exposed but uninfected children develop in environmental contexts shaped by HIV/AIDS-related adversity. When adversity is prolonged and occurs at levels that exceed the coping resources of the individual, it becomes toxic stress-a determinant of poor physical and mental health outcomes regardless of HIV-status (Varese et al., 2012). Psychosocial adversity is associated with higher rates of psychiatric disorders, which has onward negative impact on the quality of life of in HIV-affected children (Gaughan et al., 2004; Mellins & Malee, 2013). An estimated 14% of the general population of children from Sub-Saharan Africa live with some form of psychopathology (Cortina, Sodha, Fazel, & Ramchandani, 2012) compared to the 25–83% prevalence of psychopathology that has been reported among HIV-infected children and adolescents from Uganda and Kenya (Kamau, Kuria, Mathai, Atwoli, & Kangethe, 2012; Kinyanda et al., 2019; Musisi & Kinyanda, 2009). The combination of higher levels of psychosocial adversity—including HIV-associated discrimination, higher burden of psychiatric disorders, higher rates of poverty, earlier parental loss and higher household morbidity may contribute to lower self-esteem and lower positive outlook in HIV-affected children (Boyce, 2014; Ezeamama et al., 2016; Franke, 2014; Juth, Smyth, & Santuzzi, 2008; Shonkoff, 2012; Shonkoff et al., 2012; Varese et al., 2012; Zalwango et al., 2016).

Despite a higher burden of psychosocial adversity, HIV-affected children may not necessarily exhibit a vulnerable trajectory. For example, they may enhance coping by mastering competencies that allow them to make meaning in their lives in spite of adversity (Campbell, Pungello, Miller-Johnson, Burchinal, & Ramey, 2001; Garner, 2013; McMillen, 1999; Traub & Boynton-Jarrett, 2017). Social support (information, emotional, or financial) is a protective factor that may buffer the impact of adversity and promote a resilient rather than vulnerable trajectory (Campbell et al., 2001; Garner, 2013; McMillen, 1999; Traub & Boynton-Jarrett, 2017). Social support can be provided by individuals, the community or at the national level through enactment of policies that accord safety and social protection (Cluver, Orkin, Boyes, & Sherr, 2014,Cluver et al., 2015, 2016a, Cluver et al., 2016bb, Cluver et al., 2016dd; Toska et al., 2016, 2017). For example, a good relationship between HIV infected children and their adult caregivers has been associated with superior psychosocial adjustment in previous studies (Hong et al., 2010; Zhao et al., 2011) and social protection policies such as child-focused cash transfer interventions, free education,

school feeding, and teacher support, has been associated with reductions in HIV-risk behaviors in South African adolescents. (Cluver, Orkin, Meinck, Boyes, & Sherr, 2016c, 2016aa; Toska et al., 2016, 2017)

By buffering potentially negative effect of adversity, social support may improve quality of life, physical, mental, and behavioral health among vulnerable children (Franke, 2014; Friedland, Renwick, & McColl, 1996). The possible systematic variation across HIV groups in the relationship of adversity and social support to psychosocial adjustment has not been specifically investigated. This understanding is important for targeting the most vulnerable children for interventions to improve psychosocial adjustment in sub-Saharan Africa countries where HIV prevalence is high but resources are limited, and cumulative lifetime adversity may vary according to perinatal HIV status (Kimera et al., 2019; Menon, Glazebrook, Campain, & Ngoma, 2007; Sanjeeva, Pavithra, Chaitanya, Sunil Kumar, & Rewari, 2016). In order to address this gap, we present longitudinal data on cumulative lifetime adversity, social support, and psychosocial adjustment from a large cohort that includes perinatally HIV infected (PHIV), HIV exposed uninfected (HUU) and HIV unexposed uninfected children. We hypothesize that (1) high cumulative lifetime adversity, low social support and perinatal HIV status are each independently associated with poor psychosocial adjustment; and (2) the relationship of cumulative lifetime adversity and social support to psychosocial adjustment varies according to perinatal HIV status.

Methods

Study Design. Early school aged (6–10 years old) Ugandan children and their adult primary caregivers were enrolled into a prospective cohort study and followed every six months. Approximately equal numbers of HEU and HUU were enrolled and matched on age (+/−3 years) and sex to PHIV.

Study Setting. Recruitment and Follow-up Strategy; Participants were enrolled in the context of primary health care at the Kawaala Health Center (KHC)—a government run facility that provides the full range of antenatal care services, out-patient consultation, and the entire range of HIV/AIDS treatment and preventive services. Using information available through the HIV patient database, HIV+ caregivers of eligible PHIV children were approached on a first come first serve basis via telephone or in person in the general clinic ward. In addition, age-eligible HEU children born at KHC were directly identified through the Early Infant Diagnosis registers and through the out-patient department. HUU children were enrolled via referrals from the social networks of already enrolled caregiver-child pairs. Current HIV status for HEU or HUU was confirmed using HIV-rapid diagnostic test (Ezeamama et al., 2016; Zalwango et al., 2016). Study subjects were evaluated at baseline, 6 and 12 months or until loss to follow up or death.

Eligibility/Exclusion Criteria. Eligibility criteria for children included; ages 6–10 years at enrolment, birth in a healthcare setting with medical record verified information regarding HIV status of index children and their biological mother. Children born in non-clinic settings for whom official birth records were unavailable were excluded as perinatal HIV status could not be ascertained. HUU children should not have had any current illness and history of traumatic brain injury, developmental delay or diagnosed psychiatric conditions. Eligibility criteria for caregivers included; being 18 years or older and having ≥ 6 months as primary caregiver of an eligible child.

Statement of Ethical Approval. The study protocol was approved by the research ethics review committees of Michigan State University (IRB Protocol#: 16-828), Makerere University College of Health Sciences, School of Medicine (Protocol REC REF# 2017-017) and the Uganda National Council for Science and Technology (Protocol #: SS 4378). All caregivers gave written informed consent, and children provided assent for study participation.

Measures. All measures were self-reported by children using standardized questionnaires that have been translated to the local language (Luganda) and adapted for use in the study locale as previously described (Zalwango et al., 2016). To facilitate the interpretation, the theoretic maximum score for each tool was determined and each child's score was transformed to a 0–100 scale as follows: 100 × (raw score/maximum score).

Psychosocial Adjustment. This primary end point was defined by five indicators—global distress, global and area-specific self-esteem, positive outlook/future aspirations, hopefulness, and sense of purpose. Global distress was defined per the Weinberger Distress Scale (Weinberger & Schwartz, 1990) using children's Likert scale responses to twelve questions (Weinberger & Schwartz, 1990). Children's perceived esteem within their home (four questions), among their peers (three questions) and within educational setting/school (3 questions) were measured using the Hare Self-Esteem Scale (Dahlberg, Toal, Swahn, & Behrens, 2005; Shoemaker, 1980; Young, Werch, & Bakema, 1989). In addition to area specific esteem, a global esteem score was computed based on all 10 questions. Hopefulness was measured as positive future expectations using the Children's Hopefulness Scale of 17 yes/no questions. The "yes" responses reflecting hopefulness were scored as 1 and "no" responses were scored as 0 and summed. Positive outlook was measured by summing responses to six questions from the Positive Outlook Individual Protective Factors index (Philips & Springer, 1992).

Reliability of Outcome Measures. The questions within psychosocial adjustment indicator variables had acceptable internal consistency (i.e., Cronbach's alpha: 0.74–0.78) for global distress, global self-esteem, positive outlook/future aspirations, and hopefulness. The three composite questions

included in the sense of purpose variable had questionable internal consistency (i.e., Cronbach's alpha =0.61).

Potential Predictors of Psychosocial Adjustment. *Child perinatal HIV status* was defined as HIV mother-to-child transmission as objectively determined prior to 18th month of life based on a positive and negative DNA-polymerase chain reaction respectively. Status of children of HIV-infected women who continued to breast-feed for more than 18 months were identified using HIV serological or rapid diagnostic test methods. Each child's HIV-status was documented at discharge from the EID program and HIV negative status was verified at enrolment.

Cumulative lifetime adversity was used as a proxy for psychosocial stress (toxic stress). It was measured using standardized checklist of 16 items reflecting adverse events described in the National Survey of children's exposure to violence (NatSCEV) (Finkelhor, Shattuck, Turner, & Hamby, 2013; Turner, Finkelhor, Hamby, & Shattuck, 2013). An additional yes/no question probed for the experience of peer violence as included in the World Health Organization Internalized version of the ACE Questionnaire was used (Quinn et al., 2018). The sum of "yes" responses across 17 items demonstrated good internal consistency (Cronbach's alpha = 0.84). For analytic purposes, high versus low adversity distinguished between children who experienced of 2 or more versus none or one adverse events up to this point in life.

Social support was measured via the sum of child's Likert-scale responses to six questions reflecting interpersonal resources derived from a child's immediate social network and family. These questions were from the NatSCEV (Turner, Finkelhor, & Ormrod, 2010) and further simplified by the life Paths Project (Hamby, Grych, & Banyard, 2015). Internal consistency across six composite questions was acceptable (Cronbach's alpha = 0.73). We anticipated that meaningful social support related differences in psychosocial outcomes might lie at tail of the distribution of continuous social-support variable. In the absence of established high versus. low thresholds categories based on quartiles of continuous variable were initially analyzed and further collapsed as low ($\leq$ median) verses high ($>$ median) based on crude relationship to respective outcomes.

Potential confounders measured at baseline included caregiver and child sex and age in years, and caregiver socioeconomic status (employment status, occupation, or educational level). Caregiver depressive symptoms were determined using an adapted version of the Hospital Anxiety and Depression scale (Ezeamama et al., 2016). Alcohol consumption was classified as never, former or current via self-report of adult caregivers. Functioning in caregiving role was established using an adapted version of the Barkin Index of Maternal Functioning (Barkin et al., 2010).

Statistical Analyses. Descriptive statistics for the outcome and potential predictors were produced at each time point overall and according to low verses high social support at baseline. Unadjusted comparisons

according to the level of social support were performed using *t*- or chi-square tests. Time trends were assessed from linear mixed effects (LME) models with three repeated measures (baseline, 6, and 12 months) and time entered as a categorical factor to allow for non-linear patterns. Following unadjusted analyses, the LME models were fit for three repeated measures each component of psychosocial adjustment in relation to time and child's HIV exposure status while adjusting for potential confounders identified based on the literature and subject matter expertise. Next, lifetime adversity and social support were included as time-varying covariates in interaction with HIV exposure status in two separate LME models—one with lifetime adversity as a predictor and the other with social support. The presence of heterogeneity was confirmed if the *p*-value for the interaction between HIV status and lifetime adversity or social support was less than 0.10 in order to increase relative power of assessing interaction as previously described. (Marshall, 2007) To complement *p*-values and 95% confidence intervals for model coefficients (*b*'s) for predictor variables, we also computed effect sizes for differences between least square (adjusted means) of psychosocial adjustment by levels of lifetime adversity and social support. Effect size measures were interpreted in accordance with the Cohen criteria and literature on clinically meaningful differences in health status measures as follows: "trivial/small" ($< |0.33|$), "moderate" ($\geq |0.33|$ to $< |0.80|$), and "large" ($\geq |0.80|$). To account for nesting of children within caregivers, the corresponding random effect was specified in all multivariable analyses. All analyses were performed in Statistical Analysis software (version 9.4).

Results

Study Sample. Out of the 306 children with 245 respective caregivers recruited into the study, 15 children were excluded from the longitudinal study base for lack of repeated outcome assessments of self-esteem ($n = 9$), distress ($n = 1$) or baseline social support and adversity scores ($n = 5$). A total of 291 children and 232 caregivers remained in the analytic sample. Average child age at enrolment was 7.7 ± 1.5 years, and the sample was balanced in terms of biological sex with approximately 50% girls ($n = 136$). The average age of caregivers was 34.1 ± 8.3 years, and the majority were female (93% ($n = 218$)). Sixty-three percent ($n = 151$) of caregivers were HIV infected and have lived with the disease for median duration of 9.4 ± 4.3 years. The caregivers had an HIV status disclosure rate of 96% ($n = 145$) to people outside the study team but only 24% ($n = 35$) had disclosed to their study child (Table 5.1).

Compared to child respondents with low perceived social support, those with high perceived social support were on average younger, with lower acute stress, lower lifetime adversity levels, and were more likely to have a female primary caregiver. However, child sex, acute stress levels, caregiver age, percent of HIV+ caregivers, employment, and educational

Table 5.1. Baseline Sociodemographic Description of HIV-affected and HIV-unaffected 6–10 years old Ugandan Children and their Primary Caregivers

Child/Caregiver, N/n	*Overall N/n = 275/222 Mean (SD)*	*Low Social Support N/n = 127/108 Mean (SD)*	*High Social Support N/n = 148/114 Mean (SD)*	*p*
Caregiver Descriptors				
Age (years)	34.46 (8.39)	34.81 (9.19)	34.13 (7.57)	0.55
Caregiver stress				
Acute stress score	21.68 (5.53)	21.60 (5.66)	21.75 (5.42)	0.84
Recent life stress	8.32 (3.67)	8.11 (3.76)	8.53 (3.58)	0.39
Lifetime adverse experiences	2.84 (2.74)	2.23 (2.24)	3.41 (3.05)	<0.01
Female caregivers (*n*, %)	204 (93)	96 (90)	108 (96)	0.05
Caregiver HIV status and disclosure				
Ever HIV$^+$ (*n*, %)	142 (64)	66 (61)	76 (67)	0.39
Disclosed HIV status ever | HIV$^+$ (*n*, %)	133 (95)	62 (95)	71 (95)	0.30
Disclosed to child | Ever HIV$^+$ (*n*, %)	33 (25)	14 (23)	19 (27)	0.56
Years lived with HIV | Ever HIV$^+$	9.40 (4)	10.10 (5)	8.90 (4)	0.10
Socioeconomic Factors (*n*, %)				
Have own income	160 (72)	79 (73)	81 (71)	0.73
Educational Attainment				
None/<elementary	89 (41)	46 (43)	43 (39)	0.33
Elementary completed	40 (18)	21 (20)	19 (17)	
Some/completed O' levels	73 (34)	30 (28)	43 (39)	
Some A' levels or more	16 (7)	10 (9)	6 (5)	
Child Factors				
Age (years)	7.72 (1.46)	7.93 (1.47)	7.53 (1.44)	0.02
Child Stressors				
Cumulative lifetime adversity	3.80 (4.10)	5.06 (4.68)	2.71 (3.16)	<0.01
Acute stress score	13.17 (5.40)	13.58 (6.04)	12.82 (4.80)	0.26
Female child (*n*, %)	136 (50)	59 (47)	77 (52)	0.36

status were comparable among social support groups. Among caregivers living with HIV, the mean years lived with HIV infection and rates of HIV disclosure did not differ by high and low child perceived social support (Table 5.1).

Over 12 months, the number of child adverse life events and levels of child social support increased significantly in tandem with decline in levels of child distress. However, measures of child esteem, global distress, outlook, and sense of purpose did not vary substantially over the 12 months

follow up, while peer esteem and hopefulness increased significantly (Table S1).

PHIV Status, Lifetime Adversity, and Social Support in Relationship to Psychosocial Adjustment Over 12 months. Relative to the HUU peers, neither PHIV nor HEU status was associated with levels of distress, global or area specific esteem, positive outlook, hopefulness, and sense of purpose over 12 months. The absence of association between PHIV status and respective psychosocial adjustment measures over 12 months is matched with effect sizes confirming changes of trivial/small clinical importance (all $|ES| < 0.30$) (Table 5.2).

High lifetime adversity was associated with low global ($b = -2.98$, 95% CI: [−4.62, −1.35]), peer ($b = -4.94$, 95% CI: [−7.14, −2.74]) and home esteem ($b = -2.65$, 95% CI: [−4.52, −0.78]) but increased distress ($b = 3.96$, 95% CI: [1.29, 6.62]) over 12 months follow up. There was no association between lifetime adversity with positive outlook ($b = -1.93$, 95% CI: [−4.05, 0.18]), hopefulness ($b = -1.88$, 95% CI: [−3.90, 0.15]), and sense of purpose ($b = -0.61$, 95% CI: [−2.62, 1.4]). The adverse association between high adversity and global/peer esteem were of moderate clinical importance (ES: −0.36 to −0.48), whereas statistically significant high adversity-related declines in home esteem was of small clinical importance (Table 5.3).

Child reported low perceived social support predicted clinically large declines in both positive outlook/future aspirations ($b = -10.56$, 95% CI: [−12.34, −8.79], ES = −0.89) and children's reported sense of purpose ($b = -9.90$, 95% CI: [−11.44, −8.36], ES = −0.91) compared with high social support. Low social support predicted lower esteem in global ($b = -6.41$, 95% CI: [−7.59, −5.23]) and all area-specific measures of esteem ($b = -5.74$ to 6.01, 95% CI: [−7.20, −4.48]) but elevated distress ($b = 9.05$, 95% CI: [7.36, 10.73]), and were of moderate clinical importance (Table 5.3).

Perinatal HIV Status Is Not a Modifier of Adversity and Social Support Related Changes in Psychosocial Adjustment. The association of psychosocial adjustment with both perceived social support and lifetime adversity did not vary by HIV status (Table 5.4, all HIV*Support $p > 0.10$). The magnitude of deterioration in psychosocial adjustment associated with perceived social support was consistently high as reflected by large effect sizes. However, the absolute high versus low adversity associated elevations in psychosocial adjustment had mostly small magnitude as reflected by $|ES| < 0.30$ (Table 5.4).

Discussion

This prospective cohort study we investigated cumulative life adversity and interpersonal social support as determinants of five indicators of psychosocial adjustment (esteem, distress, positive outlook, hopefulness, and sense of purpose) over 12 months follow up among 6–10 year-old Ugandan

Table 5.2. Perinatal HIV Status Related Average Change in Respective Psychosocial Adjustment Measures Over 12 Months Among Ugandan Children Aged 6–10 Years Old

Perinatal HIV status	*N*	*Adjusted LSM (SE)*	*Mean Diff (95% CI)*	*Effect Size*	*p*
Global Esteem					
PHIV	90	77.31 (2.20)	−0.19 (−2.71, 2.33)	−0.02	0.06
HEU	92	79.82 (1.95)	2.32 (−0.47, 5.12)	0.20	
HUU	93	77.50 (2.35)	Ref	Ref	
Peer Esteem					
PHIV	90	69.17 (1.87)	−0.52 (−4.27, 3.24)	−0.04	0.18
HEU	92	71.56 (1.74)	1.87 (−2.17, 5.91)	0.16	
HUU	93	69.69 (2.37)	Ref	Ref	
School Esteem					
PHIV	90	67.79 (2.33)	1.50 (−2.47, 5.47)	0.12	0.50
HEU	92	68.81 (1.99)	2.52 (−1.95, 6.98)	0.20	
HUU	93	66.29 (2.82)	Ref	Ref	
Home Esteem					
PHIV	90	77.50 (2.54)	−0.92 (−3.87, 2.02)	−0.09	0.06
HEU	92	80.52 (2.30)	2.10 (−1.19, 5.39)	0.21	
HUU	93	78.42 (2.70)	Ref	Ref	
Distress					
PHIV	90	50.03 (3.36)	1.98 (−2.59, 6.54)	0.13	0.10
HEU	92	45.71 (2.90)	−2.34 (−7.26, 2.58)	−0.16	
HUU	93	48.05 (3.49)	Ref	Ref	
Positive Outlook/Future Aspirations					
PHIV	90	85.86 (1.61)	−1.70 (−4.89, 1.50)	−0.14	0.12
HEU	92	89.13 (1.16)	1.58 (−1.96, 5.12)	0.13	
HUU	93	87.56 (1.72)	Ref	—	
Hopefulness					
PHIV	90	83.26 (1.92)	0.13 (−3.81, 4.08)	0.01	0.26
HEU	92	85.37 (1.68)	2.25 (−2.18, 6.68)	0.21	
HUU	93	83.12 (2.56)	Ref	Ref	
Sense of Purpose					
PHIV	90	91.68 (1.69)	1.69 (−1.50, 4.87)	0.15	0.35
HEU	92	92.66 (1.48)	2.67 (−0.97, 6.31)	0.24	
HUU	93	89.99 (1.94)	Ref	Ref	

Multivariate linear regression model estimate produced using SAS PROC MIXED. There was clustering by household. The model adjusted for child factors (age, sex, and nutritional status) and caregivers' factors (alcohol intake, age, sex, own income, depression, care giving quality, and HIV-status disclosure). PHIV, perinatally HIV-infected; HEU, HIV-exposed uninfected; HUU, HIV-unexposed uninfected.

children with and without PHIV-exposure/ infection. In line with the study hypotheses, high cumulative life adversity predicted increased distress, lower esteem, and lower levels of hope while low perceived social support was consistently associated with higher distress and lower levels of esteem,

Table 5.3. Average Change in Social Support and Cumulative Lifetime Adversity (CLA in Relation to Psychosocial Adjustment Over 12 Months Among 6–10 Years Old Ugandan Children

	N	*Adjusted LSM (SE)*	*Mean Difference (95% CI)*	*Effect Size*	*p*
Global Esteem					
Low Social Support	127	75.00 (2.08)	−6.41 (−7.59, −5.23)	−0.77	<0.01
High Social Support	148	81.42 (2.05)	Ref	Ref	
High CLA	139	76.72 (2.09)	−2.98 (−4.62, −1.35)	−0.36	<0.01
Low CLA	136	79.70 (2.08)	Ref	Ref	
Peer Esteem					
Low Social Support	127	67.27 (1.76)	−5.74 (−7.20, −4.29)	−0.49	<0.01
High Social Support	148	73.01 (1.78)	Ref	Ref	–
High CLA	139	67.67 (1.81)	−4.94 (−7.14, −2.74)	−0.43	<0.01
Low CLA	136	72.61 (1.82)	Ref	Ref	
School Esteem					
Low Social Support	127	64.63 (2.18)	−6.00 (−7.73, −4.26)	−0.48	<0.01
High Social Support	148	70.63 (2.13)	Ref	Ref	
High CLA	139	67.15 (2.17)	−0.96 (−3.39, 1.47)	−0.08	0.40
Low CLA	136	68.11 (2.24)	Ref	Ref	
Home Esteem					
Low Social Support	127	75.81 (2.43)	−6.01 (−7.54, −4.48)	−0.60	<0.01
High Social Support	148	81.82 (2.37)	Ref	Ref	
High CLA	139	64.63 (2.18)	−2.65 (−4.52, −0.78)	−0.27	0.01
Low CLA	136	80.14 (2.42)	Ref	Ref	
Distress					
Low Social Support	127	52.46 (2.99)	9.05 (7.36, 10.73)	0.62	<0.01
High Social Support	148	43.41 (3.03)	Ref	Ref	
High CLA	139	49.91 (3.06)	3.96 (1.29, 6.62)	0.27	<0.01
Low CLA	136	45.95 (3.06)	Ref	Ref	
Positive Outlook/Future Aspirations					
Low Social Support	127	82.24 (1.26)	−10.56 (−12.34, −8.79)	−0.89	<0.01
High Social Support	148	92.80 (1.26)	Ref	Ref	
High CLA	139	86.55 (1.31)	−1.93 (−4.05, 0.18)	−0.16	0.07
Low CLA	136	88.48 (1.27)	Ref	Ref	
Hopefulness					
Low Social Support	127	82.03 (1.83)	−3.78 (−5.11, −2.45)	−0.35	<0.01
High Social Support	148	85.81(1.78)	Ref	Ref	
High CLA	139	82.98 (1.85)	−1.88 (−3.90, 0.15)	−0.17	0.07
Low CLA	136	84.86 (1.84)	Ref	Ref	
Sense of Purpose					
Low Social Support	127	86.49 (1.51)	−9.90 (−11.44, −8.36)	−0.91	<0.01
High Social Support	148	96.39 (1.43)	Ref	Ref	
High Lifetime Adversity	139	91.13 (1.48)	−0.61 (−2.62, 1.40)	−0.06	0.55
Low Lifetime Adversity	136	91.74 (1.53)	Ref	Ref	

Multivariable linear regression model estimates produced using SAS PROC MIXED. There was clustering by household. The model adjusted for child factors (age, sex, and nutritional status) and caregivers' factors (alcohol intake, age, sex, own income, depression, care giving quality, and HIV-status disclosure).

Table 5.4. Associations of Psychosocial Adjustment With Social Support or Adversity Over 12 Months in Relation to HIV Status

	Low Versus High Social Support in Relationship to Psychosocial Adjustment			*High Versus Low Adversity in Relationship to Psychosocial Adjustment*		
HIV Status	*Mean Diff (95% CI)*	*Effect Size*	*p HIV* Support*	*Mean Diff (95% CI)*	*Effect Size*	*p HIV* Adversity*
	Global Esteem			*Global Esteem*		
PHIV	−6.89 (−9.14, −4.64)	−0.83	0.86	−2.18 (−4.87,0.51)	−0.26	0.73
HEU	−6.40 (−8.19, −4.62)	−0.77		−3.75 (−6.59, −0.90)	−0.45	
HUU	−6.00 (−8.17, −3.82)	−0.72		−2.87 (−5.57, −0.16)	−0.34	
	Peer Esteem			*Peer Esteem*		
PHIV	−3.90 (−6.60, −1.21)	−0.34	0.27	−1.91 (−5.66, 1.84)	−0.16	0.14
HEU	−6.35 (−8.57, −4.13)	−0.55		−6.17 (−9.71, −2.64)	−0.53	
HUU	−6.78 (−9.52, −4.04)	−0.58		−6.48 (−10.02, −2.95)	−0.55	
	School Esteem			*School Esteem*		
PHIV	−6.18 (−9.15, −3.20)	−0.50	0.82	−2.19 (−5.79, 1.42)	−0.18	0.37
HEU	−6.57 (−9.36, −3.79)	−0.53		−2.25 (−6.39, 1.88)	−0.18	
HUU	−5.22 (−8.45, −2.00)	−0.42		1.71 (−3.00, 6.41)	0.14	
	Home Esteem			*Home Esteem*		
PHIV	−8.59 (−11.62, −5.57)	−0.86	0.11	−1.66 (−4.86, 1.54)	−0.17	0.64
HEU	−4.91 (−7.24, −2.59)	−0.49		−2.57 (−5.79, 0.65)	−0.25	
HUU	−4.81 (−7.35, −2.26)	−0.48		−3.70 (−6.67, −0.74)	−0.37	

(*Continued*)

Table 5.4. Continued

	Low Versus High Social Support in Relationship to Psychosocial Adjustment			*High Versus Low Adversity in Relationship to Psychosocial Adjustment*		
HIV Status	*Mean Diff (95% CI)*	*Effect Size*	*p HIV* Support*	*Mean Diff (95% CI)*	*Effect Size*	*p HIV* Adversity*
	Distress			*Distress*		
PHIV	9.77 (6.46, 13.07)	0.67	0.81	1.58 (−3.06, 6.22)	0.11	0.21
HEU	9.13 (6.27, 12.00)	0.62		3.29 (−1.54, 8.12)	0.22	
HUU	8.34 (5.59, 11.10)	0.57		7.05 (2.90, 11.2)	0.48	
	Positive Outlook/Future Aspirations			*Positive Outlook/Future Aspirations*		
PHIV	−12.48 (−15.58, −9.38)	−1.05	0.37	−1.16 (−5.00, 2.69)	−0.10	0.21
HEU	−9.63 (−12.85, −6.41)	−0.81		−0.46 (−4.62, 3.70)	−0.04	
HUU	−9.82 (−12.77, −6.88)	−0.83		−4.31 (−7.08, −1.53)	−0.36	
	Hopefulness			*Hopefulness*		
PHIV	−4.75 (−6.94, −2.55)	−0.44	0.45	−2.61 (−5.79, 0.58)	−0.24	0.78
HEU	−4.11 (−6.26, −1.96)	−0.38		−2.08 (−5.69, 1.52)	−0.19	
HUU	−2.60 (−5.14, −0.07)	−0.24		−0.91 (−4.50, 2.69)	−0.08	
	Sense of Purpose			*Sense of Purpose*		
PHIV	−9.87 (−13.05, −6.68)	−0.90	0.85	−1.51 (−4.61, 1.60)	−0.14	0.60
HEU	−9.40 (−11.90, −6.91)	−0.86		0.65 (−2.74, 4.03)	0.06	
HUU	−10.45 (−12.96, −7.95)	−0.96		−1.18 (−4.63, 2.28)	−0.11	

Multivariate linear regression model estimate produced using SAS PROC MIXED. There was clustering by household. The model adjusted for child factors (age, sex, and nutritional status) and caregivers' factors (alcohol intake, age, sex, own income, depression, care giving quality and HIV-status disclosure). PHIV, perinatally HIV-infected; HEU, HIV-exposed uninfected; HUU, HIV-unexposed uninfected.

positive outlook, hopefulness and sense of purpose over 12 months follow up. These findings align with prior observations in various chronic disease states where high levels of social support mitigated adversity related poor health outcomes (Dale & Safren, 2019; Mutumba et al., 2017; Parcesepe et al., 2018; Sim, Bowes, & Gardner, 2019; Zhao et al., 2011). Our findings also support previous observations of high social support related declines in distress but increased self-esteem among African-American women and Ugandan adolescents living with HIV (Dale & Safren, 2019).

The finding that high cumulative life adversity is associated with worse psychosocial adjustment is consistent with previously reported associations between high life adversity and psychopathological conditions such as post-traumatic stress disorder, major depression, alcoholism, substance use disorders, personality disorders, and distress (Dohrenwend, 2000). Contrary to our study hypothesis, we found no evidence that life adversity was associated with positive outlook, school esteem, or sense of purpose in this sample. This finding may represent a true lack of association between life adversity and respective outcomes at this stage in the life course or may suggest limited understanding and therefore lack of accuracy in children's reporting of adversity by 6–10 years of life. An alternate explanation is that children in this sample exhibited a resilient trajectory in the face of adversity (Seery, Holman, & Silver, 2010; Seery, Leo, Lupien, Kondrak, & Almonte, 2013) by purposefully adjusting their world view via greater acceptance and effective coping strategies which promote psychosocial adjustment (Seery et al., 2010; Seery et al., 2013). In fact, some authors have suggested that adversity results in psychopathology in affected persons to the degree that it affects an individual's life goals (Dohrenwend, 2000).

Relative to social support, life adversity is a less modifiable exposure although the capacity to cope with adversity can be deliberately strengthened. Fortunately, in this study, cumulative life adversity related decline in psychosocial adjustment were found to be of small clinical importance compared to social support related change in psychosocial adjustment, which were moderate to large. This suggests that regardless of HIV status, the lives of vulnerable Ugandan children can be improved by intervening to increase social support as a strategy to buffer negative impact of adversity (Barkin et al., 2020; Campbell et al., 2001; Garner, 2013). Indeed, there are data to suggest that HIV-affected children may be protected from mental health problems when support is high (Bomba et al., 2010; Bose, Moss, Brouwers, Pizzo, & Lorion, 1994; Funk, 2002; Mavhu et al., 2013; West et al., 2019).

In contradiction with study hypothesis and prior reports of lower self-esteem and higher distress in HIV affected versus HUU children from Uganda (Mutumba et al., 2017; Zalwango et al., 2016), we found no evidence of PHIV status related differences in any of the five psychosocial adjustment indicators over 12 months. We speculate that these differences are accounted for by rapid improvements in HIV-care and management with direct benefit for HIV-affected households. Unlike in our current study

where almost all HIV infected children are on treatment and demonstrate confirmed absence of immune suppression, the majority of HIV-infected children in our prior study were HAART treatment naïve or initiated HAART treatment later in disease course. This may have led to overall worse physical, emotional, and psychosocial health manifestations exacerbated by HIV-related stigma resulting in worse psychosocial adjustment measures relative to this cohort. Thus, the observation of no HIV-related difference in psychosocial adjustment in this cohort by 6–10 years of life is reassuring. We interpret this to mean that some of the previously observed HIV-status related differences in psychosocial adjustment outcomes was mediated by unavailable or poor HIV care directly contributing to worse caregiving environment through higher burden of physical morbidity, caregiver depression, stigma, and distress in HIV affected homes as previously described (Chan et al., 2015; Chan, Tsai, & Siedner, 2015; Katz & Tsai, 2015; Wagner, Ghosh-Dastidar, Garnett, Kityo, & Mugyenyi, 2012).

In addition to not being an independent predictor of psychosocial adjustment, perinatal HIV status was not a modifier of cumulative life adversity or social support related change in psychosocial adjustment because high life adversity and low social support were each associated with worse psychosocial adjustment in this sample of Ugandan children regardless of their PHIV status. Many psychosocial adjustment indicators such as sense of purpose, positive outlook/future aspirations and esteem enhance the ability of individuals to make meaning in their lives and thus influence several dimensions of healthy life trajectory including mood, disease symptom severity, and adaptive social interactions (Juth et al., 2008). Among adolescents living with HIV from Uganda higher levels of distress has been associated with non-adherence to antiretroviral therapy, increased stigma and negative life events (Mutumba et al., 2017; Mutumba et al., 2016). Hence, low psychosocial adjustment in children limits functional survival or ability of children to thrive by impeding coping skills and antiretroviral treatment effectiveness through non-adherence in HIV-infected children.

Limitations that warrant cautious interpretation of these results include observational study design and inability to exclude residual confounding by other factors such as HIV disclosure status. It is important to also note that we evaluated only the effect of interpersonal social support but not community or national level social support. Disclosure issues are pertinent to HIV-affected children and could have at least short-term impact on psychosocial adjustment in these groups. Despite this, the use of longitudinal design with repeated assessment of life adversity, social support, and each psychosocial adjustment endpoint allows for isolation of temporal sequence. Further strength lies in the inclusion of three peripartum HIV-exposure groups (PHIV, HEU, and HUU), which permitted robust comparison and control for confounding and estimation of measures of clinical importance to compliment statistical significance.

Conclusion

Regardless of perinatal HIV status, high cumulative life adversity was associated with deficits of mostly small clinical importance in psychosocial adjustment measures, whereas high social support was associated with increases of moderate to large clinical importance in psychosocial adjustment among early school-aged Ugandan children observed for 12 months. Perinatal HIV status itself was neither an independent predictor nor a modifier of observed relationships between psychosocial adjustment outcomes and respective factors. Therefore, pragmatic interventions such as economic, social, or child protection policies that enhance perceived social support among vulnerable children and their caregivers may be a promising strategy for promoting optimal psychosocial adjustment and enhancing resiliency in the face of adversity in the long-term. Future studies should also examine the role of community and national level social support in influencing changes in psychosocial adjustment among perinatally HIV affected children.

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Dr. ROBERT TUKE is a physician with Masters of Science in Epidemiology from Michigan State University. He is currently a research associate in The Global Neuropsychiatry Research group in the Department of Psychiatry at Michigan State University. In this role, he contributes analytic, clinical and contextual expertise to analysis and interpretation of data arising from longitudinal studies of differences in functional survival among Ugandan caregivers and dependent children that are perinatally HIV-infected, HIV-exposed and HIV unexposed uninfected.

Dr. ALLA SIKORSKII a methodologist and statistician with two decades of experience in health research. She has formal training in Statistics and Probability and has built a program of research in symptom management and design and evaluation of interventions to improve quality of life among people with chronic conditions. Dr. Sikorskii has designed numerous randomized controlled trials

(RCTs) including procedures for screening, randomization, timing of longitudinal assessments, measurement of important confounders, and ways to control for them. Her most recent work is devoted to the advance from traditional RCTs that test fixed interventions to adaptive interventions tailored to individuals using the sequential multiple assignment randomized trial (SMART) design. She is also applying advanced stochastic processes methods to identify individuals at risk for adverse quality of life outcomes and those in need for supportive care interventions based on biomarker data including electroencephalogram recordings.

Dr. SARAH K. ZALWANGO is a pediatrician with expertise in HIV service delivery and the implementation of clinical epidemiologic studies of HIV, TB and childhood diseases. She currently serves as the supervisor of HIV medical services in Kampala Capital City Authority-the governmental body charged with management of public hospitals in Kampala Uganda. She is a highly experienced NIH researcher with over a decade of experience in epidemiologic studies of TB/HIV with Tuberculosis Research Unit as a coordinator. As Ugandan principal investigator on this project, she led protocol adaptation for Kampala setting, hired, trained and supervised research staff and established multi-year system of enrolling and tracking large cohort of participants with high level of retention.

Dr. Kyle D. Webster is a physician scholar whose research interest includes studies of psychosocial determinants of physical and mental wellbeing in HIV-affected and HIV-unaffected populations. Active ongoing research by Dr. Webster is designed to understand utilization of mental health services among medical students. Specifically, he seeks to quantify the proximate determinants of where medical students seek mental health services and the barriers to seeking mental health service from the nearest provider (i.e. within their training institution).

Mr. ALEXANDER ISMAIL is a fourth-year student in the College of Osteopathic Medicine (COM) at Michigan State University. He is interested in pursuing a career as a psychiatrist specializing in adolescent care. Mr. Ismail contributed to background narrative as part of MSU College of Osteopathic Medicine's Biomedical Research Structure and Methods Course.

Dr. RUTH A. POBEE is a Postdoctoral Fellow in the Department of Food Science and Human Nutrition and affiliated with the Global Neuropsychiatry and Research Group, Department of Psychiatry, both at Michigan State University. She is a Nutritionist and a Research Scientist with specialization in maternal and child nutrition, micronutrient deficiencies, psychosocial assessment, growth assessment, and community outreach and development programs. She has led a number of research funded by World Food Program, American Association of University Women and Pennsylvania State University Africana Research Center. She is passionate about conducting research to inform health-related interventions in underserved communities.

Dr. JENNIFER L. BARKIN is an Associate Professor of Community Medicine and Obstetrics and Gynecology. Her expertise is in the assessment and treatment of perinatal mood disorders and measurement development. Her intellectual property, the Barkin Index of Maternal Functioning (BIMF) is being used for clinical, commercial, community-based and academic research both nationally and internationally.

Dr. MICHAEL J. BOIVIN'S expertise lies in evaluating the neuropsychological outcomes, public health risk and resilience factors for children, including the neurodevelopmental and neuropsychological impact of interventions for HIV disease, cerebral malaria, konzo disease and malnutrition in children in Uganda, Malawi, the DR Congo, Benin, Mali and South Africa. He has been involved in studies on the use of early caregiver training to enhance cognitive and psychosocial development in children, conducted a neuropsychological evaluation of HIV-infected children on different antiretroviral treatments and those with pre- and post-natal exposure to ARVs. He is also co-editor of the Neuropsychology of Children in Africa: Perspectives in Risk and Resilience (2013, Springer).

Dr. BRUNO GIORDANI is clinical neuropsychologist with research expertise in studying cognitive and behavioral problems from a lifespan and cross-cultural perspective. He is a Fellow in Division 40 and Division 12 of the American Psychological Association and is a tenured Professor in the University of Michigan (U-M) departments of Psychiatry, Neurology, and Psychology and the School of Nursing at the University of Michigan. He was the past Director of the Neuropsychology Section in the Department of Psychiatry and is now the Chief Psychologist and also Senior Director of the U-M Mary A. Rackham Institute. He has considerable experience in clinical trials, measurement technique development (including computerized assessments), pharmacological and non-pharmacological approaches to enhancing cognition, as well as basic developmental neuropsychological concepts within cross-cultural settings. He has collaborated in research in a number of areas, including Africa, India, Eastern Europe, Thailand, the Caribbean, and China.

Dr. AMARA E. EZEAMAMA is a clinical epidemiologist and the principal investigator of NIH supported longitudinal studies of differences in functional survival among Ugandan caregivers and dependent children that are perinatally HIV-infected, HIV-exposed and HIV unexposed uninfected. Her research program is designed to inform evidence-based interventions to mitigate the effects of modifiable structural, behavioral and biological determinants of limitations in health and neurocognitive function among HIV-infected populations surviving for multiple decades on long-term antiretroviral therapy in comparison to HIV-affected though uninfected and HIV-unaffected populations.