Sexual debut and risk behaviors among orphaned and vulnerable children in Zambia: which protective deficits shape HIV risk?

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Abstract

Orphaned and vulnerable children (OVC) are not only affected by, but also rendered at-risk of, HIV due to overlapping deficits in protective assets, from school to household financial security. Drawing from a protective deficit framework, this study examines correlates of sexual risk – including multiple sexual partnerships, unprotected sex, and age at sexual debut – among OVC aged 13–17 years in Zambia. In May-October 2016, a two-stage stratified random sampling design was used to recruit OVC and their adult caregivers (N = 2,034) in four provinces. OVC-caregiver dyads completed a structured interview addressing household characteristics, protective assets (i.e. finances, schooling, and nutrition), and general health and wellbeing. Associations of factors derived from the multi-component protective deficits framework were examined using multivariable ordered logistic regression, comparing sexually inexperienced OVC to those with a sexual debut and reporting ≥ sexual behavior(s). A sub-analysis of older (ages 15–17) OVC identified correlates of early (before age 15) and later (at or after age 15) sexual debut using multinomial logistic regression. Among 735 OVC aged 13–17, 14% reported a sexual debut, among whom 14% and 22% reported 2+ past-year partners and non-condom last sex, respectively. Older age (Adjusted Odds Ratio [aOR] = 2.08, 95% Confidence Interval [CI] 1.32–3.27), male sex (aOR = 1.90, CI 1.22–2.96), not having a birth certificate (aOR = 2.05, CI 1.03–4.09), out-of-school status (aOR = 2.63, CI 1.66–4.16), and non-household labor (aOR = 1.84, CI
1.01–3.38) were significantly associated with higher sexual risk. Male sex was the only factor significantly associated with early sexual debut in multivariable analysis. Sexual risk-reduction strategies require age- and sex-specific differentiation and should be prioritized for OVC in financially distressed households.

**Keywords**

Orphans and vulnerable children; protective assets; sexual debut; sexual behavior; HIV risk; sub-SAHARAN Africa

**Introduction**

Despite substantial gains in prevention and treatment over the last decade, the HIV epidemic presents unyielding health, financial, and social challenges for households and communities in Zambia. One million Zambians, roughly 12% of the adult population, are living with HIV (Zambia Ministry of Health, 2019). While steady increases in antiretroviral therapy (ART) coverage have improved health outcomes and led to noteworthy declines in population HIV incidence (R. R. Hayes et al., 2017; R. J. R. J. Hayes et al., 2019), an irreversible consequence of the epidemic’s duration and magnitude is sizeable numbers (~600,000) of HIV-orphaned children (National HIV/AIDS/STI/TB Council, 2012).

Orphaned and vulnerable children (OVC) are not only affected by, but also rendered at-risk of, HIV and other challenges due to overlapping, mutually reinforcing social and structural forces. Parental death is a traumatic event accompanied by dramatic changes in household structure and a child’s broader care environment, including newly appointed caregivers (Embleton et al., 2014; Nyambedha et al., 2003). The loss of a parental income source, or unplanned adoption of new dependents, increases financial strain on a household, rendering basic expenses on food, health, and education unaffordable (Kasedde et al., 2014; Lee et al., 2014; Olanrewaju et al., 2015; Rivers et al., 2010). Untethered to sources of parental stimulation and psychosocial support in schools and in the household, OVC may experience re-traumatizing neglect and distress that can impair decision-making and drive sexual experimentation to cope with these emotional and material deficits (Cluver et al., 2007, 2011; Gray et al., 2016; Thurman et al., 2006; Whetten et al., 2011). This subsequently exposes OVC to harms like earlier and non-condom sex, as well as sexual coercion (Gray et al., 2016; Operario et al., 2011). Deficits in protective assets, therefore, act synergistically in shaping the HIV risk environment for OVC.

While the contribution of instrumental and material scarcity to youth HIV risk is well-established (Dellar et al., 2015; Mathur et al., 2020; Pascoe et al., 2015; Pettifor et al., 2018), the mechanisms through which deficits in protective assets shape OVC sexual behavior is less understood, particularly in the Zambian context. A psychometric assessment of Zambian OVC’s HIV risk found prevalent (50%) sexual risk behaviors (Kane et al., 2018), but did not identify factors associated with specific sexual outcomes. Other studies of youth sexual behavior in Zambia have similarly reported suboptimal trends in condom use and early sex (Kayeyi et al., 2013; Ndongmo et al., 2017), but these results may have limited generalizability to OVC.
This study examines correlates of sexual risk – including multiple sexual partnerships, unprotected sex, and age at sexual debut – among OVC aged 13–17 years in Zambia. Drawing from a protective deficits framework (see Figure 1), which situates child and adolescent sexual behavior at the intersection of overlapping psychosocial and material scarcities, this study identifies and quantifies the contribution of co-occurring, multi-dimensional factors to OVC sexual behavior. Findings will help elucidate strategies for tailoring and differentiating HIV prevention programming for OVC with distinct HIV vulnerabilities and sexual risk profiles.

**Materials and methods**

**Study setting and population**

Data are derived from a benchmark survey of households supported by the Zambia Family (ZAMFAM) project, funded by the U.S. Agency for International Development (USAID) via the U.S. President’s Emergency Plan for AIDS Relief (PEPFAR). ZAMFAM is a five-year project (2015–2020) implemented in four provinces by two community-based partners: Development Aid from People to People (DAPP) and the Expanded Church Response (ECR) Trust. The project’s primary objective is to strengthen health and resilience of OVC, young people living with HIV, and their caregivers through a multi-sectoral service package, including: 1) combination socioeconomic interventions (e.g. village loans and savings groups), 2) food subsidies, 3) psychosocial support, 4) parenting workshops, and 5) community-based HIV care and treatment support (Mbizvo et al., 2018; Project SOAR, 2019).

Prior to survey implementation, DAPP and ECR Trust enumerated households receiving ZAMFAM services in project catchment areas. Eligible study participants resided in households supported by the ZAMFAM project and included adults (18 + years) who served as primary caregivers for OVC 17 years or younger. ZAMFAM-eligible OVC, conforming to the Zambian government’s classification, are children younger than 18 living in adverse conditions, including: HIV-positive status, disability, chronic illness, or household environments engendering significant physical or emotional stress threatening healthy development (Mbizvo et al., 2018).

**Recruitment and sampling**

A two-stage stratified random sampling procedure was used to recruit ZAMFAM-beneficiary households in four provinces: 1) Central and Southern (DAPP implementing areas) and 2) Copperbelt and Lusaka (ECR Trust implementing areas). Survey implementation occurred at two distinct time points in each provincial cluster: between May and July 2016 in Central and Southern (approximately one-year after ZAMFAM project introduction) and between September and October 2016 in Copperbelt and Lusaka (immediately following project introduction).

After enumeration of eligible households across 131 wards in the sampling frame, fifty wards were randomly selected proportional to the OVC beneficiary population size. Stratification by residence type ensured a representative sample of urban and rural wards.
was selected across provincial clusters. Thirty-five households were selected in each ward through systematic random sampling with replacement. Among 2,462 households approached across wards, 2,034 (82%) were enrolled.

OVC aged 0–9 years and 10–17 years, respectively, as well as their primary caregiver were eligible for participation. In accordance with PEPFAR OVC survey guidelines, random selection was used to enroll one OVC in households where more than one OVC per age band was present (Office of the Global AIDS Coordinator, 2017). In households with OVC aged 0–9 and 10–17, both OVC were eligible for participation.

Data collection

Caregivers and OVC in each household completed an enumerator-administered, tablet-based questionnaire adapted from the Child, Caregiver and Household Well-being Survey Tools for Orphaned and Vulnerable Children (MEASURE Evaluation, 2013). Caregivers answered questions pertaining to household characteristics, finances, schooling, hunger, and their general health and wellbeing. OVC aged 10–17 were interviewed directly (without a response proxy) with an age-appropriate survey instrument.

Measures

The primary outcomes of this study were lifetime and past-year sexual behaviors, obtained via self-report from OVC aged 13–17. A categorical sexual debut variable was constructed from responses to two survey items gauging whether the participant ever had sex and, if so, at what age. The variable compared OVC who report early sexual debut (before age 15), to those who report first sex at or after age 15 (later sexual debut), to those who have never had sex. An ordinal sexual risk variable was also constructed using responses to three questions assessing sexual debut, multiple (two or more) sexual partners in the past year, and condom use at last sex. The variable was coded as follows: 0 – not sexually experienced (‘low/no risk’); 1 – sexually experienced but reports neither multiple past-year partners nor unprotected last sex (‘some risk’); and 2 – sexually experienced and reports multiple past-year partners and/or unprotected last sex (‘higher risk’).

Selection of explanatory variables was guided by the protective deficits framework for HIV risk (see Figure 1). Operationalization procedures for explanatory covariates derived from the study’s guiding theoretical framework are described in Table 1. Socio-demographic covariates included age, sex, residence type, and province.

Analysis

Data were managed and analyzed in Stata 15.1 (StataCorp®, College Station, TX). Descriptive sample statistics were calculated and compared across sex using design-based Pearson’s chi-square tests of association. Multivariable ordered logistic regression modeled associations of demographic and protective deficit factors with ordinal sexual risk. Covariates were introduced into multivariable analysis in stepwise fashion, including only those that were significantly (p < 0.05) associated with the outcome in bivariate analysis. A post-estimation Brant test was performed to verify the specified model supporting the proportional odds assumption of ordered logistic regression (Brant, 1990). Subgroup
analyses were subsequently implemented to compare effect estimates in models stratified by sex (see Supplementary Table 1).

A sub-analysis restricted to older OVC (ages 15–17) was conducted to identify factors associated with age at first sex. Multinomial logistic regression compared associations of the aforementioned covariates with OVC reporting early (before age 15) and later (at or after age 15) sexual debut, respectively, with sexually inexperienced OVC served as the universal reference group in analysis. Only covariates significantly \( p < 0.05 \) associated with either early or later sexual debut in bivariate analysis were introduced into multivariable analysis.

Variance Inflation Factor (VIF) scores were inspected for multicollinearity and, when indicated, guided removal of covariates from the multivariable models until acceptable thresholds of covariate saturation (mean VIF < 5) were achieved (Craney & Surles, 2002). Linearized standard errors produced robust estimates sensitive to hierarchical clustering and stratification (by urban and rural residence) as well as the probability of selection and non-response.

**Ethics**

The Population Council Institutional Review Board (New York, NY, USA) and ERES Converge (Lusaka, Zambia) reviewed and approved the current study. The National Health Research Authority (Lusaka, Zambia), under the Zambian Ministry of Health, and the Ministry of Community Development and Social Services (Lusaka, Zambia) administratively approved the study. Caregivers provided written informed consent prior to survey administration. Assent and caregiver written consent was obtained for all participants aged 10–17.

**Results**

Among 2,034 households enrolled, 742 (36.5%) had an eligible OVC aged 13–17. Seven had incomplete or missing responses to sexual behavior items and were excluded from analysis. Table 2 presents sex-stratified descriptive statistics of the analytic sample \( (N = 735) \). The mean age was 14.7 years (Std. Dev: 1.3). Age and sex were evenly distributed in the sample. A significantly higher proportion of male OVC were older (15–17 years) than female OVC (59.7% vs. 47.0%, \( p < 0.001 \)). Most OVC resided in urban/mixed wards (68.3%), and the largest proportion were sampled from Central Province (38.5%).

One hundred OVC (13.6%) reported ever having sex, a majority of whom reported their first sex occurred before age 15 (68.0%). Among sexually debuted OVC, 14.0% reported multiple past-year sex partners, and 21.0% denied using condoms during their most recent sexual encounter. Figure 2 displays sexual behaviors among sexually experienced OVC by sex and residence. Male OVC were more likely to report early sexual debut (73.5% vs. 56.3%, \( p = 0.074 \)) and multiple past-year sex partners (17.6% vs. 6.3%, \( p = 0.148 \)), while female OVC reported unprotected last sex with greater frequency (25.0% vs. 19.1%, \( p = 0.485 \)). OVC in rural settings were more likely to report early sexual debut (78.4% vs. 61.9%, \( p = 0.057 \)), unprotected last sex (35.1% vs. 12.7%, \( p = 0.008 \)), and multiple past-year sex partners (27.0% vs. 6.3%, \( p = 0.007 \)).
OVC reported overlapping deficits in protective assets (see Table 2). Most did not have birth certificates (79.6%) and had caregivers who met their child’s needs worse than other households (63.7%). One-fourth (24.8%) had caregivers who were too sick to participate in daily activities in the previous month. A majority of OVC never discussed sex (86.0%) or HIV/AIDS (85.9%) with a caregiver. Male OVC were significantly more likely than female OVC to have never discussed sex with their caregiver (91.0% vs. 81.0%, p < 0.001).

Approximately one-fifth (17.7%) of OVC were out-of-school. Among those who had ever attended school, 17.0% had withdrawn. Half of school-enrolled OVC (49.1%) had missed at least three days of school in the past week, a significantly larger proportion of whom were female (52.9% vs. 45.1%, p = 0.036), and 15.1% did not progress in school in the previous academic year. Half of OVC lived in households where caregivers struggled to afford basic expenses, including those for food (55.1%). Most caregivers reported being less financially secure compared to their neighbors (64.2%), a significantly higher proportion of whom were guardians to female OVC (68.5% vs. 59.9%, p = 0.012). As a potential consequence of this economic instability, nearly one-fifth (21.0%) of OVC reported engagement in income-generating activities outside the household, with over twice as many males reporting labor participation (28.9% vs. 13.0%, p < 0.001).

Over three-fourths of caregivers (76.1%) had no food in their homes at least once in the previous month. OVC reported eating a smaller meal than desired (65.6%), skipping a meal (62.3%), and going to bed hungry (51.0%) at least weekly in the past month with alarming frequency. One-fourth (25.0%) spent an entire day and evening without eating at least weekly in the past month. In terms of household permeability, fewer but noteworthy proportions of OVC lived in households where a death occurred (19.9%) or new members were added (27.1%) in the past year. Insufficient shelter protection was observed in 11.6% of households, a significantly larger proportion of which housed male OVC (14.7% vs. 8.4%, p = 0.008).

**Heightened sexual risk**

Table 3 presents unadjusted and adjusted proportional odds ratios (OR) from ordered logistic regression, modeling associations between tiered sexual risk and explanatory covariates. An aOR for a three-level (ordinal) sexual risk is a pooled estimate of: 1) the odds of sexual debut plus multiple past-year partners and/or unprotected last sex compared to no sexual debut (‘higher risk’ + ‘some risk’ vs. ‘low/no risk’) with 2) the odds of sexual debut and multiple past-year partners and/or unprotected last sex compared to sexual debut without other risks and no sexual debut (‘higher risk’ vs. ‘some risk’ + ‘low/no risk’). The pooled regression coefficient (i.e. proportional odds ratio) can, therefore, be interpreted as an odds estimate corresponding to heightened, or greater degrees of, sexual risk.

In multivariable analysis, OVC who were 15–17 years (vs. 13–14: Adjusted OR [aOR] = 2.08, 95% Confidence Interval [CI] 1.32–3.27), were male (aOR = 1.90, CI 1.22–2.96), did not have a birth certificate (aOR = 2.05, CI 1.03–4.09), currently out-of-school (aOR = 2.63, CI: 1.66–4.16), and engaged in income-generating activities (aOR = 1.81, CI 1.01–3.38) had significantly higher odds with elevated sexual risk. While OVC who withdrew from school (OR = 3.50, CI 2.28–5.36) and did not progress in school in the previous academic year
(OR = 2.07, CI 1.16–3.70) had higher odds of elevated sexual risk in bivariate analysis, these covariates were excluded from multivariable analysis due to multicollinearity.

Sex-stratified models produced similar results for male and female OVC (see Supplementary Table 1). However, significant associations of not having birth certificate and engaging in income-generating activities, respectively, with ordinal sexual risk observed in the pooled model were attenuated in females.

**Early and later sexual debut**

To identify correlates of early and later sexual debut among older OVC (n = 392), multinomial logistic regression produced unadjusted and adjusted relative risk ratios (RRR) comparing OVC with early and later sexual debut, respectively, to those without sexual debut (see Table 4). Relative to OVC without sexual debut, OVC with later sexual debut were significantly more likely to be out-of-school (Adjusted RRR [aRRR] = 2.89, CI 1.25–6.67), engage in income-generating activities (aRRR = 2.44, CI 1.00–5.95), and have caregivers who could not afford food expenses (aRRR = 3.32, CI 1.28–8.60).

Relative to OVC without sexual debut, unadjusted significant correlates of early sexual debut included: male sex (RRR = 3.25, CI: 1.59–6.66), not having a birth certificate (RRR = 3.72, CI 1.06–13.09), being currently out-of-school (RRR = 2.17, CI 1.04–4.53), and engaging in income-generating activities (RRR = 2.83, CI 1.41–5.70). In the presence of other covariates, however, only male sex remained significantly associated with early sexual debut (aRRR = 2.72, CI: 1.23–6.04). School attrition was independently associated with later (RRR = 3.18, CI 1.48–6.85) and early (RRR = 2.31, CI 1.12–4.83) sexual debut, respectively, but this covariate was ultimately dropped from the multivariable model due to multicollinearity.

**Discussion**

Despite the UNAIDS global call for leaving no one behind in the multi-national efforts towards HIV prevention, treatment and care, including attainment of the 95–95–95 targets for testing, treatment and viral suppression through treatment adherence, much less research efforts have looked at factors that attenuate risk or confer protection among OVC. Drawing from a theoretical framework, this large study of Zambian OVC situates sexual debut and risk behaviors in a constellation of social, educational, and financial deficits. These emerged as significant drivers of sexual behaviors and risk among Zambian OVC. Children growing without birth certificates have limited access to schooling and other social services, and their health care can be compromised without knowledge of their actual age. In the present study, not having a birth certificate, out-of-school status, and engaging in income-generating activities were significantly associated with increased sexual risk (early sexual debut, multiple past-year sexual partners, and unprotected last sex) in ordered logistic regression. Out-of-school status, but engaging in income-generating activities, and caregiver inability to afford food expenses were, likewise, significant correlates of later sexual debut. Only male sex emerged as a significant correlate of early sexual debut among older OVC, suggesting that associations between age at first sex and protective deficits were predominantly driven
by OVC with later sexual debut. This is unsurprising, given that the majority of sexually experienced OVC reported their first sex before age 15.

Findings highlight the contribution of social adversity, educational attrition, and financial insecurity to HIV sexual risks in OVC. A qualitative study in Kenya identified food insecurity, school attrition, poor housing, and labor participation as mechanisms through which poverty influences sexual experimentation and risk-taking among orphaned and non-orphaned youth alike (Juma, Alaii, Bartholomew, Askew, Van Den Born et al., 2013a). A parallel quantitative study found caregiver social support and discussing sex with caregivers buffered sexual risks in Kenyan youth (Juma, Alaii, Bartholomew, Askew, Van den Borne et al., 2013b). The contribution of food insecurity and household wealth to OVC sexual behavior and risks, including transactional sex and sexual coercion, have similarly been documented in Malawi and South Africa (Cluver et al., 2011; Littrell et al., 2011). While previously identified associations of food security, and instrumental support from caregivers with lower sexual risk were not found in this study, these results build on existing evidence linking educational and financial deficits to sexual behavior among OVC.

Not having a birth certificate surfaced as a dimension of social adversity associated with elevated sexual risk. As a conduit to vital social and health services, civil registration is a well-documented determinant of future social and economic wellbeing (Crea et al., 2015; Phillips et al., 2015). Civil registration is also cardinal in protection against early marriages among female adolescents (The International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b) et al., 2013). In this study context, the absence of a birth certificate could reflect extreme household poverty or indicate a change in the OVC’s caregiving environment (e.g. as a result of orphanhood or financially motivated adoption). As a potential driver of access to social and financial assets, which are protective against sexual risks, civil registration should remain a programming priority for OVC, especially for those who are out-of-school or lack access to public services.

Male and rural-dwelling OVC reported more sexual risks than their female and urban-dwelling counterparts, respectively. Except for unprotected sex, male OVC reported early sexual debut and multiple partnerships with greater frequency than females, while sexual behaviors were consistently and significantly more prevalent among OVC in rural settings. Findings around sex and community differences in age at first sex and other sexual behaviors among youth in sub-Saharan Africa are highly variable. While some studies report more prevalent and earlier sexual behavior among women and in urban settings (Cluver et al., 2011; Gregson et al., 2005; Robertson et al., 2010), others observe these outcomes more frequently in men and rural communities (Juma, Alaii, Bartholomew, Askew, Van den Borne et al., 2013b; Puffer et al., 2011). Sex differences in sexual behavior could be an artifact of social desirability, with males overreporting their sexual behavior and females underreporting theirs. Without discounting the potential contribution of response biases to observed sex-specific patterns in sexual behavior, prioritizing and differentiating sexual risk-reduction strategies, including social asset building and behavior change communication, to adolescent boys and rural OVC, respectively, could reduce harms associated with earlier sex and risky sexual behavior.
This study illuminated key protective deficits associated with sexual behavior and risks among Zambian OVC; these findings, nonetheless, should be reviewed with several limitations in mind. First, as a cross-sectional study, temporal and causal relationships cannot be inferred from results. Second, self-reported measures, particularly for sensitive topics like sexual behavior, are susceptible to response biases. Third, the available measures of sexual behavior are crude indicators of sexual risk and do not capture all dimensions of sexual risk, including coercive encounters and transactional sex. Fourth, given the small proportion of OVC reporting sexual debut, sexual behaviors were aggregated analytically to achieve sufficient statistical power to detect meaningful associations. Fifth, while the ZAMFAM project supports households meeting predetermined vulnerability criteria, orphanhood status was not ascertained in the survey; its association with OVC sexual behavior, therefore, could not be assessed. Further interrogation of factors associated with independent sexual risks, including multiple partnerships and unprotected sex, is warranted. Lastly, while the sampling strategy facilitated representative selection of ZAMFAM-beneficiary households, results cannot be generalized to the broader OVC population in Zambia or other settings.

This study found that odds of sexual risk were highest among older, male, and rural-dwelling OVC. Likewise, OVC who lack birth certificates, are out-of-school, and engage in income-generating activities were more likely to have experienced their sexual debut and report other sexual risks, including multiple partners and unprotected sex. Recommended modifications to ZAMFAM service-delivery include differentiated sexual risk-reduction strategies for male and rural-dwelling OVC; prioritizing support to households experiencing financial distress (e.g. food insecurity, child labor participation, school attrition); and increasing civil registration. Given the infrequency with which OVC discussed sex and HIV/AIDS with their caregivers, leveraging existing programmatic infrastructure (i.e. ZAMFAM trained counselors) to initiate dialogue on these sensitive matters between OVC and their caregivers is a viable, low-cost risk-reduction strategy.

**Supplementary Material**

Refer to Web version on PubMed Central for supplementary material.

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**Data availability**

Data presented for this study are available from the corresponding author (MTM) upon reasonable request.

**Abbreviations**

- **ART**: Antiretroviral therapy
- **DAPP**: Development Aid from People to People
- **ECR**: Expanded Church Response
- **OVC**: Orphaned and vulnerable children
- **PEPFAR**: U.S. President’s Emergency Plan for AIDS Relief
- **USAID**: U.S. Agency for International Development
- **ZAMFAM**: Zambia Family project

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Figure 1.
Protective deficits framework for sexual behavior among orphaned and vulnerable children.
Figure 2.
Proportion of sexually debuted orphaned and vulnerable children aged 13–17 who report sexual risk behaviors (early sexual debut [before age 15], unprotected last sex, and multiple past-year sex partners), by sex and residence (N = 100).
Table 1.
Operationalization of dichotomous explanatory variables included in analysis, by corresponding domain in the protective deficits framework

| Explanatory Variable                              | Operationalization                                                                                                                                 |
|---------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| **Social Adversity**                              |                                                                                                                                                   |
| Does not have a birth certificate                 | Compares OVC who self-report not having a birth certificate to those who do                                                                       |
| Caregiver meets child’s needs worse than others   | Responses to a single-item, five-point scale (‘much worse’ to ‘much better’) were dichotomized, with responses of ‘much worse’ and ‘a bit worse’ compared to others |
| Caregiver too sick for daily activities, past month| Caregiver self-reports being too sick to perform daily activities ≥ 1 weekly in the past month                                                      |
| Never discussed sex with caregiver               | Compares OVC who never discussed sex with a caregiver to those who have                                                                            |
| Never discussed HIV/AIDS with caregiver          | Compares OVC who never discussed HIV/AIDS with a caregiver to those who have                                                                       |
| **Educational Attrition**                         |                                                                                                                                                   |
| Currently out-of-school                          | Captures all OVC who are currently unenrolled or have never been enrolled in school                                                                 |
| Missed any school                                | Among school-attending OVC, compares OVC who missed ≥ 1 school days in the past week for any reason compared to those who had perfect attendance |
| Withdrew from school                             | Among OVC who had ever attended school, compares OVC who discontinued attendance to those currently enrolled                                         |
| Did not progress in school previous year         | Includes school-attending OVC who either 1) did not advance to the next grade in school or 2) withdrew from school in the previous year            |
| **Financial Instability**                        |                                                                                                                                                   |
| Engaged in income-generating activities          | Includes OVC who currently participate in any form of non-household labor for money or kind                                                          |
| Caregiver could not afford food expenses         | Compares caregivers who are unable to access money for food expenses to those who can                                                             |
| Household less financially secure than others    | Responses to a single-item, three-point scale (‘less secure’ to ‘more secure’) were dichotomized, with ‘less secure’ responses compared to others |
| **Food Insecurity**                              |                                                                                                                                                   |
| No food in household                             | Caregivers report any episode of not having food in the home ≥ 1 weekly in the past month                                                           |
| Ate a smaller meal                               | OVC report eating a smaller meal than desired ≥ 1 weekly in the past month                                                                        |
| Went whole day and night without eating          | OVC report spending an entire day and evening without eating ≥ 1 weekly in the past month                                                          |
| Skipped a meal                                   | OVC report skipping at least one meal ≥ 1 weekly in the past month                                                                                |
| Went to bed hungry                               | OVC report going to bed hungry ≥ 1 weekly in the past month                                                                                    |
| **Household Permeability**                       |                                                                                                                                                   |
| Deaths in the household, past year              | Captures death of household member(s) of any age in the past year                                                                               |
| New household members, past year                 | Captures addition of at least one new household member of any age in the past year                                                              |
| Household has insufficient shelter protection    | Survey enumerator observes household for incomplete roof or walls                                                                              |
Table 2.
Descriptive statistics (%) of orphaned and vulnerable children aged 13–17 years in Zambia Family project catchment areas, by sex (N = 735)

| Demographics          | Total % | Male n = 367 | Female n = 368 | p*    |
|-----------------------|---------|--------------|----------------|-------|
| **Age group**         |         |              |                |       |
| 13–14 years           | 46.7    | 40.3         | 53.0           | <0.001|
| 15–17 years           | 53.3    | 59.7         | 47.0           |       |
| **Residence**         |         |              |                | 0.287 |
| Rural                 | 31.7    | 33.5         | 29.9           |       |
| Urban                 | 68.3    | 66.5         | 70.1           |       |
| **Province**          |         |              |                | 0.403 |
| Central               | 38.5    | 37.6         | 39.4           |       |
| Copperbelt            | 31.6    | 34.0         | 29.1           |       |
| Lusaka                | 21.6    | 20.2         | 23.1           |       |
| Southern              | 8.3     | 8.2          | 8.4            |       |
| **Social Adversity**  |         |              |                |       |
| Does not have a birth certificate | 79.6 | 78.7 | 80.4 | 0.571 |
| Caregiver meets child’s needs worse than other households§ | 63.7 | 65.4 | 62.0 | 0.307 |
| Caregiver too sick for daily activities, past month§ | 24.8 | 26.7 | 22.8 | 0.253 |
| Never discussed sex with caregiver | 86.0 | 91.0 | 81.0 | <0.001 |
| Never discussed HIV/AIDS with caregiver | 85.9 | 88.8 | 82.9 | 0.050 |
| **Educational Attrition** |     |              |                |       |
| Currently out-of-school | 17.7 | 19.6 | 15.8 | 0.146 |
| Missed any school (n = 605) | 49.1 | 45.1 | 52.9 | 0.036 |
| Withdrew from school (n = 729) | 17.0 | 19.2 | 14.8 | 0.080 |
| Did not progress in school previous year (n = 643) | 15.1 | 15.4 | 14.8 | 0.794 |
| **Financial Instability** |     |              |                |       |
| Engaged in income-generating activities | 21.0 | 28.9 | 13.0 | <0.001 |
| Caregiver could not afford food expenses§ | 55.1 | 55.0 | 55.2 | 0.972 |
| Household less financially secure than others§ | 64.2 | 59.9 | 68.5 | 0.012 |
| **Food Insecurity**   |         |              |                |       |
| No food in household§ | 76.1    | 79.0         | 73.1           | 0.140 |
| Ate a smaller meal     | 65.6    | 66.5         | 64.7           | 0.674 |
| Went whole day and night without eating | 25.0 | 29.7 | 20.4 | 0.016 |
| Skipped a meal         | 62.3    | 63.8         | 60.9           | 0.465 |
| Went to bed hungry     | 51.0    | 53.1         | 48.9           | 0.290 |
| **Household Permeability** |     |              |                |       |
| Deaths in the household, past year§ | 19.9 | 19.3 | 20.4 | 0.713 |
| New household members, past year§ | 27.1 | 25.6 | 28.5 | 0.367 |
|                                | Total % | Male n = 367 | Female n = 368 | P * |
|--------------------------------|---------|--------------|----------------|-----|
| Household has insufficient shelter protection | 11.6    | 14.7         | 8.4            | 0.008 |

* Bolded values indicate statistically significant (p < 0.05) differences by sex, per design-based Pearson’s chi-square tests of association.

§ Variables generated from interviews with adult (18+ years) caregivers of OVC.
Table 3.

Unadjusted and adjusted proportional odds ratios (pOR) of sexual risk behaviors (0 – no sexual debut, 1 – sexual debut only, 2 – sexual debut and unprotected last sex and/or multiple past-year sex partners) derived from ordered logistic regression, by demographic and protective deficit factors, among orphaned and vulnerable children (N = 735)

| Demographics                  | Unadj. pOR (95% CI) | P    | Adj. pOR* (95% CI) | P    |
|-------------------------------|---------------------|------|--------------------|------|
| **Age group**                 |                     |      |                    |      |
| 13–14 years                   | 1.00 Ref.           |      | 1.00 Ref.          |      |
| 15–17 years                   | 2.69 (1.76, 4.11)   | <0.001 | 2.08 (1.32, 3.27)  | 0.002 |
| **Sex**                       |                     |      |                    |      |
| Female                        | 1.00 Ref.           |      | 1.00 Ref.          |      |
| Male                          | 2.39 (1.63, 3.49)   | <0.001 | 1.90 (1.22, 2.96)  | 0.005 |
| **Social Adversity**          |                     |      |                    |      |
| Does not have a birth certificate | 2.29 (1.17, 4.44)  | 0.016 | 2.05 (1.03, 4.09)  | 0.042 |
| Caregiver meets child’s needs worse than other households | 0.89 (0.61, 1.26) | 0.470 |                     |      |
| Caregiver too sick for daily activities, past month | 1.02 (0.62, 1.68) | 0.940 |                     |      |
| Never discussed sex with caregiver | 0.88 (0.50, 1.53) | 0.636 |                     |      |
| Never discussed HIV/AIDS with caregiver | 1.01 (0.55, 1.84) | 0.975 |                     |      |
| **Educational Attrition**     |                     |      |                    |      |
| Currently out-of-school       | 3.40 (2.22, 5.19)   | <0.001 | 2.63 (1.66, 4.16)  | <0.001 |
| Missed any school (n = 605)   | 0.86 (0.49, 1.53)   | 0.610 |                     |      |
| Withdrew from school (n = 729)* | 3.50 (2.28, 5.36) | <0.001 |                     |      |
| Did not progress in school previous year (n = 643)* | 2.07 (1.16, 3.70) | 0.014 |                     |      |
| **Financial Instability**     |                     |      |                    |      |
| Engaged in income-generating activities | 2.80 (1.63, 4.81) | <0.001 | 1.84 (1.01, 3.38)  | <0.001 |
| Caregiver could not afford food expenses | 1.00 (0.65, 1.54) | 0.999 |                     |      |
| Household less financially secure than others | 0.74 (0.48, 1.14) | 0.167 |                     |      |
| **Food Insecurity**           |                     |      |                    |      |
| No food in household          | 0.88 (0.54, 1.43)   | 0.597 |                     |      |
| Ate a smaller meal             | 1.14 (0.70, 1.84)   | 0.599 |                     |      |
| Whole day and night without eating | 1.09 (0.70, 1.70) | 0.699 |                     |      |
| Skipped a meal                | 1.21 (0.73, 1.72)   | 0.593 |                     |      |
| Went to bed hungry            | 1.13 (0.74, 1.75)   | 0.567 |                     |      |
| **Household Permeability**    |                     |      |                    |      |
| Deaths in the household, past year | 0.87 (0.51, 1.49) | 0.612 |                     |      |
| New household members, past year | 1.02 (0.62, 1.67) | 0.938 |                     |      |
| Household has insufficient shelter protection | 1.34 (0.67, 2.66) | 0.396 |                     |      |

* Model adjusted for all covariates presented in the column.

§ Covariate excluded from multivariable model due to multicollinearity.
| Demographics                        | Early (<15) Sexual Debut (vs. No Sexual Debut) | Later (15+) Sexual Debut (vs. No Sexual Debut) |
|------------------------------------|-----------------------------------------------|-----------------------------------------------|
|                                    | Unadj. RRR (95% CI)          | P     | Adj. RRR* (95% CI)          | P     |
|                                    | Unadj. RRR (95% CI)          | P     | Adj. RRR* (95% CI)          | P     |
| Sex                                |                                |       |                                |       |
| Female                             | 1.00 (Ref.)                   |       | 1.00 (Ref.)                   |       |
| Male                               | 1.08 (0.54, 2.16)            | 0.830 | 0.84 (0.39, 1.78)            | 0.641 |
| Social Adversity                   |                                |       |                                |       |
| Does not have a birth certificate  | 1.19 (0.44, 3.25)            | 0.726 | 1.08 (0.38, 3.11)            | 0.884 |
| Caregiver meets child’s needs worse than other households | 0.79 (0.40, 1.58) | 0.500 | 0.84 (0.44, 1.61) | 0.593 |
| Caregiver too sick for daily activities, past month | 0.93 (0.40, 2.19) | 0.870 | 1.13 (0.46, 2.80) | 0.781 |
| Never discussed sex with caregiver |                                |       |                                |       |
| Never discussed HIV/AIDS with caregiver |                                |       |                                |       |
| Educational Attraction             |                                |       |                                |       |
| Currently out-of-school            | 3.22 (1.48, 7.01)            | 0.004 | 2.89 (1.25, 6.67)            | 0.014 |
| Missed any school (n = 298)        | 1.78 (0.62, 5.17)            | 0.281 | 0.73 (0.29, 1.85)            | 0.505 |
| Withdrew from school (n = 387)     | 3.18 (1.48, 6.85)            | 0.004 | 2.31 (1.12, 4.83)            | 0.026 |
| Did not progress in school previous year (n = 324) | 2.39 (0.91, 6.28) | 0.075 | 1.67 (0.63, 4.38) | 0.295 |
| Financial Instability              |                                |       |                                |       |
| Engaged in income-generating activities | 2.48 (1.09, 5.63) | 0.031 | 2.44 (1.00, 5.95) | 0.050 |
| Caregiver could not afford food expenses | 3.39 (1.28, 8.96) | 0.015 | 3.32 (1.28, 8.60) | 0.014 |
| Household less financially secure than others | 0.84 (0.43, 1.68) | 0.624 | 0.87 (0.45, 1.67) | 0.664 |
| Food Insecurity                    |                                |       |                                |       |
| No food in household               | 0.65 (0.28, 1.49)            | 0.303 | 1.13 (0.53, 2.39)            | 0.746 |
| Ate a smaller meal                 | 1.35 (0.58, 3.16)            | 0.481 | 0.69 (0.37, 1.27)            | 0.232 |
| Whole day and night without eating | 0.69 (0.28, 1.73)            | 0.425 | 1.30 (0.64, 2.62)            | 0.464 |
| Skipped a meal                     | 1.20 (0.52, 2.79)            | 0.663 | 1.32 (0.69, 2.55)            | 0.397 |
| Went to bed hungry                 | 1.13 (0.53, 2.40)            | 0.740 | 1.28 (0.62, 2.63)            | 0.495 |

*Adjusted for age

**Table 4.**

Unadjusted and adjusted relative risk ratios (RRR) of early (before age 15) and later (at or after age 15) sexual debut derived from multinomial logistic regression, by demographic and protective deficit factors, among older (ages 15–17) orphaned and vulnerable children (N = 392)
|                                      | Later (15+) Sexual Debut (vs. No Sexual Debut) | Early (<15) Sexual Debut (vs. No Sexual Debut) |
|-------------------------------------|-----------------------------------------------|-----------------------------------------------|
|                                     | Unadj. RRR (95% CI)   | P         | Adj. RRR* (95% CI) | P         | Unadj. RRR (95% CI) | P         | Adj. RRR* (95% CI) | P         |
| Deaths in the household, past year | 1.02 (0.41, 2.54)     | 0.968     | 0.58 (0.22, 1.55)  | 0.274     |                     |          |                     |          |
| New household members, past year    | 1.18 (0.55, 2.56)     | 0.665     | 0.79 (0.32, 1.93)  | 0.597     |                     |          |                     |          |
| Household has insufficient shelter protection | 1.24 (0.39, 3.94) | 0.709     | 1.68 (0.64, 4.41)  | 0.289     |                     |          |                     |          |

* Model adjusted for all covariates presented in the column.

§ Covariate excluded from multivariable model due to multicollinearity.