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HIV Infection and Related Risk Behaviors: Does School Support Level the Playing Field between Orphans and Non-orphans in Zimbabwe?

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Abstract

Research is limited on whether providing school support to female adolescent orphans mitigates their HIV risk disadvantage compared to other female adolescents. This paper examines 2011 Zimbabwe Demographic and Health Survey (ZDHS) HIV-related biomarker and behavior data for orphaned and non-orphaned rural adolescent females to compare findings from a similar sample participating in a randomized controlled trial (RCT) testing school support as HIV prevention. HIV status, marriage, pregnancy, sexual debut, school dropout, years of schooling, and socioeconomic status were analyzed with the combined datasets. Bivariate analyses compared variables between RCT comprehensive intervention and delayed partial intervention conditions, and between ZDHS orphan and non-orphan groups. Multivariable analyses included a series of group comparisons as follows: ZDHS orphans vs ZDHS non-orphans; RCT orphans in each condition vs. ZDHS non-orphans; RCT orphans in each condition vs. ZDHS orphans. Analyses methods accounted for the complex survey sampling design within each dataset. A total of 751 observations were included. All orphan groups had consistently higher odds of HIV infection than ZDHS non-orphans. ZDHS orphans had higher odds of marriage, pregnancy and sexual debut than ZDHS non-orphans. Comprehensive intervention participants had lower odds of marriage, sexual debut and school dropout than ZDHS non-orphans. RCT participants in both conditions had lower odds of marriage, sexual debut and school dropout than ZDHS orphans. The findings indicate that orphans are at a distinct disadvantage to HIV risk compared to non-orphans, and much of this is likely related to vertical transmission. We found no evidence that provision of school fees to orphans will reduce their risk of HIV infection relative to non-orphans but further evidence that such programs may reduce risk behaviors including early sexual debut, child marriage and school dropout. Further research is needed to determine how these programs can be sustainably scaled-up in resource-limited settings.

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Introduction

Despite a decline in HIV prevalence over the past decade, the proportion of Zimbabwe children who are orphans remains high (Rusakaniko, Chikwasha, Bradley, & Mishra, 2010). Among all children (under 18 years), 21% are orphans (one or both parents dead); by ages 15-17 years, the proportion rises to 41% (ZIMSTAT & ICF International, 2012). Studies in sub-Saharan Africa suggest that adolescent orphans, compared to non-orphans, are more likely to comprise the poorest households (Luseno, Singh, Handa, & Suchindran, 2014), drop out of school and have lower educational achievement/attainment (Case & Ardington, 2006; Yamano, Shimamura, & Sserunkuuma, 2006), engage in earlier sexual behavior, and be infected with HIV (Operario, Underhill, Chuong, & Cluver, 2011). Orphan girls are especially vulnerable to HIV compared to both orphan boys and non-orphan girls (Operario, Pettifor, Cluver, MacPhail, & Rees, 2007).

Previous studies show that higher educational attainment and/or school attendance is significantly associated with later sexual debut, marriage and child-bearing (Fortson, 2008; Hargreaves et al., 2008; Palermo & Peterman, 2009; Pettifor, et al. 2008) and that structural interventions of financial support to help adolescent girls stay in school may reduce HIV risk (Baird, Garfein, McIntosh, and Ozler, 2012). Increasing access to education for adolescent orphan girls has been shown to reduce HIV risk behaviors in Zimbabwe (Hallfors et al., 2011; Hallfors et al., 2015). If, as the literature suggests, adolescent orphan girls are systematically disadvantaged relative to their non-orphan counterparts, then policies to assist orphan girls with school fees, especially in sub-Saharan countries, may be justified.

The current paper uses a novel approach to examine whether providing school support to adolescent orphan girls reduces the odds of HIV infection and HIV-related risk behaviors compared to non-orphans. To make our comparison, we use data from a school support randomized controlled trial (RCT) and the 2011 Zimbabwe Demographic and Health Survey (ZDHS), a nationally representative household survey. This was not possible with trial data alone since only orphans were enrolled.

Methods

Study procedures and measures for the RCT and 2011 ZDHS are described in detail elsewhere (Hallfors et al., 2011; Hallfors et al., 2013; Hallfors et al., 2015; Miller et al., 2013; ZIMSTAT & ICF International, 2012). Briefly, RCT participants were orphan girls in the sixth grade from 25 primary schools in a rural Shona-speaking province of Zimbabwe. The intervention group (N=183 in 13 schools) received comprehensive school support including fees, uniforms, and school supplies from 2007-2010. The control group (N=145 in 12 schools) did not receive any school support. After the 2007 baseline, three annual surveys were administered (Hallfors et al., 2013).

Starting in January 2011, control group participants were offered school fees only (delayed partial intervention), while the intervention group continued with comprehensive school support (comprehensive intervention). A two year extension of the study allowed one final survey, including biomarker HIV and HSV-2 data, to be collected in 2012. Relevant ZDHS items (see measures below) were added to the RCT survey for comparability. A total of 287 RCT participants (88% of the original sample, with similar proportions in each condition) completed the survey. HIV biomarkers for the RCT were collected and analyzed (Luseno et al., 2014) by the Zimbabwe National Microbiology Reference Laboratory, which also collected and analyzed the 2011 ZDHS HIV biomarkers using the same procedures. Protocols for both studies were approved by appropriate institutional review boards in Zimbabwe and the US.

For matching purposes, we limited the ZDHS sample to rural Shona-speaking females 15-17 years. Although RCT participants range in age from 15-21 years, ZDHS participants > 18 years were not asked about orphan status. We also excluded ZDHS participants with less than five years of education, since all RCT participants were in Grade 6 at baseline. The resulting ZDHS sample size was 464 females (201 orphans, 263 non-orphans).

Dependent variables included ever married, ever pregnant, HIV status, ever had sex (sexual debut), school dropout, years of schooling and SES. The independent variable of interest was group membership, that is, comprehensive intervention and delayed partial intervention in the RCT and non-orphans and orphans in the 2011 ZDHS. Control variables included age, religion and SES. Study purpose was to compare the four groups, rather than generating population level estimates. Analyses took into account complex sampling designs, including clustering, within each dataset.

Bivariate analyses (chi-squared and t tests) were conducted to examine differences between the two RCT conditions and between ZDHS non-orphan and orphan groups. In multivariable analyses, each of the two RCT conditions and the ZDHS orphans were first compared to the ZDHS non-orphans (Model 1). Then, the two RCT conditions were compared to the ZDHS orphans (Model 2). The SES index was included as a control variable in all multivariable models except in one regression where it was the dependent variable. We conducted sensitivity analyses with the RCT subsample restricted to age 15-17 years to check the robustness of our results. We also conducted un-weighted analyses for comparison. All analyses were conducted using SAS 9.3 (SAS Institute, 2002-2010) survey procedures.

Results

Analyses included a total of 751 observations. The mean age in the RCT sample was about one year older than the ZDHS sample, with a wider age range; mean SES for the RCT sample was also higher and they were less likely to be Apostolic (Table 1). ZDHS non-orphans were significantly less likely to be HIV positive and to report sexual debut, ever married, and ever pregnant compared to ZDHS orphans. Similarly, the comprehensive intervention group was less likely to report sexual debut, ever married, ever pregnant, and school dropout than the delayed partial intervention group, and also had significantly higher mean years of schooling and SES.

All orphan groups (i.e., ZDHS orphans, and both RCT conditions) had significantly higher odds of HIV infection than ZDHS non-orphans (Table 2, Model 1; marginal for delayed partial intervention group). ZDHS orphans also had significantly higher odds of marriage, pregnancy and sexual debut than ZDHS non-orphans. Comprehensive intervention participants had significantly lower odds of marriage, sexual debut and school dropout than ZDHS non-orphans. Delayed partial intervention participants also had lower odds of school dropout than ZDHS non-orphans.

Participants in both RCT conditions had significantly lower odds of marriage, sexual debut and school dropout than ZDHS orphans (Table 2, Model 2). Comprehensive intervention participants also had significantly lower odds of pregnancy than ZDHS orphans. There were no significant differences in HIV infection between orphan groups.

The comprehensive intervention group had significantly more years of schooling and higher SES relative to both the ZDHS non-orphans (Table 3, Model 1) and orphans (Table 3, Model 2). The delayed partial intervention group had significantly higher SES than the ZDHS orphans. Similar results were obtained from the sensitivity and un-weighted analyses.

Discussion

We examined whether providing orphan girls with comprehensive or delayed partial school support reduced orphan girls' odds of HIV infection and risk behaviors relative to a sample of comparable non-orphans and orphans. Although the RCT sample was almost a year older on average, we found that they were less likely to engage in sexual risk behaviors compared to ZDHS orphans. Moreover, the comprehensive intervention condition had better behavioral and SES outcomes compared to ZDHS non-orphans, while the delayed partial intervention group exhibited outcomes that were largely similar to the non-orphans.

All orphan groups, however, had higher risk for HIV infection compared to the non-orphans. This finding supports previous research (e.g., Eaton et al., 2013; Ferrand et al., 2010) that a sizeable proportion of sub-Saharan children infected with HIV through mother-to-child transmission (MTCT) are surviving to adolescence, albeit as orphans. While comprehensive, and even partial, school support reduced HIV risk behaviors, we did not see parallel reductions in HIV prevalence.

About a third of HIV positive young women in both RCT study conditions were HSV-2 negative and reported never marrying, never being pregnant and never having sex (Hallfors et al., 2015). This suggests that much of the difference in HIV prevalence among female orphans compared to non-orphans in Zimbabwe may be related to MTCT, but due to measurement error in both biological and self-reported survey data, these findings are not definitive. Other reasons for the lack of intervention effect may include inadequate power to estimate intervention effect on HIV.

Limitations of our study include the use of pooled data from two different studies. The RCT was a longitudinal study conducted in the Manicaland Province of Zimbabwe, while the ZDHS was a national cross-sectional epidemiological study. Because we limited the ZDHS sample to adolescents ages 15-17, the RCT participants were on average about a year older

than the ZDHS respondents. Age odds ratios (Table 2), however, indicate that advancing age greatly increases risk behaviors, suggesting present findings are conservative. Likewise, the difference in mode of data collection, i.e., self-administration by RCT participants vis-à-vis interviewer administration in the ZDHS, suggests ZDHS participants would be more likely to under-report these sensitive behaviors.

In conclusion, present findings suggest that in resource-limited sub-Saharan countries with a high prevalence of orphans, policies that provide a modest level of school support to adolescent orphan girls may have a substantial effect on reducing HIV-related risk behaviors, and may help to level the playing field on key outcomes, compared to non-orphans.

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Table 1

Descriptive statistics of study sample by group membership

	ZDHS				RCT[1]		
	Overall (N=751)	**Non-orphans (N=263)**	**Orphans (N=201)**	**p-value**	**Comprehensive intervention (N=161)**	**Delayed partial intervention (N=126)**	**p-value**
Covariates							
Mean Age (Std Dev.)	16.32 (0.94)	15.95 (0.79)	16.00 (0.76)	0.542	16.82 (0.93)	16.97 (0.91)	0.196
Age Range	14.5-20.6	15.0-17.0	15.0-17.0		14.5-20.1	15.1-20.6	
Apostolic Religion	335 (45%)	139 (53%)	94 (47%)	0.212	55 (34%)	47 (37%)	0.581
HIV risk indicators							
HIV Status	22 (3%)	3 (0.9%)	8 (4%)	0.017	7 (4%)	5 (4%)	0.863
Sexual Debut	154 (21%)	46 (17%)	55 (27%)	0.011	23 (14%)	30 (24%)	0.039
Ever Married	137 (18%)	40 (15%)	50 (25%)	0.009	18 (11%)	29 (23%)	0.007
Ever Pregnant	107 (14%)	25 (10%)	35 (17%)	0.012	19 (12%)	28 (22%)	0.018
School Dropout	232 (31%)	92 (35%)	86 (43%)	0.087	17 (11%)	37 (29%)	<0.0001
Mean Years of Schooling (Std Error)	8.82 (1.54)	8.63 (1.59)	8.56 (1.68)	0.634	9.51 (1.06)	8.74 (1.49)	<0.0001
Years of Schooling Range	5-13	5-13	5-11		5-10	5-10	
Mean SES (Std Error)	5.72 (2.71)	5.39 (2.63)	5.15 (2.42)	0.317	6.71 (2.87)	6.04 (2.72)	0.046
SES Range	0-14	0-13	0-12		1-14	0-12	

[1] All study participants were orphans.

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Table 2

Associations between group membership and dichotomous outcomes

	HIV AOR[1] (CI)[2]	Sex debut AOR (CI)	Ever married AOR (CI)	Ever pregnant AOR (CI)	Dropout AOR (CI)
Age	1.12 (0.72 1.72)	2.38*** (1.86 3.03)	2.61*** (1.98 3.44)	2.93*** (2.16 3.96)	1.92*** (1.55 2.37)
Apostolic religion (ref=Other Christian)	1.62 (0.66 3.96)	2.88*** (1.85 4.46)	3.26*** (2.02 5.26)	2.29*** (1.39 3.80)	2.42*** (1.65 3.55)
SES[3]	1.03 (0.87 1.23)	0.93† (0.85 1.01)	0.93 (0.86 1.01)	0.95 (0.86 1.04)	0.85*** (0.78 0.92)
Model 1 Group Membership (ref=ZDHS[4] non-orphan)					
ZDHS orphan	5.96* (1.19 29.78)	2.07** (1.25 3.42)	2.22** (1.30 3.80)	2.17* (1.24 3.79)	1.45 (0.92 2.28)
Comprehensive intervention	6.27* (0.98 40.11)	0.47** (0.25 0.91)	0.38*** (0.19 0.75)	0.57 (0.26 1.25)	0.14*** (0.08 0.26)
Delayed partial intervention	5.59† (0.86 36.25)	0.84 (0.44 1.60)	0.91 (0.47 1.75)	1.22 (0.59 2.54)	0.48** (0.28 0.83)
Model 2 Group Membership (ref=ZDHS orphan)[5]					
Comprehensive intervention	1.05 (0.32 3.49)	0.23*** (0.12 0.43)	0.17*** (0.09 0.33)	0.26*** (0.12 0.56)	0.10*** (0.05 0.19)
Delayed partial intervention	0.94 (0.29 3.16)	0.41** (0.22 0.77)	0.41** (0.26 0.77)	0.56 (0.28 1.14)	0.33** (0.18 0.60)

[1] Adjusted Odds Ratio

[2] 95% Confidence Interval

[3] Socio-economic status

[4] Zimbabwe Demographic and Health Survey

[5] ZDHS non-orphans were included in Model 2 analyses with findings equivalent to Model 1.

† $p < 0.10$

* $p \leq 0.05$

** $p \leq 0.01$

*** $p \leq 0.001$

Table 3

Associations between group membership and continuous outcomes

	Years of schooling coefficients	se[1]	SES coefficients	se
Age	0.07	0.08	−0.01	0.13
Apostolic religion (ref=Other Christian)	−0.32**	0.12	−0.93***	0.21
SES	0.15***	0.02		
Model 1 Group Membership (ref=ZDHS non-orphan)				
ZDHS orphan	−0.10	0.17	−0.35	0.26
Comprehensive intervention	0.52***	0.15	1.08***	0.33
Delayed partial intervention	−0.15	0.19	0.44	0.35
Model 2 Group Membership (ref=ZDHS orphan)				
Comprehensive intervention	0.62***	0.17	1.42***	0.33
Delayed partial intervention	−0.05	0.20	0.79*	0.35

* $p \leq 0.05$

** $p \leq 0.01$

*** $p \leq 0.001$

[1] Standard error