

# Are Female Orphans at Risk for Early Marriage, Early Sexual Debut, and Teen Pregnancy? Evidence from Sub-Saharan Africa

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*Female orphans are widely cited as being at risk for early marriage, early childbearing, and risky sexual behavior; however, to date no studies have examined these linkages using population-level data across multiple countries. This study draws from recent Demographic and Health Surveys from ten sub-Saharan African countries to examine the relationship between orphanhood status and measures of early marriage, early sexual debut, and teen pregnancy among adolescent girls aged 15 to 17. Results indicate that, overall, little association is found between orphanhood and early marriage or teen pregnancy, whereas evidence from seven countries supports associations between orphanhood and early sexual debut. Findings are sensitive to the use of multivariate models, type of orphan, and country setting. Orphanhood status alone may not be a sufficient targeting mechanism for addressing these outcomes in many countries; a broader, multidimensional targeting scheme including orphan type, schooling, and poverty measures would be more robust in identifying and aiding young women at risk. (STUDIES IN FAMILY PLANNING 2009; 40[2]: 101–112)*

The transition to adulthood is a crucial time when a series of important life events may occur, including sexual debut, marriage, and childbearing. Millions of adolescent girls make these transitions every year, yet many do not have exclusive control over the decisions involved and are forced into early transitions. Across the developing world, adolescent marriage rates remain high, despite evidence linking sexual debut and early marriage to a wide range of adverse outcomes, including low levels of schooling, risk of HIV infection, intimate partner violence, maternal and infant mortality, and poverty (Jensen and Thornton 2003; Bruce and Clark 2004; Clark 2004; Nour 2006; Jain and Kurz 2007).<sup>1</sup> Estimates suggest that one in seven girls marries before the age of 15 in developing countries;<sup>2</sup> in Africa 42 percent of girls marry before the age of 18 (UNICEF 2005; Population Council 2007).

Although a variety of studies have examined trends and determinants of early marriage, early sexual debut, and teen pregnancy, few explorations have been undertaken that focus on the linkages to the HIV pandemic and, specifically, whether growing numbers of orphans may be at risk for poor outcomes. Many organizations claim that orphanhood is a potential risk factor, particularly for risky sexual behavior resulting from girls' lack of guidance or economic security; however, empirical analyses documenting this link are few and inconclusive (UNAIDS et al. 2004; Williamson et al. 2004). Therefore, whether these relationships are a function of characteristics unique to orphans or of underlying traits, such as poverty and lack of education, shared by many young, disadvantaged girls, is not clear.

This study seeks to fill this gap in empirical evidence by examining orphanhood status (maternal, paternal, and double) as a determinant for early marriage, early sexual debut, and teen pregnancy, using recent (2003 to 2006) Demographic and Health Surveys (DHSs) from ten sub-Saharan African countries. The population-level data are drawn from a sample of adolescent girls aged 15 to 17 who were interviewed as part of the women's survey of the DHS for each country and can be merged with orphanhood-status data from matching household sur-

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veys. The analysis uses bivariate methods and logit regression to assess the association between the variables ever married, ever had sex, and ever experienced pregnancy and indicators of orphanhood status. This study is the first we are aware of to explore these linkages using developing-country population-level data and to offer cross-country comparisons. Therefore, the usefulness of the study lies in presenting a broad picture of these relationships across sub-Saharan Africa rather than in exploring country-specific mechanisms through which they may occur.

## Literature Review

A growing and inconclusive literature explores how orphans, primarily those in sub-Saharan Africa, may be disadvantaged with respect to human capital outcomes (for schooling outcomes, see Bicego et al. 2003, Case et al. 2004, Beegle et al. 2006, Case and Ardington 2006, Parikh et al. 2007, and Timæus and Boler 2007; for health and nutritional outcomes, see Ainsworth and Semali 2000, Bishai et al. 2003, Crampin et al. 2003, Lindblade et al. 2003, and Miller et al. 2007). Recently, research has begun to consider outcomes during the adolescent ages and how orphanhood may affect decisionmaking and behavior surrounding marriage transitions, sexual debut, and other risky behaviors. The literature points to several pathways through which this linkage may occur. First, households that experience an adult's death may marry off adolescent girls because the families lack resources to invest in alternatives such as the girls' continued education. Likewise, if households are in a position to gain economic benefits from the brideprice paid by the husband's family, they have an additional incentive to marry girls off early, especially those who are not closely related to the household head or primary decisionmaker (Mathur et al. 2003).<sup>3</sup> Early marriage may also be driven by the adolescent girls themselves, who may see it as a way to improve their situation and their quality of life (Oleke et al. 2006). Expectations such as low life expectancy or the belief that marriage protects against having multiple sex partners and thereby against HIV infection may encourage early marriage in communities where HIV is perceived as a significant problem (Bracher et al. 2003; Oleke et al. 2006).

Sexual debut and pregnancy may coincide with marriage for some adolescents, whereas for others they may occur prior to marriage. Orphans without role models or lacking close supervision may be particularly vulnerable to sexual experimentation. Specifically, children who were orphaned as a result of AIDS have been shown to have high levels of psychological distress, including de-

pression, hopelessness, and suicidal thoughts, compared with those who are not orphans. Their distress may lead to poor sexual and other decisionmaking (Makame et al. 2002; Antwine et al. 2005). Adolescent orphans may perceive sexual activity as a way they can gain the love and affection that they may lack at home (Juma et al. 2007). Finally, orphans may be at risk for sexual abuse or transactional sex, which may provide a source of in-kind gifts and/or financial support (Morreireira and Rudd 2000; Muula et al. 2003; Rau 2003). In all of these scenarios, sex is likely to be unprotected and may lead to pregnancy. Generally, these and other hypotheses all point to reasons why orphans may be at risk for early marriage, early sexual debut, and teen pregnancy. Many of these pathways are complex, however, and likely will vary with differences in the financial and behavioral situations in the households fostering orphans and with differences in the individual characteristics of the orphans.

Few rigorous empirical studies have examined the associations between orphanhood and early marriage, early sexual debut, or teen pregnancy. Beegle and Krutikova (2007) use longitudinal data from the Kagera region in Tanzania and find that, for girls, the loss of a father before the age of 15 translates into a 25 percent increase in likelihood that they will marry by ages 17 to 23. In contrast, the authors find that neither paternal nor maternal orphanhood has an effect on timing of marriage for young men. In rural Kenya, Yamano and Jayne (2004) find that the death of an adult male is associated with an out-migration of females, which suggests that marriage may function as a coping mechanism for previous household mortality.

The association between orphanhood and sexual debut and risky sexual behaviors is supported by additional evidence. Hallman's study (2006) using a two-year panel in KwaZulu-Natal, South Africa, finds that adolescent orphans aged 14 to 22 are three times more likely than nonorphans to experience sexual debut between panel rounds and that this effect is greater for females than for males. Generally, significance does not carry over, however, to such additional risk factors as condom use at last sex, secondary abstinence, or sex with multiple partners. Using cross-sectional data from the same study in KwaZulu-Natal, Thurman and her colleagues (2006) find orphans to be 1.5 times more likely than nonorphans ever to have engaged in sex, and to have experienced sexual debut at an earlier age. Gregson and his colleagues (2005) find that adolescent girls aged 15 to 18 in eastern Zimbabwe who are maternal orphans are more likely to be married, to have STI symptoms, to have commenced sexual activity, and to have experienced pregnancy, adjusting for age and sampling clusters.<sup>4</sup> No significant association is found for paternal orphans in the same sample, how-

ever. An evaluation conducted by the Population Council using a sample in the Nyanza district of Kenya suggests that maternal orphans may be particularly vulnerable to a variety of risky sexual behavior. The study uses bivariate methods, however, and thus does not account for potential mediating variables (Juma et al. 2007). Generally these studies show that paternal orphans may be at risk for early marriage, whereas all types of orphans, and primarily maternal orphans, are likely to engage in early sexual experimentation. The study conducted by Gregson and his colleagues (2005) is the only published research we found that specifically examines pregnancy. The authors find a rate of 8 percent who had experienced pregnancy among 15–18-year-old orphans and vulnerable girls versus 2 percent among nonorphans. None of the current literature uses population-level data and offers cross-country comparisons such as are implemented in the analysis that follows. In light of the differences in numbers of orphans and the cultural and economic situations within each country, a larger scope such as is offered here may be essential for gaining understanding of whether orphans are particularly vulnerable to these outcomes.

## Data

The data used in this analysis are taken from the recent DHS surveys for ten sub-Saharan African countries: Benin (2006), Chad (2005), Congo/Brazzaville (2005), Côte d'Ivoire (2005), Lesotho (2004), Malawi (2004), Mozambique (2003), Tanzania (2004), Uganda (2006), and Zimbabwe (2005–06). The DHS is a population-level survey collected by host-country governments with funding and technical assistance from Macro International and USAID.<sup>5</sup> Similarity of the survey instrument allows cross-country comparisons of variables and outcomes selected for this analysis. Because of the changing nature of the HIV pandemic and of the rates of orphanhood, we include only DHS data from the past five years. The sample is limited to females aged 15 to 17, the only age range for which all variables used in this analysis are available. Reproductive health outcomes are available only for women aged 15 to 49, and orphanhood status is available only for children aged 0 to 17.<sup>6</sup> Therefore, countries that collected orphanhood-status data only for those aged 14 and younger are not included.<sup>7</sup> We focus on girls because, typically, they are married at an earlier age than boys and, therefore, are at higher risk of marriage during adolescence. Moreover, pregnancy is measured only for females. The DHS sample sizes for boys aged 15 to 17 are much smaller than those for girls (generally, one-third to one-half the size).

## Empirical Model

The empirical model presented here takes the following specification:

$$(\Pr [\text{Ever married} = 1]) = (\text{Orphan}_i, X_i, X_h, X_c) \quad (1)$$

The probability of having ever been married is a function of orphanhood status, individual-level characteristics  $X_i$  (age, schooling levels, and religion), household-level characteristics  $X_h$  (wealth), and community-level characteristics  $X_c$  (urban and regional indicators). A second set of parallel models is run that disaggregates the indicator of any orphan into type of orphan (maternal, paternal, or double, where the reference category is nonorphan), whereas all other control variables remain the same. Orphans' characteristics are mutually exclusive and are taken from the household questionnaire, which, for every child aged 17 and younger, asks the household head the status of the mother and father. If the respondent's mother has died or her status is unknown, the child is classified as a maternal orphan. Alternatively, if the respondent's father has died or his status is unknown, the child is classified as a paternal orphan. Finally, if both parents have died or the information about both parents is unknown, the child is classified as a double orphan. Whereas the status of "unknown" could be considered a separate category, if the child has virtually no interaction with a parent or parents for purposes of care or support, she is at the same potential disadvantage as a child whose parents are deceased.<sup>8</sup> We are not able to assess whether the parent's death is due to AIDS, a caveat discussed further below. Analysis is run using a logit model; coefficients are reported as odds ratios. A specification identical to Equation 1 is run among the same sample predicting the proportions who have ever had sex and have ever experienced pregnancy. We construct "ever experienced pregnancy" as a combination of three components: equal to one if either (a) the number of children ever born is greater than zero, (b) the girl is currently pregnant, or (c) the girl has ever had a pregnancy that ended in stillbirth, miscarriage, or abortion; and zero otherwise.

## Results

Table 1 displays weighted descriptive statistics for the three dependent variables and the key independent variable (orphanhood type) by country. The proportions of girls ever married range from 7 percent (Lesotho) to 29 percent (Chad), and the proportion reporting ever having had sex is substantially higher than the proportion ever married in every country. Zimbabwe has the lowest

**Table 1** Percentage of girls aged 15–17, by country, according to sexual and reproductive outcomes and orphanhood type, sub-Saharan Africa

Country	(N)	Dependent variable			Type of orphan			
		Ever married	Ever had sex	Ever pregnant	Any	Maternal	Paternal	Double
Benin (2006)	(1,801)	9.9	33.1	10.7	16.3	2.8	11.0	2.8
Chad (2005)	(884)	28.6	31.6	20.8	20.8	6.4	11.1	3.3
Congo (2005)	(914)	9.6	48.4	18.3	17.9	4.4	10.6	2.8
Côte d'Ivoire (2005)	(711)	24.5	61.0	28.2	20.5	4.6	10.5	5.4
Lesotho (2004)	(1,043)	7.0	26.9	7.6	40.2	5.1	25.5	9.6
Malawi (2004)	(1,337)	16.0	31.6	15.0	29.4	4.8	14.9	9.7
Mozambique (2003)	(1,484)	24.9	57.3	23.9	24.4	5.1	15.0	4.3
Tanzania (2004)	(1,375)	13.5	33.5	12.7	19.2	5.6	9.7	4.0
Uganda (2006)	(1,219)	9.4	28.0	10.9	28.6	6.0	16.3	6.4
Zimbabwe (2005–06)	(1,207)	11.5	17.4	8.7	36.4	6.0	19.5	10.8

**Note:** Samples are weighted according to survey weights provided by the DHS sampling framework.

proportion reporting ever having had sex (17 percent), whereas Côte d'Ivoire has the highest proportion (61 percent). The proportion reporting ever having become pregnant ranges from 8 percent (Lesotho) to 28 percent (Côte d'Ivoire). In five of the ten countries, the proportion ever pregnant is smaller than the proportion ever married (Chad, Malawi, Mozambique, Tanzania, and Zimbabwe); in the remaining five, higher proportions have been pregnant than have been married.

The proportion of girls categorized as being an orphan of any type is sizable, ranging from 16 percent (Benin) to 40 percent (Lesotho). Substantial variation by orphanhood type is found across the countries. One clear pattern is that the majority of orphans in each country are paternal orphans. After paternal orphans, the countries are roughly split between those with larger proportions of maternal orphans (Chad, Congo, Mozambique, and Tanzania), those with larger proportions of double orphans (Côte d'Ivoire, Lesotho, Malawi, and Zimbabwe), and two with approximately the same in each category (Benin and Uganda).

Table 2 displays a bivariate analysis of the three outcomes of interest—ever married, ever had sex, and ever pregnant—by composite and disaggregated measures of orphanhood (with nonorphans as the omitted category in both cases). The results show that the indicator for any type of orphan statistically significantly increases the probability of ever having been married in Mozambique, whereas orphanhood type (disaggregated) is statistically significantly associated with early marriage in Benin, Chad, Côte d'Ivoire, and Uganda. As shown in the middle and bottom panels, female orphans aged 15 to 17 are more likely than nonorphans to have experienced sexual debut and to have experienced pregnancy in Mozambique. When disaggregated, significant differences in sexual debut are also found in Benin, Chad, and Côte d'Ivoire. For early pregnancy, the disaggregated measures are sig-

**Table 2** Bivariate analysis showing percentage of adolescent girls aged 15–17 who were ever married, ever had sex, and ever pregnant, by country, according to orphanhood status, sub-Saharan Africa

Outcome variable	Composite measure			Disaggregated measures			
	Non-orphan	Orphan (any type)	p-value	Maternal orphan	Paternal orphan	Double orphan	p-value
<b>Ever married</b>							
Benin	10.5	10.8		6.3	8.5	25.7	**
Chad	27.4	34.2		35.1	21.9	74.0	***
Congo	10.2	7.8		11.4	6.9	5.7	
Côte d'Ivoire	25.2	22.5		36.6	26.9	2.1	*
Lesotho	7.0	6.9		6.2	5.6	11.1	
Malawi	17.1	16.0		13.5	15.3	21.5	
Mozambique	23.1	31.3	*	35.7	30.1	28.7	
Tanzania	13.3	15.4		19.0	16.8	7.0	
Uganda	8.4	11.9		15.8	13.8	3.5	*
Zimbabwe	11.1	12.1		9.6	11.7	14.1	
<b>Ever had sex</b>							
Benin	32.7	33.5		26.1	30.0	57.4	**
Chad	30.6	34.8		37.1	24.3	66.4	**
Congo	48.1	48.8		53.1	47.8	45.6	
Côte d'Ivoire	59.1	67.2		85.1	84.7	17.8	***
Lesotho	24.4	30.3		21.0	29.7	37.0	
Malawi	29.8	35.2		29.9	33.3	40.6	
Mozambique	54.5	65.6	**	66.7	65.8	63.4	*
Tanzania	27.3	29.6		41.0	28.5	21.7	
Uganda	27.3	29.6		41.0	28.5	21.7	
Zimbabwe	16.1	19.5		16.5	19.5	21.0	
<b>Ever pregnant</b>							
Benin	11.4	11.4		7.8	10.5	19.2	
Chad	19.6	25.3		29.2	16.9	46.0	*
Congo	19.0	14.8		18.8	12.0	19.1	
Côte d'Ivoire	29.1	25.4		48.3	26.6	3.7	*
Lesotho	6.5	9.3		2.5	9.5	12.3	
Malawi	14.2	17.0		12.2	18.2	17.4	
Mozambique	22.3	28.9	*	34.1	27.0	29.5	
Tanzania	11.8	16.1		18.6	16.2	12.2	
Uganda	10.7	11.3		13.8	11.7	8.0	
Zimbabwe	9.3	7.7		10.4	7.7	6.3	

\*Significant at  $p \leq 0.05$ ; \*\* $p \leq 0.01$ ; \*\*\* $p \leq 0.001$ .

**Note:** Bivariate comparisons for composite and disaggregated measures both use nonorphan as the omitted category. Samples are weighted according to survey weights provided by the DHS sampling framework.



nificantly different in Chad and Côte d'Ivoire, but differences by orphan type do not carry over for pregnancy in Mozambique. Overall, significant differences are lacking for all three measures across the majority of countries.

Tables 3, 4, and 5 display logit results by country for regressions predicting ever having been married, sexual debut, and ever having experienced pregnancy among our sample of adolescent girls aged 15 to 17. Descriptive statistics by country for all control variables are reported in Appendix Table A1. Table 3 shows that for all countries, when controlling for various demographic characteristics, the composite measure of orphanhood is not statistically significant in predicting early marriage. Table 4 shows that orphanhood is significantly associated with early sexual debut in four of the ten countries examined (Côte d'Ivoire, Lesotho, Mozambique, and Tanzania). Table 5 shows that only orphans in Chad and Côte d'Ivoire are more likely to have experienced a pregnancy. Results for several key control variables in these models are discussed below.

Because early marriage, early sexual debut, and teen pregnancy may be the norm in many of these countries

for orphans and nonorphans alike, we replicate the analysis using alternative measures of the dependent variables: marriage before the age of 15, sexual debut before the age of 15, and childbirth before the age of 15.<sup>9</sup> Because these categories are more stringent than the alternative measures, they are expected to capture a higher level of risk. We hypothesized, therefore, that significant associations between orphanhood status, marriage, and sexual debut would be found in countries where the relationship was previously insignificant. Results (not shown) suggest that on average, however, indicators of orphanhood status become less significant with respect to the second set of dependent variables. The three exceptions are Tanzania, for which the composite orphanhood indicator is significant with respect to marriage before age 15, and Chad and Côte d'Ivoire, for which it is significant with respect to sexual debut before age 15. Because of the low proportions in each category, these analyses are likely not powerful enough to pick up differential effects. In general, this extension does not support the hypothesis that orphans are disadvantaged with respect to transitions into adulthood beyond what is found in the main analysis.

**Table 3** Among adolescent girls aged 15–17, odds ratios from logit regressions for early marriage, by selected characteristics, according to country, sub-Saharan Africa

Characteristic	Benin	Chad	Congo	Côte d'Ivoire	Lesotho	Malawi	Mozambique	Tanzania	Uganda	Zimbabwe
Nonorphanhood (r)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Orphanhood of any type	1.53	1.33	0.84	1.23	0.83	1.08	1.14	1.39	1.58	0.78
Age (years)										
15 (r)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
16	1.84*	3.77**	3.15**	1.08	8.35**	4.38**	2.44**	3.57**	2.75**	4.16**
17	6.36**	7.89**	4.24**	1.96**	15.83**	14.39**	5.18**	13.91**	13.39**	8.38**
Education										
None	4.09**	1.25	1.93	1.28	6.59	1.97	2.44**	3.93**	1.26	0.00
Incomplete primary (r)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Completed primary	0.52	0.40	1.14	0.52	1.01	0.70	1.37	1.37	0.68	1.44
Incomplete secondary+	0.44	0.29**	1.08	0.98	0.67	0.24**	0.21**	0.00	0.36*	0.35**
Religion										
Protestant (r)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Catholic	0.49*	1.63	0.85	0.72	1.39	1.03	0.87	0.64	1.06	0.44
Muslim	0.32**	3.68*	5.18	1.15	na	1.53	1.22	0.86	2.66**	0.00
Other	0.74	1.90	1.33	1.30	0.00	2.29	0.75	1.50	1.77	1.83
Wealth quintile										
First	4.80**	0.49	2.19	3.58**	11.84**	2.29*	2.64**	1.81	5.17**	5.74**
Second	4.54**	0.65	2.59	2.26	7.08**	4.84**	1.87*	2.16	2.97*	9.00**
Third	4.30**	0.72	2.16	2.69**	6.01**	2.33**	1.72	1.43	2.59*	4.36*
Fourth	2.92	0.93	2.35**	1.94	3.92*	2.17*	1.81**	1.05	1.90	5.91**
Fifth (r)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Urban–rural residence										
Rural (r)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Urban	0.46*	0.67	1.10	0.89	0.67	1.88*	0.76	1.16	2.15	1.10
χ <sup>2</sup> for regional indicators	24.35*	21.83**	7.81	5.69	6.50	8.71*	44.18**	45.11**	14.06	9.37
χ <sup>2</sup> for ethnic indicators	17.80	18.50	na	na	na	9.17	na	na	na	na
Pseudo R-squared	0.37	0.22	0.09	0.08	0.17	0.20	0.20	0.31	0.22	0.19
(N)	(1,801)	(884)	(914)	(711)	(1,043)	(1,337)	(1,484)	(1,375)	(1,219)	(1,207)

\*Significant at  $p \leq 0.05$ ; \*\* $p \leq 0.01$ . na = Not available.

**Notes:** Standard errors (not shown) are clustered at the primary sampling unit level. They are available from the authors upon request. Regional and ethnicity controls (where available) are included but are not shown above.

**Table 4** Among adolescent girls aged 15–17, odds ratios from logit regressions for sexual debut, by selected characteristics, according to country, sub-Saharan Africa

Characteristic	Benin	Chad	Congo	Côte d'Ivoire	Lesotho	Malawi	Mozambique	Tanzania	Uganda	Zimbabwe
Nonorphanhood (r)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Orphanhood of any type	1.04	1.32	1.20	2.08**	1.51**	1.23	1.46**	1.42*	1.30	0.98
Age (years)										
15 (r)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
16	1.61**	3.07**	2.64**	1.69*	2.75**	2.41**	2.60**	2.32**	2.08**	2.22**
17	4.00**	7.98**	4.72**	2.35**	6.59**	6.09**	7.80**	5.22**	5.17**	6.36**
Education										
None	1.11	1.45	1.16	0.75	3.44	1.11	1.69**	2.20**	0.76	0.00
Incomplete primary (r)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Completed primary	1.07	0.61	1.50	0.99	1.07	1.14	1.95	1.02	1.46	1.25
Incomplete secondary+	1.10	0.43**	1.39	1.51	0.89	0.68	0.58**	0.27**	0.86	0.40**
Religion										
Protestant (r)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Catholic	1.08	1.36	0.98	0.84	0.88	0.97	1.27	1.13	1.15	0.59
Muslim	0.90	3.11*	0.42	0.66	na	1.21	0.77	1.23	0.98	2.71
Other	0.81	1.39	1.27	1.26	0.00	1.08	1.60	1.81	1.81	1.68
Wealth quintile										
First	1.22	0.57	2.04	3.19**	2.11*	1.65*	1.61	1.27	1.29	2.76*
Second	1.28	0.79	1.31	3.74**	2.11*	1.77*	1.46	1.32	1.20	3.61**
Third	1.06	0.94	1.43	3.83**	1.21	1.26	1.24	0.99	1.29	2.34
Fourth	1.01	0.99	2.04**	1.80*	1.30	1.26	1.59*	0.91	1.21	3.08**
Fifth (r)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Urban–rural residence										
Rural (r)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Urban	1.01	0.82	1.31	0.80	0.99	1.06	1.32	1.62*	1.44	1.36
$\chi^2$ for regional indicators	42.93**	24.35**	10.43*	12.37	41.57**	37.68**	57.36**	152.14**	36.63**	11.22
$\chi^2$ for ethnic indicators	11.54	20.29	na	na	na	3.54	na	na	na	na
Pseudo R-squared	0.10	0.21	0.09	0.10	0.14	0.13	0.15	0.24	0.11	0.14
(N)	(1,801)	(883)	(913)	(711)	(1,042)	(1,336)	(1,484)	(1,374)	(1,218)	(1,206)

\*Significant at  $p \leq 0.05$ ; \*\* $p \leq 0.01$ . na = Not available.

**Notes:** Standard errors are clustered at the primary sampling unit level (not shown). They are available from the authors upon request. Regional and ethnicity controls (where available) are included but are not shown above.

**Table 5** Among adolescent girls aged 15–17, odds ratios from logit regressions for pregnancy, by selected characteristics, according to country, sub-Saharan Africa

Characteristic	Benin	Chad	Congo	Côte d'Ivoire	Lesotho	Malawi	Mozambique	Tanzania	Uganda	Zimbabwe
Nonorphanhood (r)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Orphanhood of any type	1.19	1.69*	0.86	1.69*	1.20	1.18	1.14	1.54	1.12	0.85
Age (years)										
15 (r)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
16	1.81*	4.27*	3.26**	0.98	3.96**	4.46**	2.19**	2.71**	4.54**	3.53**
17	6.47**	12.68**	4.97**	1.81**	8.31*	12.90**	5.99**	9.18**	15.15**	9.56**
Education										
None	2.58**	2.29*	1.26	1.22	5.32	1.19	1.89**	2.22**	0.58	0.00
Incomplete primary (r)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Completed primary	1.47	0.29	0.96	0.80	1.16	0.59*	1.75	0.85	1.70	1.12
Incomplete secondary+	0.60	0.48	0.82	0.96	0.96	0.36**	0.34**	0.04**	0.55	0.47**
Religion										
Protestant (r)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Catholic	0.90	2.20	1.08	0.51*	0.99	0.94	1.26	1.27	1.18	0.36
Muslim	0.87	3.80**	2.80	0.73	na	1.79	1.08	1.56	1.82	4.47
Other	0.98	3.52	1.18	1.11	0.00	0.00	1.01	1.85	1.61	1.48
Wealth quintiles										
First	2.92*	0.52	2.36	3.61**	6.99**	1.15	2.17**	1.40	3.08**	5.39*
Second	3.20**	0.62	2.48*	3.39**	4.36**	2.67**	1.78*	1.41	1.14	8.4**
Third	3.60**	1.12	2.59**	3.03**	3.71*	1.47	1.45	1.51	1.54	3.83*
Fourth	2.82*	1.22	1.97*	2.31*	1.94	1.03	1.62**	0.87	1.11	7.03**
Fifth (r)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Urban–rural residence										
Rural (r)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Urban	0.55**	0.78	1.21	0.91	0.97	1.05	1.40	1.21	1.36	0.66
$\chi^2$ for regional indicators	23.14*	16.62*	6.59	8.60	9.57	8.63*	15.36	33.82	13.48	15.28
$\chi^2$ for ethnic indicators	10.28	26.20*	na	na	na	10.56	na	na	na	na
Pseudo R-squared	0.25	0.25	0.09	0.08	0.13	0.17	0.13	0.23	0.17	0.18
(N)	(1,801)	(883)	(913)	(711)	(1,042)	(1,336)	(1,484)	(1,374)	(1,218)	(1,206)

\*Significant at  $p \leq 0.05$ ; \*\* $p \leq 0.01$ . na = Not available.

**Notes:** Standard errors are clustered at the primary sampling unit level (not shown). They are available from the authors upon request. Regional and ethnicity controls (where available) are included but are not shown above.

**Table 6** Among adolescent girls aged 15–17, odds ratios from logit regressions for ever being married, experiencing sexual debut, and experiencing pregnancy, by country, according to orphanhood type, sub-Saharan Africa

Country	(N)	Ever married			Experienced sexual debut			Experienced pregnancy		
		Maternal orphan	Paternal orphan	Double orphan	Maternal orphan	Paternal orphan	Double orphan	Maternal orphan	Paternal orphan	Double orphan
Benin	(1,801)	1.17	0.87	7.31**	0.78	0.80	3.81**	1.23	0.91	2.62*
Chad	(884)	1.17	1.17	2.25	1.03	1.30	1.95	1.42	1.83*	1.75
Congo	(914)	0.93	0.90	0.48	1.15	1.25	1.09	0.90	0.75	1.33
Côte d'Ivoire	(711)	2.06	1.18	0.36	2.86	2.12*	1.22	2.57**	1.60	0.83
Lesotho	(1,043)	0.85	0.70	1.16	0.95	1.54*	1.86**	0.33	1.34	1.52
Malawi	(1,337)	1.13	0.77	1.74*	1.49	0.93	1.78**	1.17	1.09	1.35
Mozambique	(1,484)	1.74*	0.97	1.05	1.52	1.48*	1.34	1.16	0.99	1.15
Tanzania	(1,375)	1.88	1.27	1.03	1.88*	1.15	1.62	2.09	1.30	1.53
Uganda	(1,219)	3.13**	1.77*	0.35	2.18**	1.31	0.74	1.94	1.06	0.70
Zimbabwe	(1,207)	0.87	0.76	0.76	1.06	1.03	0.85	1.10	0.85	0.71

\* Significant at  $p \leq 0.05$ ; \*\*  $p \leq 0.01$ .

**Note:** Standard errors are clustered at the primary sampling unit level (not shown). They are available from the authors upon request. The reference category for all cells is nonorphan. Control variables include age, education and religion indicators, wealth quintiles, urban residence, and regional and ethnic indicators (where available).

Table 6 displays a summary of regressions parallel to those in Tables 3, 4, and 5, replacing the composite measure of “any orphan” with disaggregated measures (maternal, paternal, and double orphan). Female double orphans aged 15 to 17 in Benin and Malawi are more likely than nonorphans to ever have been married. In Uganda, female maternal and paternal orphans and in Mozambique female maternal orphans are more likely than nonorphans to have been married. Results for early sexual debut reveal significant findings for seven of the ten countries. In Lesotho, associations are found for female double and paternal orphans, whereas in the remaining six countries, maternal orphans only (Tanzania and Uganda), paternal orphans only (Côte d'Ivoire and Mozambique), or double orphans only (Benin and Malawi) are significantly more likely than nonorphans to have engaged in early sexual activity. Having experienced pregnancy is associated with double orphanhood in Benin, with paternal orphanhood in Chad, and with maternal orphanhood in Côte d'Ivoire.

## Discussion

We find little evidence that female orphans aged 15 to 17 as a composite group are at higher risk for early marriage across the sub-Saharan African countries considered in this analysis; higher risk is found in one country when using bivariate analysis, and in none when sociodemographic variables are controlled for. Moreover, in only four of the ten countries are any of the three disaggregated orphanhood types exposed to higher risk of marriage. These findings suggest that either female orphans are similar to other adolescents in the challenges they face regarding marriage transitions, or that they face a set of challenges that offset each other in relation to timing of marriage. For example, in addition to the factors that may

hasten marriage for adolescent orphans, several factors may delay marriage transitions. Orphans may face stigmatization from their peers and other families because of their connection or suspected connection to an HIV-related death (Gilborn 2002; Castle 2004; Cluver and Gardner 2007). In the case of a traditional marriage negotiation, orphans may lack a guardian to arrange the contract or find a suitable match, thus delaying marriage. If adolescents are of working age, they may be retained by families that have recently experienced a prime-age death in order to contribute to the family's income or to help with childcare and housework. Finally, as Yamano and Jayne (2004) found in Kenya, households may respond to death through out-migration or by sending family members to other households. Such a change in location may delay the marriage transition as young girls are exposed to a different environment with varying expectations about their roles within unfamiliar households and changes in their pool of potential husbands. Little research has been published, however, investigating these mechanisms and the circumstances under which they may offset risk factors for orphans in their marriage transitions; therefore, attributing the lack of significance to one or more of these factors is difficult.

We find greater evidence supporting the hypothesis that orphans are at risk for early sexual debut. Our bivariate analysis identifies one higher-risk country out of ten, but our logit regressions identify four—three of which have highly significant associations. Moreover, in seven of the ten countries, at least one of the three disaggregated orphanhood types faces elevated risk of early sex, as shown in the logit regressions. Among the three countries with no significant association between any of the three orphanhood types and early sexual debut (Chad, Congo, and Zimbabwe), no clear trend is found, which suggests that this lack of significance may be driven by fewer ado-

lescents overall who have experienced sexual debut, or fewer orphans in the sample overall. Several possibilities may partially explain the lack of significance in these three countries, however. Having an HIV-positive parent could promote adolescents' positive decisionmaking as a result of their increased knowledge and sensitivity concerning risky sexual behaviors. In a study conducted in Uganda among HIV-positive parents, 68 percent thought that disclosure of their HIV status would promote better decisionmaking among their children (Gilborn et al. 2001). Whether parents do, in fact, disclose or discuss HIV status and sexual behavior with their children in those cases where a parent dies of AIDS is unclear, especially in cultures where talking about sex is taboo. For example, in the Ugandan study, only 43 percent of HIV-positive parents reported having spoken to their children about their condition, citing uncertainty about how to discuss the topic (Gilborn et al. 2001). Narratives from Zimbabwe showed that although teens wished to talk about a parent's illness and death, caregivers and surviving parents were often ill prepared or unequipped to communicate with teens and provide them with emotional support (Wood et al. 2006). A randomized control study of a coping-skills intervention in the United States among HIV-positive parents and their children showed that significantly fewer problem behaviors and sexual partners were reported among the treatment group after two years, and fewer teenage pregnancies had occurred after four years (Rotheram-Borus et al. 2003). This finding suggests that helping adolescents to understand the reasons behind a parental death, communicating with them, and helping them cope with grief may play important roles in lessening the likelihood of their engaging in risky behaviors. Moreover, if others or the orphans themselves suspect that they may be HIV-positive, they may resist engaging in sexual activity for fear of transmission of the infection or disclosure of their status.

Surprisingly, although we find evidence of increased risk of early sexual debut for at least one orphanhood type across the majority of countries, we find associations between pregnancy and the composite measure of orphanhood for only two countries (Chad and Côte d'Ivoire), and for those two plus Benin when disaggregating by type of orphanhood. This finding is consistent with several possibilities. First, although orphans are more likely to engage in early sexual activity, they may not be more likely to engage in frequent sex, thereby increasing their risk of pregnancy only marginally. This situation would be the case if their first sex was a forced encounter or the result of sexual abuse that may not be a regular occurrence. Second, orphans may be more likely to use protection during sex if they are more cautious or more in control of their sexual encounters, compared with adolescents who have not experienced a parental death,

especially if they are concerned or informed about HIV. Hallman (2006) finds no differences, however, in condom use at last sex or in number of sexual partners by orphanhood type among adolescents in South Africa.

The influence of two control variables—wealth and urban residence—is worth highlighting. These two indicators are widely believed to vary with orphanhood status. Orphans are frequently cited as being vulnerable because they are economically disadvantaged as a result of the loss of one or both parents. In countries where orphans as a group are not associated with adverse marriage and sexual debut outcomes, we might expect to find such associations within a group of relatively poor orphans. Likewise, orphans who live in urban areas are typically viewed as being at increased risk, particularly for sexual abuse, sexual violence, and transactional sex. Our regression results show that although adolescents in the lowest wealth quintile are significantly more likely than those in the highest quintile to be at risk for the three outcomes examined (in seven out of ten countries for early marriage, in six countries for early pregnancy, and in four countries for early sexual debut), adolescents living in urban areas generally do not differ from their rural counterparts for these three outcomes (with the exceptions of Benin and Malawi for early marriage, Tanzania for early sexual debut, and Benin for early pregnancy). To test how poor and urban orphans may differ from others with respect to the outcomes, we ran parallel models adding interaction terms between “any orphan” status and lowest wealth quintile and between “any orphan” status and urban residence.<sup>10</sup> The results of this analysis show that all interaction coefficients between orphanhood and wealth and orphanhood and urban residence are insignificant for all outcomes across all countries with one exception: urban females in Malawi are less likely than their rural counterparts ever to have experienced pregnancy. This extension supports the hypothesis that orphanhood status alone, even when targeted toward poor or urban groups, is not a consistent indicator of risk for adverse outcomes in our sample.

An important contingency to address is uncertainty about the cause of parents' death. In many discussions, the assumption is made that the preponderance of orphanhood in sub-Saharan Africa is due to HIV infection, although there may be other causes. Mortality due to HIV is notoriously hard to identify in developing countries with incomplete registration of deaths. Although we are unable to identify the causes of deaths of the parents in our sample, countries with the highest proportions of orphans included in the study—Lesotho (40 percent), Zimbabwe (36 percent), and Malawi (29 percent)—also have the highest HIV rates, as reported in the *AIDS Epidemic Update* (UNAIDS and WHO 2007). In a cross-country



study conducted in sub-Saharan Africa using DHS data, Bicego and his colleagues (2003) find strong correlations between proportions of orphans younger than 15 and estimated HIV-prevalence rates. Studies conducted using demographic surveillance systems data from Kisesa, Tanzania; Hlabisa, South Africa; and Karonga, Malawi, estimate that AIDS is the leading cause of death in these study areas, accounting for between 60 and 66 percent of deaths among adults aged 15 to 44 in Karonga and 48 and 50 percent of adult deaths in Hlabisa and Kisesa, respectively, for the years analyzed (Boerma et al. 2002; Hosegood et al. 2004 and 2007; Jahn et al. 2005). Based on this evidence, a sizable proportion of orphans identified in our analysis are likely to be AIDS orphans, and we attempt to control for some variations in parental HIV rates by means of regional and urban controls. Clearly, causal mechanisms underlying transitions to adulthood and policy implications for preventing orphanhood vary by parental HIV status and are important areas of further research. Our main conclusions (and their policy and programmatic implications) hold for orphans regardless of the cause of parental death. Although countries with the highest HIV rates in our sample are also those with the largest proportions of orphans (Lesotho, Malawi, and Zimbabwe), these countries do not have consistently significant associations between orphanhood and the outcomes considered. For example, Lesotho has the highest HIV prevalence (24 percent for those aged 15 to 49) in our sample, but orphanhood is significantly correlated only with early sexual debut (MOHSW et al. 2005). Alternately, in Benin, which has a low HIV prevalence (1 percent for those aged 15 to 49), one of the disaggregated measures of orphanhood (double orphanhood) is significantly correlated with all three outcomes (INSAE and Macro International 2007). Likewise, the countries in our sample with the lowest rankings on the Human Development Index (Chad, Côte d'Ivoire, and Mozambique) do not stand out as countries with consistently strong associations.<sup>11</sup> The lack of patterns between HIV prevalence, proportions of orphans, and socioeconomic standing across countries highlights the importance of conducting further research to identify the mechanisms and underlying causes of the outcomes considered here.

One finding we cannot generalize across countries is the type of female orphan at risk for the three outcomes. Although the conventional wisdom would be that double orphans may be at greatest disadvantage in terms of economic, social, and psychological support, our results do not support this hypothesis. Children who have lost one parent may continue to live with their remaining parent, whereas those who lose both may be placed with relatives or other foster households. Our lack of significant findings supporting this hypothesis are not unexpected,

because the literature is divided concerning the effects of type of orphanhood on adverse outcomes. Case and Ardington (2006) find that less money is spent for the education of maternal orphans, compared with that for other children in the household. Timæus and Boler (2007) find that maternal orphanhood does not adversely affect schooling but that paternal orphans progress more slowly in school than other students. With respect to marriage and sexual behavior, other studies find that maternal orphans may be particularly vulnerable, that paternal orphans may be at risk for early marriage, and that all types of orphans are likely to begin being sexually active early (Gregson et al. 2005; Thurman et al. 2006; Juma et al. 2007). Clearly, country-specific behavioral, cultural, and institutional contexts influence adolescent transitions and warrant investigation. Future research that includes orphanhood only as a composite measure may be missing information on risk for specific types of orphans.

Several additional limitations of the study are worth mentioning. First, this analysis examines only adolescent girls between the ages of 15 and 17. Although it is based on population-level data, it does not take into account dynamics among girls of younger and older age groups for which the relationship between orphanhood and outcomes may not be comparable. Second, the data are cross-sectional, precluding a more sophisticated approach using data points for before and after marriage or sexual transition and experience of changes specifically due to orphanhood. For example, information on timing of parental death is unavailable. This information may be important if the timing of orphanhood, specifically during adolescence, initiates sexual exploration because of grief or sudden changes in household structure. In some cases, orphanhood may occur after marriage or sexual debut if girls experienced either transition relatively early in their adolescence. Likewise, we are not able to capture the effect of potential adverse conditions in the period before the parental death, such as struggles to treat or support chronic morbidity. We are unable to control for changes in household wealth among girls who may have moved after marriage; to the extent that wealth differs substantially between households, the measurement contains bias. In addition to measuring current wealth, it is important to recognize that distribution of the benefits of wealth within households may be unequal, especially between orphans and other children with closer biological ties to household heads (Case et al. 2004; Case and Ardington 2006). The analysis does not take into consideration any partner characteristics of adolescent girls within the sample. If a concern exists that the quality of the marriage match and the riskiness of the sexual experience are more important in determining long-term outcomes than the timing of the marriage or sexual debut, this analysis will

miss important pieces of the story. Finally, like data from other household surveys, DHS data do not include information about street children or populations in refugee camps, who may be the most vulnerable to risky behavior and poor outcomes. This sampling limitation may be particularly relevant for the current study if only the orphans who are relatively well to do are placed in households. Therefore, our sample may be expected to reflect the lower bound of the relationship between orphanhood and adverse outcomes within the entire population of adolescent girls aged 15 to 17.

## Conclusion and Policy Implications

As the number of orphans in sub-Saharan Africa making the transition to adulthood increases, policymakers and practitioners must consider orphans' potential vulnerability to adverse outcomes. Although orphanhood has long been understood to be a handicap in achieving human capital outcomes, we find little evidence that orphanhood status or type is associated with early marriage or early pregnancy. By contrast, we find evidence that orphanhood status is associated with early sexual debut. Overall, associations are sensitive to orphanhood type, country setting, and the analytical model used (multivariate versus bivariate). Thus, broad generalizations

that lump categories of orphans or countries within sub-Saharan Africa or that rely on bivariate analysis alone, all of which tend to overestimate the significance of the association, may not be appropriate. Clearly, a need exists for research that addresses the mechanisms that drive these differences (including existing program efforts) and how they may be used for country-specific programmatic or social policy change. For example, if orphans engage in sex earlier because of sexual abuse and forced sex, the programmatic action will differ from that for a scenario in which teens lack supervision or use sex to compensate for the absence of parental support and love. The differences found regarding early sexual debut should not, however, overshadow the finding that large proportions of nonorphans engage in sexual activity, marry early, and experience early pregnancy across all countries. We cannot predict significant associations between orphanhood and the outcome measures from the proportions of orphans in our sample or by underlying HIV-prevalence rates within the sample. Our findings suggest that orphanhood status alone may not be a sufficient targeting mechanism for addressing adverse sexual and reproductive outcomes in many sub-Saharan countries, and that perhaps a broader, multidimensional policy framework—focused on specific types of orphans, schooling, and poverty-alleviation measures—would encourage the delay of sexual debut and reach a larger group of young women at risk.

## Appendix

**Table A1** Percentage of adolescent girls aged 15–17, by selected control variables, according to country, sub-Saharan Africa

Variable	Benin	Chad	Congo	Côte d'Ivoire	Lesotho	Malawi	Mozambique	Tanzania	Uganda	Zimbabwe
Age (years)										
15	35.1	38.6	38.7	38.4	30.9	33.2	34.8	33.3	35.8	31.0
16	33.0	31.4	31.3	27.9	36.9	35.2	34.8	35.2	34.8	40.8
17	31.9	30.0	30.0	33.7	32.2	31.7	30.4	31.5	29.4	28.2
Education										
None	34.6	59.8	3.9	38.7	0.3	4.5	17.1	19.0	2.4	0.0
Incomplete primary	21.7	26.9	31.2	27.2	46.9	66.8	68.3	35.2	64.5	25.3
Completed primary	7.7	2.9	12.2	4.5	21.4	12.3	1.8	36.7	7.4	6.5
Incomplete secondary+	35.5	10.4	52.7	29.6	31.4	16.3	12.8	9.0	25.0	68.0
Religion										
Protestant	25.8	16.6	29.8	28.2	51.3	64.6	53.3	30.8	42.5	80.2
Catholic	34.7	22.7	34.8	25.9	48.4	25.8	29.8	28.6	40.4	10.7
Muslim	21.5	58.7	1.1	29.6	0.0	9.1	16.7	28.2	12.9	0.8
Other	18.0	2.0	11.3	16.3	0.3	0.0	0.2	12.4	4.2	8.2
Wealth quintile										
First	14.8	21.1	17.6	12.5	14.6	15.4	13.1	16.6	14.1	16.2
Second	15.7	18.6	20.0	18.6	20.3	15.5	13.3	19.6	16.4	18.6
Third	17.4	15.9	18.6	12.4	20.2	18.7	15.3	18.2	18.4	20.6
Fourth	21.9	22.5	21.2	21.8	21.4	22.2	24.5	17.5	20.5	20.0
Fifth	30.2	21.9	22.6	34.8	23.6	28.0	33.8	28.0	30.6	24.5
Urban residence	46.0	24.1	56.1	48.1	18.7	18.5	50.3	29.7	16.8	35.7
(N)	(1,801)	(884)	(914)	(711)	(1,043)	(1,337)	(1,484)	(1,375)	(1,219)	(1,207)

**Notes:** Samples are weighted according to survey weights provided by the DHS sampling framework. Categories may not sum to 100 percent because of rounding.

## Notes

- 1 Early marriage is internationally recognized as a violation of human rights, and in various forms it is discouraged in the Universal Declaration of Human Rights (1948); the Convention on Consent to Marriage, Minimum Age for Marriage and Registration of Marriages (1962); the Convention on the Elimination of All Forms of Discrimination against Women (1979); and the Convention on the Rights of the Child (1989) (Nour 2006).
- 2 This statistic excludes China.
- 3 Brideprice (or bridewealth) refers to a transfer from the groom's to the bride's family negotiated prior to the marriage. This transfer is often substantial; a recent study in Zimbabwe found the average brideprice to be four times the average annual household income (Dekker and Hoogeveen 2002).
- 4 Gregson and his colleagues (2005) include vulnerable adolescents in their definition of orphans (those who have a parent who is HIV-positive or seriously ill, or who live in a household that has experienced a death in the past year).
- 5 Funding is provided by USAID-sponsored MEASURE DHS in addition to other international development agencies. Data are available at <<http://www.measuredhs.com>>.
- 6 From the total sample of adolescents aged 15 to 17 in the women's questionnaire, a small proportion were missing status-of-parents data in the household questionnaire. As a result, 49 observations were dropped for Benin, 37 for Chad, 34 for Congo, 39 for Côte d'Ivoire, 10 for Lesotho, 20 for Malawi, 33 for Mozambique, 37 for Tanzania, 11 for Uganda, and 46 for Zimbabwe.
- 7 DHS surveys that collected orphanhood-status data only for those aged 14 and younger, and were thus not eligible for this analysis, include Burkina Faso (2003), Cameroon (2004), Ethiopia (2005), Ghana (2003), Guinea (2005), Kenya (2003), Madagascar (2003–04), Mali (2006), Namibia (2000), Niger (2006), Nigeria (2003), Senegal (2005), and Zambia (2001–02). Rwanda gathered information for older girls but did not have data for sufficient numbers of girls aged 15 to 17 who had ever been married and was, therefore, dropped from the analysis.
- 8 The percentages of girls whose orphanhood status is unknown are small (0.13 in Benin, 0.00 in Chad, 0.00 in Congo, 0.11 in Côte d'Ivoire, 0.47 in Lesotho, 0.07 in Malawi, 0.00 in Mozambique, 0.07 in Tanzania, 0.08 in Uganda, and 0.08 in Zimbabwe). Therefore, we expect the impact of this coding to be negligible.
- 9 Age at pregnancy is only distinguishable for live births, and therefore the dependent variable we use in the under-15 analysis is "gave birth before age 15" and not "ever experienced pregnancy," as is used in the main analysis.
- 10 Results of the models including interaction terms are not presented here; they are available from the authors upon request. Significance levels of interaction terms are computed using the STATA ado file "inteff," which is available online and discussed in Ai and Norton (2003).
- 11 The Human Development Index measures development by combining indicators of life expectancy, educational attainment, and income into a composite score, which measures both social and economic development. For more information, see <<http://hdr.undp.org/en/humandev/hdi/>>.

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