

Understanding Sexual and Reproductive Health Among Orphaned and Separated  
Adolescent Girls in Five Low- and Middle-Income Countries

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Thesis submitted in partial fulfillment of  
the requirements for the degree of  
Master of Science in the Duke Global Health Institute  
in the Graduate School of Duke University

2023

ABSTRACT

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## **Abstract**

Adolescent girls' sexual and reproductive health (SRH) is a significant public health issue, but little is known about the SRH outcomes of orphaned and separated adolescent girls, who face a higher risk of abuse and neglect in the absence of parental guidance, underscoring the critical need for research. This study examines early pregnancy and condom use among adolescent girls aged 16 or older in five low- and middle-income countries (LMICs), including orphaned and separated children. We conducted a cross-sectional analysis of 933 participants from a longitudinal cohort study to assess predictors of these outcomes, first using bivariable regression analysis. Potential predictors included education level, abuse, working status, relationship status, and age. Significant predictors ( $p \leq 0.10$ ) were then added to a multivariable model to assess associations in the presence of other predictors. Education, marital status, history of abuse, work status, and age were significant predictors of early pregnancy in bivariable analysis, but only secondary education, single status, and working in the past week for income were significant predictors in the multivariable analysis. However, we did not find a significant association for condom use with any predictors. It should be noted that the findings may be imprecise due to the small sample sizes of children age-eligible ( $>16$ ) to answer sensitive SRH questions. Further research is needed to draw reliable conclusions.

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## **Acknowledgements**

My deepest gratitude goes out to Dr. Chris Gray, my principal investigator and mentor, for her unwavering support, guidance, and encouragement throughout my academic career. This thesis would not have been possible without her support.

I also want to thank the Duke Global Health Institute and the Center for Health Policy & Inequalities Research for providing me with the resources and support I needed to carry out my research. In addition, I am grateful to the POFO Research Team and the study participants who generously shared their time, expertise, and experiences with the study. It has helped better understand the context and subject matter. Thanks to all the individuals who provided me with support and invaluable feedback throughout the thesis, especially my family and friends, Dr. Joe Egger, and my committee-- Dr. Megan Huchko and Dr. Puffer.

I would like to close by expressing my sincere gratitude to everyone who helped. Your support has been a source of strength and motivation for me, and I am deeply grateful for your contribution.

# 1. Introduction

Globally, more than 147 million children (0–17 years) have lost one or both parents, and millions more have been abandoned or separated (UNICEF DATA, 2022). As of 2021, Sub-Saharan Africa and South Asia had the highest number of orphaned and separated children (OSC), with 54 and 38 million children, respectively. Approximately 15 million children were orphaned due to AIDS-related causes, three quarters of whom live in sub-Saharan Africa (UNICEF DATA, 2022). Children in lower and middle-income countries (LMIC) are at higher risk of orphaning or separation significantly due to HIV/AIDS and other socioeconomic causes (Hosegood et al., 2007; UNICEF, 2008). Moreover, OSCs in LMIC are more likely to experience potentially traumatic events (PTEs) such physical and sexual abuse, which is linked to negative health outcomes, delayed cognitive development, and poor mental health (Gray et al., 2015; Whetten et al., 2009).

Studies suggest a significant association between parental absence, especially paternal, and double orphaning, with experiencing sexual violence (Kidman & Palermo, 2016). Girls who are subjected to child marriage or abuse are more likely to experience unintended pregnancy (*Adolescent Pregnancy*, WHO, 2022). Adolescent girls may be more susceptible to poor reproductive and sexual health outcomes, such as early pregnancy and related maternal morbidities, high-risk sexual behavior, HIV/AIDS, and sexually transmitted infections (STIs), all of which can be disabling or life-threatening given the

high rates of PTEs and potentially resource-limited circumstances, including limited education among OSC in LMIC (Gregson et al., 2005).

Sexual and reproductive ill health is a major cause of morbidity and mortality among young people (WHO, 2001). Although if the global rate of adolescent pregnancies has dropped from about 64.5 births per 1000 women in the early 2000s to 42.5 births per 1000 women in 2021, the actual number of adolescent births still remains high (*Adolescent Pregnancy*, WHO, 2022). In low- and middle-income countries (LMICs), there are nearly 21 million adolescent pregnancies each year, half of which are unplanned, resulting in 12 million births and various health issues for both mother and child (*Adolescent Pregnancy*, WHO, 2022). Adolescents who become pregnant are at higher risk of experiencing complications during pregnancy and childbirth, such as eclampsia, obstetric fistula, and stillbirths (UNFPA, 2017). Additionally, adolescent mothers are more likely to drop out of school or have their income earning potential affected due to childcare, which can limit their future opportunities and worsen the cycle of poverty. Infants born to adolescent mothers are at higher risk of being born prematurely or with a low birth weight, which can lead to long-term health problems. They may also be more susceptible to malnutrition and infectious diseases, particularly if their mothers are unable to provide adequate care due to their young age and limited resources (*Adolescent Pregnancy*, WHO, 2022).

STIs, including curable infections, are prevalent among adolescents, with an estimated 333 million new cases occurring worldwide each year, particularly among 15-24 year old (Dehne & Riedner, 2005). STIs can lead to serious health consequences such as infertility, pregnancy complications, cancer, and chronic pain, among others (CDC, 2023). Safe sex practices, such as using condom, and early detection and treatment can decrease the risk of negative health outcomes related to STIs (CDC, 2023). However, adolescents' use of contraception is generally low, and they are less likely to use condoms than adults or have access to STI services. For girl, the inability to insist on use of condom adds to additional challenge of protected sex. The risk is often higher for those in socially and economically marginalized positions, where sexual activity may occur within a context of coercion, violence, or transactional sex (Dehne & Riedner, 2005). Adolescent behavioral patterns are likely to continue into adulthood, which underscores the significance of education on safe sex practices (CDC, 2023; Dehne & Riedner, 2005)

Currently, there is a lack of literature that addresses this global issue in a cross-cultural setting. This study aims to understand the prevalence of negative sexual and reproductive health outcomes among the OSC compared to non-OSC and identify their predictors. In addition to HIV/AIDS, other socio-economic and environmental factor such as poverty, conflict and displacement can contribute to higher orphaning and separation in LMICs. Children may separate due to violence or displacement, and poverty may pressure

families to abandon their children (*Orphans*, 2023). Children who are separated from their families, displaced by conflict or emergencies, or migrating are also particularly vulnerable to exploitation (CDC, 2014). This high risk of sexual exploitation in Southeast Asia has been highlighted by international organizations as orphanage tourism is rising which provides opportunities for child sex offenders to exploit vulnerable children (Lyneham & Facchini, 2019). Due to events such the pandemic, the recent regional conflicts including in Ukraine, the massive earthquake in Turkey and Syria, and more, many more children have been orphaned and separated potentially exposing more girls to adverse health outcomes and factors with suggested association with poor SRH outcomes such as poverty, malnutrition, lack of education, trauma, and physical or sexual abuse (Hillis et al., 2021; *Orphans*, 2023; Sanadiki, 2023). Understanding the predictors of sexual and reproductive health among adolescent girls, particularly orphaned and separated children in low- and middle-income countries, can contribute to filling a critical knowledge gap and inform the development of more effective interventions or research.

## **2. Methods**

This exploratory cross-sectional study focuses on the latest wave of data collected from a longitudinal cohort. The subsequent includes an overview of the parent study and the sampling procedures employed, followed by a description of the participants included in this analysis.

### ***2.1 Parent Study: Positive Outcomes for Orphans (POFO)***

#### **2.1.A Setting**

The Positive Outcomes for Orphans (POFO) study was conducted across six sites in five LMICs, namely Addis Ababa in Ethiopia, Battambang District in Cambodia, Bungoma District in Kenya, Nagaland and Hyderabad in India, and Kilimanjaro Region in Tanzania. The sites were selected based on their cultural and historical diversity. To facilitate generalizability to other OSCs, children were sampled randomly from community-based and residential-based settings through two-stage cluster sampling. Interviews were conducted at either the homes of the participants or local organizations involved in the research process at each site, and further details about the procedures can be found in the following section.

## **2.1.B Participants**

The study's participants were orphaned and separated children, defined as those who have lost a parent or have been separated from their parents with no hope of reuniting (Whetten et al., 2009). The sample population for the parent study was representative and included 1,356 children living in residential-care, 1,481 children living with families or in community settings, and 300 non-orphaned children, for a total cohort of 3,137 children. These care setting reflect where the study participants grew up. Residentially-based orphans were sampled from randomly selected residential care facilities identified through enumerated lists; up to 20 age-eligible children were randomly selected from each residential care facility. OSC living in families were selected using two-stage, cluster-randomized sampling, with 50 clusters in each site randomly selected, and five age-eligible OSC were selected from each cluster through lists and house-to-house census until five OSC in a cluster were identified. Non-orphans were selected in the same manner as the family-based OSC.

Informed consent was obtained in from the primary caregiver of children under 18 years old, followed by children's assent to participate in the study. Participants and caregivers were explained the study in an age-appropriate manner and given the opportunity to ask questions. The interviewer assessed the subject's competency during the consent process

based on their learning capacity and mental health status. Participants who reached 18 years of age during the study were required to give their consent again.

### **2.1.C Procedures**

The POFO study is an ongoing longitudinal study that followed a cohort of over 3,000 children from five LMICs to examine the impact of traumatic life events, care setting (residential-based or community-based), and cultural setting on the children. The baseline data was collected between 2006 and 2008 from OSCs aged 6-12 years during enrollment, and follow-up data have been collected at least annually from the cohort, who have since transitioned to young adulthood, aged 14 and above. POFO includes data from 11 rounds of data collected over approximately 8 years. For the first three years, seven rounds of data were collected, with follow-ups every six months. Subsequently, rounds of data were collected approximately annually.

Each site had a local NGO or organization with local staff who conducted interviews for the study. The staff from each of these sites were trained by the research team. These interviewers visited participants' homes in most cases or organizations to conduct the surveys. The interviews were conducted in local languages by local interviewers who were mostly the same throughout the study to build rapport with the participants, especially those with HIV. Participants were gender-matched with interviewers.

Participants were compensated for their time. For the earlier rounds, children were given snacks or toys, while for the later rounds, compensation such as cell phone top-ups of up to \$2 or merch with study contact information were considered.

## **2.2 Current Study**

This study draws on data collected during the latest round of the Positive Outcomes for Orphans (POFO) parent study, conducted in 2014-15. All girls aged 16 or over during the survey were included in this study. This study includes analytics sample of 933 adolescent girls from Cambodia, India (Hyderabad and Nagaland), Kenya, Tanzania, and Ethiopia of whom 349 are resident-based orphans, 479 are family-based orphans, and 105 are non-orphans. [See Table 1.] Only those aged 16 or older were asked questions regarding sexual behavior, sexual activity, and reproductive outcomes including pregnancy and knowledge about contraceptives. However, children who were 15 years old also, in some cases, responded to questions intended for older children because of cultural differences in how age is defined; in those cases, their data was kept for analysis.

## **2.3 Measures**

This study examines the self-reported survey responses from 933 females aged 16 or older in the latest round of the parent study, when many participants had reached later adolescence or young adulthood, and conducts a cross-sectional analysis to understand the predictors of sexual, and reproductive health outcomes among adolescent girls.

### **2.3.A Outcomes**

This study calculates prevalence of two sexual and reproductive outcomes (early pregnancy and condom use as a birth control measure) among resident-based orphans, family-based orphans and non-OSCs.

We chose early pregnancy as an outcome measure as it is considered negative reproductive health outcome because adolescent mother is at higher risk of maternal and infant mortality and morbidities. Determining the prevalence and factors associated with it can be helpful in informing solution interventions. To evaluate early pregnancy, we used questions about pregnancy history. Participants were asked, "How old were you when you first became pregnant?" Participants could respond with their age (continuous variable) or say they have not been pregnant. We chose the age limit of 18 years was chosen because it is believed that the ideal age for a woman's first pregnancy is a balance

between building up enough nutrition for pregnancy, maximizing fertility while minimizing the risk of complications (Allal et al., 2004). Therefore, those who reported age below 18 were identified as having early pregnancy and coded 1, while the rest were coded 0 as to not having early pregnancy.

Additionally, condom use was evaluated as a form of birth control because it also provides protection against sexually transmitted infections (STIs), including HIV. The data were derived from the survey question, “which birth control options have you or your partner ever used?” The question referred to current partners. While multiple birth control measures were present to choose from, such as the pill, IUD, Depo-provera, and more, this study focused on use of condoms as a form of birth control because it has spill over benefits of protection against STIs. Consistent use of condoms has been shown to be highly effective in preventing the transmission of HIV and other sexually transmitted diseases (CDC, 2021). Only those who had responded “Yes” to the question “Have you had a sexual partner?” were included, resulting in a total analytical sample size of 107 adolescent girls. Those who reported using condoms for birth control were coded as 1, while others were coded as 0.

### **2.3.B Predictors**

Participants reported educational attainment (grade 1 to 16), current relationship status (married, customary marriage, engage, widowed, divorced, separated, single, other), care setting (residence-based (referent), family-based, non-orphan), work in the past week for income generation or work trade (no (referent), yes), and reported ever being physically or sexually abused (no (referent), and yes). Age in years (continuous) was calculated using date of birth estimates from baseline enrollment and interview date.

These predictors were chosen based on past literature that links social determinants such as education and economic status with sexual and reproductive health outcomes, where those with lower education and economic status are at higher risk of early pregnancy and delayed progress (*Adolescent Pregnancy*, WHO, 2022). We used work in the past week as a measure of economic status instead of monthly income due to differences in income levels across countries. Those who answered “Yes’ to working in the past week for income or trade were coded 1, others were coded 0. We used current grade or highest grade completed as our education variable for this analysis; the grade ranged from 0 to 16 and was recategorized into primary education (grade  $\leq 8$ ; a referent), secondary education (grade  $> 8$  &  $\leq 12$ ), and higher education (grade  $> 12$ ).

Similarly, care setting was included as a predictor due to the potential influence of context and social support systems with the participants grew up on their behavior and risk exposure (Gray et al., 2016; Whetten et al., 2009; World Health Organization, 2013). Age and relationship status were also included as predictors, as they may affect sexual activity frequency and contraception use (Sully et al., 2020; UNFPA, 2017). Relationship status was recategorized into three groups: married/engaged status (included: married, customary marriage, and engage), never married (included: single), and others (included: widowed, divorced, separated, and others).

Finally, trauma was measured using a question about history of physical and sexual abuse from the Life Events Checklist (Gray et al., 2004) and recategorized as a binary variable where those who ever experienced physical or sexual abuse were coded 1, others were coded 0.

## **2.4 Analysis**

To investigate the sexual and reproductive health outcomes among orphaned or separated girls in five low- and middle- income countries, we first calculated the distribution of the sample population based on characteristics such as site, education, marital status, history of physical or sexual abuse, and work. We grouped the frequency by type of children, which were resident-based orphans, family-based orphans, and

non-OSC. We then calculated the distribution of sexual and reproductive outcomes, including early pregnancy and condom use, among the three groups. The frequency and percentage were calculated, excluding missing data, to identify any noticeable difference among the groups.

We fit bivariable logistic regression for both the outcomes with each potential predictor to understand individual relationship to assess inclusion for the multivariable regression model. If the p-value was more than 0.1, the predictor was not included in the multivariable model. For categorical predictors, if more than one level of the variable did not show significant association, the overall predictor was not included. Odds ratio, 95% confidence interval, and p-value were evaluated for each predictor. We opted to use a p-value of 0.1 instead of the conventional threshold of 0.05 because our study was exploratory in nature, with several variables and smaller sample sizes within certain categories. This decision allowed us to be more sensitive for the initial bivariable associations to assess which progressed to the multivariable model for each outcome.

We then ran a multivariable model for each outcome, using predictors that had stronger individual associations shown by p-value in the bivariable model. The odds ratio, 95% confidence intervals, and p-value of each SRH health outcome were estimated again to explore the variation in outcomes. Analyses were conducted using R.

### 3. Results

Of the 933 participants from six different sites, the most were from Hyderabad (21.8%) and Nagaland had the smallest representation, with only 13.1% of participants [See Table 1]. The age of participants in the study ranged from 15- 21 years, the mean age for orphans in both residential care, family-based care as well as the non-orphaned children was similar at around 17 years old. Most of the children were either studying in or had completed secondary education, accounting for 62.1% of the sample; 30.7% had primary education, and 7.2% had completed higher education. Overall, 63.2% of the participants reported being physically or sexually abused. Among all type of care, more than half the participants reported being abused [See Table 1]. The percentage of girls who reported experiencing abuse was similar across residential care (65.3%), family-based care (64.5%), and non-orphaned girls (50.5%). Overall, 12.4% of the girls reported working for income in the past week. 14.8% girls in family-based care reported working for income, residential care (10.4%) or non-orphans (7.7%).

Table 1: Characteristics of adolescent girls in the POFO study at Round 11 (n = 933)

Characteristics	Overall (n=933)		Residential Care (n=349)		Family- fbased Care (n=479)		Non-OSC (n=105)	
	N	%	N	%	N	%	N	%
<b>Site</b>								
Cambodia	128	13.7	29	8.3	83	17.3	16	15.2
Ethiopia	146	15.6	47	13.5	83	17.3	16	15.2
Hyderabad	203	21.8	100	28.7	87	18.2	16	15.2
Kenya	182	19.5	74	21.2	86	18.0	22	21.0
Nagaland	122	13.1	39	11.2	66	13.8	17	16.2
Tanzania	152	16.3	60	17.2	74	15.4	18	17.1
Missing								
<b>Education Level</b>								
Primary	277	30.7	76	22.4	174	37.4	27	27.6
Secondary	560	62.1	230	67.8	268	57.6	62	63.3
Higher Education	65	7.2	33	9.7	23	4.9	9	9.2
Missing	31		10		14		7	
<b>Marital Status</b>								
Married or engaged	61	6.6	13	3.7	44	9.2	4	3.8
Never married	844	90.8	331	95.1	415	87.0	98	93.3
Other	25	2.7	4	1.1	18	3.8	3	2.9
Missing	3		1		2		0	
<b>Abused status</b>								
Ever	590	63.2	228	65.3	309	64.5	53	50.5
Never	343	36.8	121	34.7	170	35.5	52	49.5
Missing								
<b>Work Status</b>								
Worked	114	12.4	36	10.4	70	14.8	8	7.7
No work	807	87.6	309	89.6	402	85.2	96	92.3
Missing	12		4		7		1	
	Mea n	SD	Mea n	SD	Mean	SD	Mea n	SD
Age (mean)	17.3	1.6	17.4	1.7	17.3	1.6	16.8	1.5

\* SD is standard deviation

A higher percentage of family-based orphans reported early pregnancy (5.8%) compared to residential orphans (1.1%) and non-orphans (2.9%) [See Table 2]. Condom use, a birth control measure, was used as a sexual health outcome in this study due to its additional benefits in preventing STIs. Higher percentage of non-orphan girls reported using condoms for birth control (44.4%) compared to girls in family-based care (37.2%) and residential care (30.0%).

Table 2: Distribution of outcomes among different types of children

Outcome	Residential Care (n=349)		Family-based Care (n=479)		Non-OSC (n=105)	
	N	%	N	%	N	%
<b>Early pregnancy &lt;18</b>						
Yes	4	1.1	28	5.8	3	2.9
No	345	98.9	451	94.2	102	97.1
	(n=20)		(n=78)		(n=9)	
	N	%	N	%	N	%
<b>Condom Use (Ever)</b>						
Yes	6	30.0	29	37.2	4	44.4
No	14	70.0	49	62.8	5	55.6

Note: The sample size (n) for both outcome variables were different.

In the bivariable analysis of the outcomes with each potential predictor, we observed that orphans in residential care had lower odds of experiencing early pregnancy (OR=0.37, 95% CI 0.17-0.71, p=0.01) compared to non-orphans [See Table 3]. Secondary (OR=0.10, 95% CI 0.03-0.22, p=0.00) and higher education (OR=0.14, 95% CI 0.01-0.67, p=0.05) showed significant negative association with early pregnancy. In contrast, working for

income (OR=2.57, 95% CI 1.11-5.45, p=0.02) and history of abused (OR= 2.90, 95% CI 1.28-7.81, p=0.02) showed positive association with early pregnancy.

Table 3: Bivariable Regression of outcomes and potential predictors

Variables	Early pregnancy (N=933)			Condom Use (N=107)		
	OR	95% CI	P	OR	95% CI	P
Age (mean)	1.30	(1.06, 1.60)	0.01	0.97	(0.74, 1.27)	0.80
Type						
Non-OSC	1.00		-	1.00		-
Family-based Care	1.93	(0.61, 5.69)	0.23	1.55	(0.48, 5.01)	0.45
Residential Care	0.37	(0.17, 0.71)	0.01	0.99	(0.45, 2.12)	0.98
Site						
Cambodia	1.00		-	1.00		-
Ethiopia	0.00	**	0.98	**	**	0.99
Hyderabad	0.06	(0.00, 0.31)	0.01	**	**	0.99
Kenya	1.38	(0.63, 3.18)	0.44	**	**	0.99
Nagaland	0.10	(0.00, 0.52)	0.03	1.00	**	1.00
Tanzania	0.32	(0.08, 0.98)	0.06	**	**	0.99
Education Level						
Primary	1.00		-	1.00		-
Secondary	0.10	(0.03, 0.22)	0.00	0.78	(0.32, 1.82)	0.57
Higher Education	0.14	(0.01, 0.67)	0.05	1.63	(0.06, 42.39)	0.74
Marital Status						
Married or engaged	1.00		-	1.00		-
Never married	0.02	(0.01, 0.04)	0.00	5.28	(2.24, 13.14)	0.00
Other	0.00	**	0.99	0.78	(0.039, 5.54)	0.83
Abused status						
Ever	2.90	(1.28, 7.81)	0.02	1.76	(0.61, 5.85)	0.32
Never	1.00		-	1.00		-
Work Status						
Worked	2.57	(1.11, 5.45)	0.02	1.83	(0.71, 4.70)	0.20
No work	1.00		-	1.00		-

\*\* Note: We could not estimate the value resulting from a small sample size in the sub-categories.

The bivariable analysis suggests that family-based orphans may be at higher risk for early pregnancy and have higher rates of condom use compared to other types of children. However, it is important to note that the sample sizes for some groups are small. The results are also not significant as indicated by the p-value greater than 0.1.

Regarding condom use, as a birth control method, most predictors did not display a significant relationship, except for being single. There was insufficient data to support estimates in a multivariable setting. As a result, a multivariable logistical regression for condom use was not performed.

Table 4 presents the results of a multivariable logistical analysis examining the relationship between early pregnancy and several predictors. The model uses current age (continuous variable) and dummy variables to represent each category of predictors: education level (primary, secondary, and higher education), relationship status (married or engaged, never married, and others), ever physically or sexually abused status (never or ever) and worked in the past week (yes or no).

The results indicate that secondary education level (OR=0.22, 95% CI 0.08-0.61,  $p<0.01$ ) and never married relationship status (OR=0.03, 95% CI 0.01-0.08,  $p<0.01$ ) were significantly associated with lower odds of early pregnancy [See Table 4]. Whereas, work in the past week (OR=2.54, 95% CI 0.91-7.06,  $p=0.07$ ) had a marginally significant positive

association with early pregnancy. History of abuse did not show significant association in the multivariable regression. The model had good fit (residual deviance = 175.20 on 880 degrees of freedom) and explained a significant amount of the variance in the outcome variable.

Table 4: Multivariable Regression of outcome and predictors

Variables	Early pregnancy (age <18) (N=933)		
	OR	(95% CI)	P
Age (mean)	0.97	(0.72 - 1.31)	0.85
Type			
Non-OSC	1.00		-
Family-based Care	1.54	(0.43-5.56)	0.51
Residential Care	0.54	(0.24 - 1.25)	0.15
Education Level			
Primary	1.00		-
Secondary	0.22	(0.08 - 0.61)	0.00
Higher Education	0.92	(0.10 - 8.25)	0.94
Marital Status			
Married or engaged	1.00		-
Never married	0.03	(0.01 - 0.08)	0.00
Other	**	**	**
Abused status			
Ever	1.49	(0.51 - 4.36)	0.47
Never	1.00		-
Work Status (Past week)			
Worked	2.54	(0.91 - 7.06)	0.07
No work	1.00		-

\*\* Note: We could not estimate the value due to sparse data

## **4. Discussion**

The multivariable analysis showed that secondary education level and never married relationship status were significantly associated with lower odds of early pregnancy, while working in the past week was significantly associated with slightly higher odds of early pregnancy. Age and history of abuse did not show significant association with early pregnancy in the multivariable regression, despite showing positive associations in the bivariable analysis. Regarding condom use, only never married relationship status showed a significant positive association in bivariable regression. However, the small sample size, especially for sub-categories, made estimates imprecise and limited the ability to draw conclusions.

### **4.1 Study strengths and limitations**

The study has several strengths, including the inclusion of multiple LMICs from diverse geographical and political backgrounds. It includes representative sample of both resident and family based OSC at multiple sites in LMICs as well as non-orphan populations. The original sample was randomly selected, increasing the likelihood of its representativeness and mitigating some bias. However, there are several limitations to the study. First, only individuals older than 16 were asked about SRH-related questions, which may underestimate the prevalence among younger girls who may be at higher risk. Younger mothers are at greater risk of developing eclampsia, puerperal endometritis, and other systemic infections (WHO, 2022). The limited available data from some LMICs including

Angola, Bangladesh, Mozambique, and Nigeria suggest that the birth rates for age group (10-14) who are excluded in this data are higher than 10 births per 1000 girls (United Nations, 2020).

Additionally, survival bias may have influenced the results, as individuals who experienced negative outcomes could have been differentially lost to follow-up. Moreover, the use of self-reported data is subject to potential biases, despite measures taken to ensure confidentiality and validity. To mitigate this, the study employed both male and female staff from each site who worked with the same cohort throughout the longitudinal study. This approach enabled participants to meet with the same interviewer regularly, which helped build rapport and establish a level of trust, particularly for discussing sensitive and personal topics such as sexual behavior and pregnancy (Whetten et al., 2011). It is also possible that talking about sexual behavior, pregnancies, or experiences of sexual or physical abuse may still be a sensitive topic, leading to underreporting based on the cultural context of the sites.

This exploratory study aimed to explore association among different predictor and outcome. Pregnancy before the age of 18 is associated with increased risk of physical complications and may result in opportunity costs, such as limited educational or employment opportunities and worsened financial strain or instability. However, among married participants, the higher odds of early pregnancy and lower odds of condom use

may not be interpreted as negative outcome requiring of intervention, as having a child might be a goal after marriage. Also, pregnancy and marriage may also provide some with social prestige, acceptance, and financial stability. These results can vary greatly depending on their individual circumstances and the agency they have in making decisions about their reproductive health. This study did not observe whether the early pregnancy or no use of condom occurred by choice or not among the adolescent girls. Because pregnancy and starting a family are expected after marriage, and we are uncertain to what extent the girls had agency in these outcomes, it is difficult to label these outcomes as either positive or negative, and the need for intervention cannot be determined without further investigation.

The sexual health measure selected for the study on use of condom does not represent the regular use of condom, as “have ever used” could also include those who have used it once. Also, condom use was not assessed as a measure of STI risk but as means of birth control, still it was included as a sexual health measure due to its benefit of preventing both unintended pregnancies and the spread of STIs. So, it may be limited in measuring the current sexual health of the participant. Because of the numerous methodological challenges that arise in studying sensitive and private behaviors such as having sexual partner or using condom, that cannot be directly observed or measured, determining the exact magnitude of protection is difficult (CDC, 2021).

This study has another limitation that pertains to the temporality of the events. There is a possibility of reverse causality, where predictors such as education, abuse, or employment for income may have occurred after the outcome, leading to the study's findings being limited to mere correlations. Lastly, some of the associations between predictors could not be established due to very few or no responses in the corresponding sub-categories, as indicated in the regression tables. The limited number of responses could compromise the accuracy of the conclusions drawn from the data.

#### ***4.2 Implications for policy and practice***

Based on the results presented in the study, programs targeting the reduction of early pregnancy and promotion of condom use could benefit from promoting attainment of education beyond primary level. Policymakers and program designers seeking to reduce early pregnancy rates among adolescents in LMICs would be well advised to consider the significant association observed between work and relationship status, which underscores the need for a more nuanced approach to addressing this complex issue. It may be worthwhile for change efforts to target interventions and policies to particular care settings to achieve more favorable results, given the notable differences in the prevalence of early pregnancy and condom use among non-orphans and both residential and family-based orphans.

### ***4.3 Implications for further research***

It may be beneficial to include younger participants to capture a broader range of age-related experiences in the future study, which could increase the representativeness of the sample. The study's findings may not be generalizable to all orphans as it excludes street orphans, so further research is needed to explore the SRH outcomes of this population.

Future research could use accurate and reliable methods to measure condom use, that could better reflect consistent and habitual condom use as opposed to a basic history of ever having used them. More research is needed to determine the level of agency involved in the relationship between marriage and early pregnancy or condom use. By studying the role of agency in these outcomes, we can gain a deeper understanding of the complex factors that influence reproductive decisions. To address stigmatization of sensitive topics, using anonymous or group-administered surveys may be useful. It would be beneficial to study future data from the same cohort on their sexual and reproductive to have a deeper understanding of the context, exposure and outcomes.

## **5. Conclusion**

In light of the findings from this exploratory study, policy makers and interventions aimed at reducing early pregnancy in LMICs may want to consider the significant negative association between higher education and early pregnancy. Moreover, having to work for income during adolescence was also significantly associated with early pregnancy, highlighting the need to consider the predictors for further research. This study also revealed differences in early pregnancy and condom use as a birth control measure among non-orphans and orphans in both family-based and residential care settings. These results provide insights that can inform the development of more effective and tailored interventions or policies to improve adolescent sexual and reproductive health. However, further research with larger sample sizes within sub-categories and more reliable measures is necessary to confirm and expand on these findings.

## References

- Allal, N., Sear, R., Prentice, A. M., & Mace, R. (2004). An evolutionary model of stature, age at first birth and reproductive success in Gambian women. *Proceedings of the Royal Society of London. Series B: Biological Sciences*, 271(1538), 465–470. <https://doi.org/10.1098/rspb.2003.2623>
- CDC. (2021, September 14). *Condom Effectiveness*. CDC. <https://www.cdc.gov/condomeffectiveness/brief.html>
- CDC. (2023, March). *Sexually Transmitted Diseases (STDs)*. CDC. <https://www.cdc.gov/std/general/default.htm>
- Dehne, K. L., & Riedner, G. (2005). *Sexually transmitted infections among adolescents: The need for adequate health services*. Department of Child and Adolescent Health and Development, World Health Organization ; Deutsche Gesellschaft für Technische Zusammenarbeit, Division for Health, Education and Social Protection.
- Gray, C. L., Pence, B. W., Ostermann, J., Whetten, R. A., O'Donnell, K., Thielman, N. M., & Whetten, K. (2015). Gender (in) differences in prevalence and incidence of traumatic experiences among orphaned and separated children living in five low- and middle-income countries. *Global Mental Health*, 2, e3. <https://doi.org/10.1017/gmh.2015.1>
- Gray, C. L., Whetten, K., Messer, L. C., Whetten, R. A., Ostermann, J., O'Donnell, K., Thielman, N. M., & Pence, B. W. (2016). Potentially traumatic experiences and sexual health among orphaned and separated adolescents in five low- and middle-income countries. *AIDS Care*, 28(7), 857–865. <https://doi.org/10.1080/09540121.2016.1147013>
- Gray, M. J., Litz, B. T., Hsu, J. L., & Lombardo, T. W. (2004). Psychometric Properties of the Life Events Checklist. *Assessment*, 11(4), 330–341. <https://doi.org/10.1177/1073191104269954>
- Gregson, S., Nyamukapa, C. A., Garnett, G. P., Wambe, M., Lewis, J. J. C., Mason, P. R., Chandiwana, S. K., & Anderson, R. M. (2005). HIV infection and reproductive health in teenage women orphaned and made vulnerable by AIDS in Zimbabwe. *AIDS Care*, 17(7), 785–794. <https://doi.org/10.1080/09540120500258029>
- Hillis, S. D., Unwin, H. J. T., Chen, Y., Cluver, L., Sherr, L., Goldman, P. S., Ratmann, O., Donnelly, C. A., Bhatt, S., Villaveces, A., Butchart, A., Bachman, G., Rawlings, L., Green, P., Nelson, C. A., & Flaxman, S. (2021). Global minimum estimates of children affected by COVID-19-associated orphanhood and deaths of caregivers: A modelling study. *The Lancet*, 398(10298), 391–402. [https://doi.org/10.1016/S0140-6736\(21\)01253-8](https://doi.org/10.1016/S0140-6736(21)01253-8)
- Hosegood, V., Floyd, S., Marston, M., Hill, C., McGrath, N., Isingo, R., Crampin, A., & Zaba, B. (2007). The effects of high HIV prevalence on orphanhood and living arrangements of children in Malawi, Tanzania, and South Africa. *Population Studies*, 61(3), 327–336. <https://doi.org/10.1080/00324720701524292>

- Kidman, R., & Palermo, T. (2016). The relationship between parental presence and child sexual violence: Evidence from thirteen countries in sub-Saharan Africa. *Child Abuse & Neglect*, 51, 172–180. <https://doi.org/10.1016/j.chiabu.2015.10.018>
- Lyneham, S., & Facchini, L. (2019). *Benevolent harm: Orphanages, voluntourism and child sexual exploitation in South-East Asia*. Australian Institute of Criminology.
- Orphans*. (2023). UNICEF. <https://www.unicef.org/topics/orphans>
- Sanadiki, O. (2023, March 1). UN scrambles to reunite families after Turkey-Syria quake. *AP News*. <https://apnews.com/article/syria-turkey-earthquake-unicef-children-reuniting-families-2edf5a390231d44cbe9c937b90ffef3f>
- Sully, E., Biddlecom, A., Daroch, J., & Riley, T. (2020). *Adding It Up: Investing in Sexual and Reproductive Health 2019*. Guttmacher Institute. <https://www.guttmacher.org/report/adding-it-up-investing-in-sexual-reproductive-health-2019>
- UNFPA. (2017). *Adolescent pregnancy*. United Nations Population Fund. <https://www.unfpa.org/adolescent-pregnancy#summery105866>
- UNICEF (Ed.). (2008). *Maternal and newborn health*. UNICEF.
- UNICEF DATA. (2022, July). *Orphanhood*. UNICEF. <https://data.unicef.org/topic/hiv aids/orphanhood/#:~:text=As%20of%202021%2C%20an%20estimated,live%20in%20sub%2DSaharan%20Africa.&text=Source%3A%20UNAIDS%202022%20estimates>.
- United Nations. (2020). *Fertility among Young Adolescents at Ages 10-14 Years—A global assessment*. United Nations, Department of Economic and Social Affairs, Population Division.
- Violence against children in Haiti: Findings from a national survey 2012*. (2014). Centers for Disease Control and Prevention (U.S.);United States. President’s Emergency Plan for AIDS Relief.;Haiti. Comité de Coordination.;Together for Girls.;Interuniversity Institute for Research and Development.; <https://stacks.cdc.gov/view/cdc/30582>
- Whetten, K., Ostermann, J., Whetten, R. A., Pence, B. W., O’Donnell, K., Messer, L. C., Thielman, N. M., & The Positive Outcomes for Orphans (POFO) Research Team. (2009). A Comparison of the Wellbeing of Orphans and Abandoned Children Ages 6–12 in Institutional and Community-Based Care Settings in 5 Less Wealthy Nations. *PLoS ONE*, 4(12), e8169. <https://doi.org/10.1371/journal.pone.0008169>
- Whetten, K., Ostermann, J., Whetten, R., O’Donnell, K., Thielman, N., & The Positive Outcomes for Orphans Research Team. (2011). More than the loss of a parent: Potentially traumatic events among orphaned and abandoned children: More Than the Loss of a Parent. *Journal of Traumatic Stress*, 24(2), 174–182. <https://doi.org/10.1002/jts.20625>

WHO. (2001). *The Second decade: Improving adolescent health and development*.  
<https://apps.who.int/iris/handle/10665/64320>

WHO. (2022, September 15). *Adolescent pregnancy*. WHO. <https://www.who.int/news-room/fact-sheets/detail/adolescent-pregnancy>

World Health Organization. (2013). *Handbook on health inequality monitoring with a special focus on low- and middle-income countries*. World Health Organization.  
<https://apps.who.int/iris/handle/10665/85345>