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RESEARCH ARTICLE

# Child marriage, educational attainment, and comprehensive knowledge of HIV/AIDS: a multi-country analysis

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**Abstract**

Understanding the link between HIV/AIDS knowledge and child marriage is important for designing and planning effective intervention programmes. Despite significant advances in HIV/AIDS prevention and treatment, it remains important to study the impact of child marriage on HIV/AIDS knowledge because HIV/AIDS continues to affect millions globally. This study investigated the association of child marriage with scores on an index measuring comprehensive knowledge about HIV/AIDS transmission and prevention. Analysis was conducted on a sample of women aged 18–24 years, using nationally representative DHS household surveys from 18 countries. Findings indicate that there is no direct statistically significant effect of child marriage on women's comprehensive knowledge about HIV/AIDS once controls for other factors affecting knowledge are included in the regression. However, the coefficients for educational attainment are statistically significant in most countries, at least when secondary or higher education is considered. This suggests that child marriage may affect knowledge about HIV/AIDS indirectly through its impact on educational attainment for girls who marry early.

**Keywords:** HIV/AIDS; Education; Marriage and mate selection

## Introduction

Despite the pervasiveness of child marriage, insufficient evidence exists on associations between child marriage and health outcomes in most affected countries, particularly HIV/AIDS-related interactions (Burgess *et al*, 2023; Fan & Koski, 2022). It is important to identify health outcomes and knowledge that are related to child marriage in different settings in order to effectively develop programmes targeted at married girls. This paper aims to explore the susceptibility of married girls to HIV infection through their level of knowledge about HIV/AIDS. Despite significant advances in HIV/AIDS treatment and prevention, it remains important to study the impact of early marriage on HIV knowledge because HIV/AIDS continues to affect millions globally. In 2023 alone, 1.3 million new infections and 630,000 AIDS-related deaths were reported, highlighting the ongoing burden of the disease (UNAIDS, 2024). Research into the relationship between child marriage and HIV/AIDS knowledge is crucial for identifying vulnerable populations, addressing regional disparities, and tailoring interventions to ensure that progress in combating HIV/AIDS is sustained and effective in reducing future infections and improving health outcomes.

The link between HIV transmission and behavioural change strategies including correct and comprehensive knowledge of HIV/AIDS is well established (Fenny *et al*, 2017; Teshome *et al*, 2016). Having comprehensive knowledge of HIV/AIDS can help reduce the risk of becoming

infected with the virus (Zyl-Cillié & Vries, 2024). By understanding how the virus is transmitted and how to prevent transmission, individuals can make informed decisions about behaviours that put them at risk of infection and take necessary precautions to protect themselves. These precautions include avoiding unprotected sex, using barrier methods during sexual activity, avoiding shared needles, and getting tested regularly. In addition, understanding the stigmas and misconceptions surrounding HIV/AIDS reduces discrimination and promotes early testing and treatment. In the context of child marriage, comprehensive knowledge of HIV/AIDS can potentially empower girls to negotiate safer sexual practices and to seek testing and treatment (Bekker *et al*, 2018). This awareness is crucial even within child marriage situations where power imbalances often exist, limiting the ability of the girl to negotiate (Godha, Hotchkiss & Gage, 2013). With child brides, knowledge about HIV prevention would not immediately translate into adoption of appropriate HIV/AIDS prevention behaviours due to their lack of autonomy and empowerment. However, while knowledge alone may not be sufficient to overcome deeply entrenched power imbalances, it is still a vital component of her overall empowerment and a critical tool that can inform other decisions she might make within the constraints of her situation. Over time, knowledge can also contribute to gradual shifts in power dynamics (Blanc, 2001).

Historically, research findings have been inconsistent regarding the association of child marriage with HIV risk and infection (Petroni *et al*, 2019). This inconsistency may be attributed to several factors including variations in study populations and contexts, differences in HIV prevalence, differences in study methodology, measurement of variables, differences in marriage dynamics, reach of HIV prevention efforts, and selection of study participants. Some earlier studies found evidence of an increased risk of HIV infection among married girls. Other studies argued to the contrary, while still others found no statistically significant differences between married and unmarried girls. Research carried out by Beegle & De Walque, 2009 found a protective effect of child marriage on HIV infection among 15–19-year-old females in Burkina Faso and among 20–24-year-old females in Ghana and Burkina Faso. In contrast, the same study found an association of marriage with a greater risk for HIV infection in women aged 15–19 years in Cameroon, women aged 20–24 years in Tanzania, and in the pooled group of women aged 15–24 years in both countries. Other studies, however, found evidence of an increased risk of HIV infection with child marriage. Findings from multi-country qualitative research suggested that an incentive to the practice of child marriage is the belief by parents that marrying off a girl early protects her from rape, premarital sexual activity, unintended pregnancies, and sexually transmitted infections (STIs), especially HIV/AIDS (Nour, 2009). Contrary to these beliefs, some research findings indicated that marriage by the age of 20 years was a risk factor for HIV infection in girls (UNAIDS, 2004), especially in settings with generalised HIV/AIDS epidemics (African Union Commission, 2016; Auvert *et al*., 2001).

Both female and male youth are at risk for HIV infection due to risky behaviour. However, this risk was found to be higher for female youths and especially for married girls. In a study conducted in Kenya and Zambia (Clark, 2004), 15–19-year-olds who were married were 75% more likely to be infected with HIV than their sexually active, unmarried counterparts. Reasons for this huge discrepancy for married girls included high coital frequency, coital violence, decreased or zero condom use, and inability to refuse sex (Clark, Bruce & Dude, 2006). In the countries studied by the Clark team, the prevalence of unprotected sex in the previous week among females aged 10–19 years was higher among those married compared to those that were not married. When young girls were married to much older men, the men tended to be more sexually experienced because of their increased window of sexual activity. They also tended to have multiple sex partners or wives and higher rates of infection. Even when girls were married to single but older spouses, they remained vulnerable as research indicates that especially for men, later marriage leads to a longer period of premarital sexual activity, and thus a higher risk of HIV infection (Bongaarts, 2007). In addition, the presence of other STIs during this period can raise vulnerability to HIV infection. Therefore, while married girls are less likely to have multiple sex partners compared to their

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unmarried peers, the benefit of this protective behaviour can be offset by their greater exposure via their husbands.

Finding no difference in the likelihood of infection between married and unmarried women; Bongaarts argued that one group of risk factors puts unmarried women at increased risk, while another group raises the risk for married women. For unmarried women, the risks include a more frequent change of partners that are more likely to be infected, while married women are at risk due to higher coital frequency, lack of condom use, and higher infection rates for partners. The two sets of factors partially offset each other, but the effects of the second set outweigh the first, potentially leaving unmarried sexually active women with a net elevated risk of HIV infection. Bongaarts, however, reconciled this finding with the results from the Clark study by suggesting that the primary factor in the relationship is the timing of first marriage in relation to the timing of first sexual intercourse. If a girl gets married prior to the age at which she would otherwise become sexually active (on average, 18 years in much of sub-Saharan Africa), then she would indeed be exposed to an increased risk of HIV infection that would not occur without the early marriage. Similarly, if a girl's marriage occurs significantly beyond the average age at first sexual intercourse, the window of premarital sexual activity increases, putting her again at increased risk of infection.

Married girls may have comparatively less knowledge of HIV/AIDS and protective strategies used to prevent infection. According to World Health Organization (2021), two-thirds of adolescent girls and young women 15–24 years old in sub-Saharan Africa do not have comprehensive knowledge about HIV/AIDS. Although young women face a higher risk for HIV infection, males are more probable than females to have comprehensive knowledge of HIV (Kefale *et al*, 2020). Compared to 11% of unmarried sexually active girls, 19% of married girls aged 15–24 years do not know ways to avoid HIV transmission, are less likely to have acquired information about HIV from radio, newspapers, or magazines, are less likely to have heard about voluntary counselling and training (VCT), and are less likely to know where to obtain such services (Undie, 2011). It is also possible that married girls would be less likely to know about the use of the female condom as an alternative to the male condom for protection against pregnancy and STIs (Bernard, 2017; Bauni & Jarabi, 2003).

Comprehensive knowledge of HIV transmission and prevention is particularly important in contexts like India, where a study by Raj *et al* (2009) found a link between child marriage and high rates of sterilisation among women aged 20–24 years. The study revealed that 20% of those married as minors had been sterilised, with 1 in 10 undergoing the procedure before the age of 18 years. This can be challenging for HIV control efforts as sterilisation may lead to reduced condom use among couples (Sangi-Haghpeykar *et al*, 2001), potentially increasing the transmission of HIV and other sexually transmitted infections in the absence of comprehensive HIV/AIDS knowledge. This issue is further complicated by the fact that many women view sterilisation as an empowering act (Brault *et al*., 2016), mostly driven by son preference and family size desires (Mookerjee *et al*., 2022; Edmeades *et al*., 2011).

Married adolescents remain an overlooked population in public health programming (Siddiqi *et al*, 2024; McIntyre, 2006). Yet, the bulk of sexually active girls aged 15–19 years in developing countries are married (Girls Not Brides and United Nations Children's Fund, 2019). Due to their peculiar situation, married girls very often fail to fit into initiatives that target adolescents and likewise do not fit into maternal health services due to their age, lack of experience, and lack of autonomy (Bruce & Clark, 2003). In adolescent sexual and reproductive health programming, there sometimes exists an assumption that marriage is safe. This can lead to the exclusion of married girls from programmatic interventions and focusing disproportionately on premarital sexual activity (Santhya & Jejeebhoy, 2015). As a result, there remains a scarcity of programs targeted at married girls. Findings from a study in Kenya revealed that although the HIV prevalence rate among married adolescent girls was almost twice that of girls aged 15 to 19 years nationwide, most HIV-positive married adolescent girls were not on antiretroviral therapy (ART)

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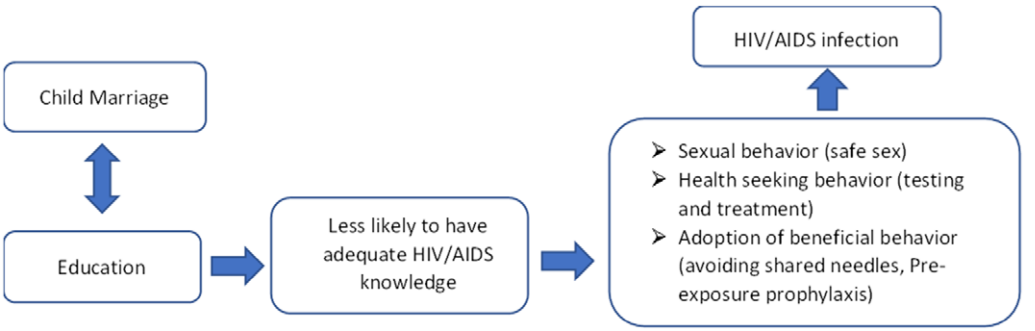


**Figure 1.** Conceptual framework.

and the use of Prevention of Mother to Child Transmission (PMTCT) services was low among this population (Undie *et al*., 2012).

Findings from the Bongaarts study raised concerns that delaying marriage to the international legal age of 18 years could increase the percentage of sexually active unmarried girls engaged in risky sexual behaviour. However, this concern is alleviated by findings that in much of sub-Saharan Africa, although premarital sex has increased in tandem with some success in reducing the prevalence of child marriage, still the median age of sexual initiation for girls remains mostly unchanged at 17 to 18 years of age (Melesse *et al*, 2020). Thus, increasing the age at marriage, if it delays sexual intercourse would reduce the age-specific rate of HIV infection among young women (Mensch, Singh & Casterline, 2005). Overall, in addition to developing interventions to delay age at marriage, there is a research and programmatic need to develop means of providing social support, targeted health messages, safe sex strategies, and other services appropriate for married girls and their partners, especially in settings where HIV remains a concern (Bruce, 2007). Developing appropriate programmatic measures to mitigate the peculiar HIV risks that married girls face depends on several factors such as the levels of HIV and AIDS-related knowledge, and access to quality services for HIV counselling and testing.

Given this context, the objective with this paper is to assess the association between child marriage and comprehensive knowledge about HIV/AIDS. Demonstrating this impact may help in making the case for better programmes and policies to help reduce the prevalence of child marriage. It is hypothesised that a younger age at marriage is associated with poorer HIV/AIDS knowledge measures such as having HIV stigmatisation beliefs, inadequate knowledge about HIV/AIDS and its means of transmission, not ever undergoing HIV testing, and not having knowledge of HIV testing services.

This research is guided by the conceptual framework provided in Figure 1. The association between child marriage and education is bidirectional. Child marriage often results in girls dropping out of school while at the same time, low educational attainment can be the cause of child marriage. Numerous studies have shown that educational attainment particularly to the secondary level increases knowledge about the causes, transmission, symptoms, and treatments of HIV/AIDS (Kefale et al, 2020; Mandiwa, Namondwe & Munthali, 2021).

The behaviour box shows how lack of comprehensive knowledge about HIV/AIDS can affect health behaviours which in turn influence health outcomes. The sexual behaviour of the girl is affected and is expressed by her ability to control her own sexuality and adopt safe sex practices. Her health-seeking behaviour can also be affected by her perceptions regarding the benefits of certain health services. Negative perceptions about the benefits of seeking health might stem from beliefs that she is at lesser risk for being infected by HIV. It should be noted, of course, that her adoption of beneficial sexual or health-seeking behaviour is subjective to her decision-making ability and other power dynamics within her household. Health-seeking behaviour is also

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dependent on the affordability, availability, acceptability, accessibility, and appropriateness of services and programmes. Conclusively, via the pathway depicted in the conceptual framework, child marriage can increase the risk of HIV/AIDS infection.

While existing studies have often focused on broad outcomes like HIV prevalence, sexual behaviour, or access to HIV services in relation to child marriage, fewer studies have specifically examined how child marriage impacts comprehensive knowledge about HIV/AIDS. This study addresses this gap by providing insights into how child marriage affects specific knowledge areas related to HIV/AIDS. This can inform more targeted interventions that address knowledge gaps, which are crucial for reducing HIV transmission.

## Methods

### *Data and study population*

The data used for this study come from the Demographic and Health Surveys (DHS) conducted in 18 purposively selected countries. For all countries, the surveys were implemented in 2010 or later and the results are based on the latest DHS survey available at the time of the analysis. Although priority was given to countries with a relatively high incidence of child marriage, the selection also aimed to capture a diverse range of contexts. By including countries with both high and lower incidences of child marriage, the study can explore how different levels of prevalence interact with other factors, such as educational systems, healthcare infrastructure, and cultural norms, to influence women's knowledge and behaviours related to HIV/AIDS. The selection of countries was also influenced by the availability of key independent variables within country datasets. The countries chosen for this analysis are Bangladesh (2014), Burkina Faso (2021), Dominican Republic (2013), Democratic Republic of Congo (2014), Egypt (2014), Ethiopia (2016), Guinea (2018), India (2021), Malawi (2016), Mali (2018), Mozambique (2023), Nepal (2022), Niger (2012), Nigeria (2018), Pakistan (2018), Republic of Congo (2012), Uganda (2016), and Zambia (2018).

The DHS are nationally representative, cross-sectional, publicly available household surveys that provide data on health and population and allow for international and sub-national comparisons due to their use of uniform survey instruments and data quality. The DHS typically employ a multistage sampling methodology and country-specific sampling plans are detailed in each country's final DHS report. This analysis focused on information collected from women aged 15 to 49 years, using the women's questionnaire which asked participants about their birth history, family planning, and socio-economic and marital status, among other characteristics. In addition, the women were asked about their knowledge of HIV transmission and prevention. In order to reduce recall bias, the analysis is restricted to ever-married young women aged 18–24 years at the time of the survey. Restricting the sample to this age cohort allows for a shorter period since the onset of marriage and enables the capture of more recent experiences.

### *Measures and statistical analysis*

In the DHS surveys, respondents were asked to agree or disagree with statements regarding HIV preventive measures, transmission modes, and symptoms. The statements included – the risk of getting HIV can be reduced by abstaining from sexual intercourse; the risk of getting HIV can be reduced by always using a condom when having sexual intercourse; the risk of getting HIV can be reduced by restricting sexual intercourse to one faithful partner; HIV can be transmitted by mosquito bites; HIV can be transmitted by sharing food with an infected person; a healthy-looking person can have HIV; HIV can be transmitted by witchcraft or supernatural means; HIV-infected persons can live longer with drugs; HIV can be transmitted during pregnancy; HIV can be transmitted during delivery; HIV can be transmitted through breastfeeding; HIV can be

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transmitted by sharing sharp materials; HIV can be transmitted through unsafe blood transfusion; HIV can be transmitted by using unsterilised needles or syringes; and HIV can be transmitted by touching an infected person. These questions were restricted to those women who had previously indicated that they had heard about HIV/AIDS.

The dependent variable is an index which measures HIV comprehensive knowledge. To create the index, principal component analysis was carried out on the range of indicators for a woman's comprehensive knowledge of HIV/AIDS, listed in the previous paragraph. The first factor or component is used as the index of comprehensive knowledge after scaling in order to take a value between zero (lowest level of knowledge among all women in the sample) and 100 (highest level of knowledge among all women in the sample). The questions and modalities differ slightly between countries, and thus the index is specific to each country (the weights for the various variables included in the index are estimated for each country separately). This means that the index is not strictly comparable between countries, but it is comparable within country for women who married early and those who did not.

Linear regressions were carried out to estimate the association between child marriage and comprehensive knowledge about HIV. Child marriage is defined as a first marriage or union before age 18 years and is captured in the analysis through a dummy variable where the reference category is marriage as an adult (at age 18+ years). Other independent variables included as controls include location (urban vs. rural), educational attainment (no education, primary, secondary, and higher), household wealth quintiles, religion, ethnicity, region or province of residence, and age of the respondent in years. Additional controls include the spousal age difference, whether the respondent's husband has other wives, whether the respondent is a regular paper reader, whether the respondent is a regular radio listener, whether the respondent is a regular TV watcher, whether the respondent has ever tested for HIV, and whether the respondent works. In addition, the level of comprehensive HIV knowledge in the area where the respondent lives (through leave-out-means for the primary sampling unit or PSU, to avoid endogeneity issues) was included. Leave-out-means are average statistics over a sub-sample for a variable with the statistics estimated for the PSU in the survey where the respondent lives, but not including that particular respondent. These variables capture community-level effects.

## Results

Statistics presented in Table 1 compare, for each country, the mean values of the index between women who married early and those who did not. Adjusted Wald tests were carried out to test the statistical significance of the differences in means between the two marriage groups. The numbers suggest that there are differences in many countries between women who married early and those who did not, with women who married early having a slightly lower knowledge about HIV/AIDS than those who did not marry early. However, there is considerable variation in the pattern of the differences. For instance, large differences are observed in Egypt, Nepal, and Mali, where child marriage is associated with noticeably lower knowledge levels. Conversely, in Malawi and Uganda, both groups – those married early and those not – exhibit relatively high HIV/AIDS knowledge scores. In Pakistan, low knowledge scores are observed across both groups. This wide variation underscores the complex interplay of cultural, educational, and health service factors that influence HIV/AIDS awareness and knowledge in different contexts. However, observing differences in the mean values of the knowledge index does not necessarily imply that child marriage is the reason for such differences, whether directly or indirectly, as other factors such as socio-economic background may be at work. Regression analysis is used to measure at the margin the direct association between child marriage and the knowledge index, as well as potential indirect association through other variables such as education attainment.

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**Table 1.** Mean HIV knowledge index for women aged 18–24 years (scaled between 0 and 100)

| | All married women | Married before 18 | Married after 18 | Cronbach's alpha |
|---|---|---|---|---|
| Bangladesh*** | 66.9 (1.2) | 65.1 (1.2) | 71.7 (2.0) | 0.9499 |
| Burkina Faso** | 86.5 (0.7) | 85.3 (1.0) | 88.0 (0.8) | 0.8396 |
| Dominican Republic | 90.8 (0.5) | 90.5 (0.5) | 91.3 (0.6) | 0.7831 |
| DRC | 77.9 (1.1) | 77.4 (1.1) | 78.5 (1.4) | 0.8711 |
| Egypt*** | 51.3 (1.1) | 41.0 (1.6) | 56.2 (1.1) | 0.9431 |
| Ethiopia** | 77.3 (1.1) | 75.8 (1.4) | 80.0 (1.5) | 0.8920 |
| Guinea* | 65.4 (1.5) | 64.2 (1.7) | 68.6 (2.3) | 0.9307 |
| India*** | 84.3 (0.3) | 83.2 (0.5) | 85.1 (0.3) | 0.7851 |
| Malawi | 92.0 (0.4) | 91.8 (0.4) | 92.2 (0.5) | 0.8339 |
| Mali*** | 71.0 (1.2) | 68.0 (1.5) | 78.2 (1.4) | 0.9386 |
| Mozambique | 77.7 (0.9) | 77.1 (1.0) | 79.0 (1.4) | 0.8480 |
| Nepal*** | 65.8 (1.6) | 59.7 (2.0) | 73.1 (1.8) | 0.9298 |
| Niger*** | 64.4 (1.4) | 63.1 (1.5) | 71.5 (2.2) | 0.9146 |
| Nigeria*** | 84.2 (0.6) | 83.5 (0.7) | 86.0 (0.7) | 0.8894 |
| Pakistan*** | 14.2 (1.0) | 9.3 (1.1) | 17.9 (1.4) | 0.9645 |
| Rep. Congo*** | 84.7 (0.8) | 83.0 (1.0) | 86.7 (1.1) | 0.7909 |
| Uganda** | 94.3 (0.2) | 93.9 (0.2) | 94.7 (0.2) | 0.6843 |
| Zambia*** | 89.6 (0.5) | 87.7 (0.9) | 91.6 (0.5) | 0.8331 |

*Note*: Linearised standard errors are in parentheses.
*** Test of significance is design-based F-test (adjusted Wald for means) for differentials in knowledge index between age at marriage categories at *$p$ <0.10; **$p$ < 0.05; ***$p$ < 0.01.

Table 2 provides regression analysis results for key variables of interest (child marriage and educational attainment). The interpretation of the coefficients is in terms of gains or losses in the knowledge index. A significant coefficient of −2.0 for women marrying early would suggest that marrying early is associated with a reduction of the expected knowledge index by two points (on a scale of 100 points) in comparison with similar women who married later. In Table 2, the coefficient for the direct effect of child marriage is statistically significant for only two countries. The coefficients for the educational attainment of women are however statistically significant in all but one country (Zambia), at least when secondary or higher education is considered. The results reveal varying degrees of this association across countries. In five countries, primary education was not significantly associated with HIV knowledge compared to no education, possibly indicating that primary education alone may not be sufficient to substantially enhance HIV/AIDS awareness in these contexts. For several countries, there is a strong dose–response relationship, with coefficients increasing progressively at each higher level of education, reflecting the cumulative impact of education on HIV knowledge as individuals progress through the educational system. In some countries like Mali, a threshold effect is observed, where the coefficient for secondary education is higher than that for higher education, suggesting that secondary education may provide the avenue needed for substantial HIV knowledge. Interestingly, countries such as Egypt, Bangladesh, and Pakistan exhibit particularly high coefficients for higher education, which may be due to the concentrated impact of education in societies where access to higher education is limited, thus significantly distinguishing those with

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**Table 2.** Selected correlates of HIV knowledge index for women aged 18–24 years

| | | Education (vs. none) | | |
|---|---|---|---|---|
| | Child marriage | Primary | Sec | Higher |
| Bangladesh | NS | 10.32*** | 27.48*** | 38.31*** |
| Burkina Faso | NS | 3.42*** | 7.96*** | 7.39*** |
| Dominican Republic | NS | 25.41*** | 29.56*** | 29.71*** |
| DRC | NS | NS | 7.32*** | 8.52*** |
| Egypt | −5.45*** | NS | 26.99*** | 44.86*** |
| Ethiopia | NS | 9.14*** | 11.22*** | 12.93*** |
| Guinea | NS | 7.84*** | 17.47*** | 17.69*** |
| India | NS | 2.24** | 4.16*** | 6.45*** |
| Malawi | NS | 3.24** | 4.89*** | 3.84* |
| Mali | NS | 11.37*** | 14.95*** | 12.47*** |
| Mozambique | NS | 4.87** | 6.11*** | 13.17** |
| Nepal | NS | 20.07* | 43.16*** | 48.74*** |
| Niger | NS | 8.00*** | 12.14*** | 19.94*** |
| Nigeria | NS | 1.60* | 4.22*** | 6.90*** |
| Pakistan | NS | NS | 9.67*** | 38.79*** |
| Rep. of Congo | −2.65** | 8.58** | 12.79*** | 17.39*** |
| Uganda | NS | NS | 2.38** | NS |
| Zambia | NS | NS | NS | NS |

*$p$ <0.10; **$p$ < 0.05; ***$p$ < 0.01.

higher education in terms of knowledge. Conversely, in Uganda, the lack of significance for higher education could suggest that HIV knowledge is already widespread at lower educational levels, reducing the relative impact of higher education on this outcome.

Table 3 provides coefficients for other variables in the regression model. There are differences between countries in the variables for which statistically significant associations with comprehensive HIV/AIDS knowledge are observed. The leave-out-mean of the HIV knowledge index at the PSU level has a statistically significant association with the individual knowledge index in all countries, except one. In 9 of the 18 countries, a statistically significant gain is observed when a woman is employed. While employment is statistically significant with the knowledge score in Burkina Faso, it is not in the expected direction (being employed is associated with a reduction in the knowledge index by three points). This may be influenced by a complex interplay of factors, including the nature of employment, work timing constraints preventing access to information events, and targeting of public health interventions.

The broader socio-economic status of the household as measured by quintiles of wealth does not seem to be systematically associated with comprehensive HIV/AIDS knowledge, and in countries where there is an association, the gains are mainly observed in the top two quintiles of wealth. This could be because wealthier households have better access to education, health services, and media, which are key sources of HIV/AIDS information, while lower quintiles may face barriers that limit their exposure to such knowledge. Where there is an effect of urban/rural residency, it is mostly negative with women that reside in urban areas scoring lower on the knowledge index compared to women residing in rural areas, which is a bit surprising. Rural areas

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**Table 3.** Correlates of HIV knowledge index for women aged 18–24 years

| | BAN | BFA | DOM | DRC | EGY | ETH | GUI | IND | MLW |
|---|---|---|---|---|---|---|---|---|---|
| **Child marriage** | | | | | | | | | |
| Married as adult | Ref | Ref | Ref | Ref | Ref | Ref | Ref | Ref | Ref |
| Married at <18 | 1.455 | 0.298 | −0.983 | 1.302 | −5.450*** | 3.240 | 3.207 | −0.374 | −0.106 |
| **Leave-out-mean (LOM)** | | | | | | | | | |
| LOM HIV knowledge index | 0.500*** | 0.346*** | 0.161 | 0.831*** | 0.637*** | 0.625*** | 0.611*** | 0.615*** | 0.481*** |
| **Woman's education** | | | | | | | | | |
| No education | Ref | Ref | Ref | Ref | Ref | Ref | Ref | Ref | Ref |
| Primary | 10.32*** | 3.418*** | 25.41*** | 2.341 | 2.941 | 9.141*** | 7.841*** | 2.244** | 3.241** |
| Secondary | 27.48*** | 7.964*** | 29.56*** | 7.318*** | 26.99** | 11.22*** | 17.47*** | 4.162*** | 4.890*** |
| Higher | 38.31*** | 7.387*** | 29.71*** | 8.515*** | 44.86*** | 12.93*** | 17.69*** | 6.449*** | 3.836* |
| **Household demographics Wealth quintile** | | | | | | | | | |
| Quintile 1 | Ref | Ref | Ref | Ref | Ref | Ref | Ref | Ref | Ref |
| Quintile 2 | 2.853 | 2.494 | −0.533 | 2.831 | −6.491** | −1.420 | 2.978 | 1.354* | 1.295 |
| Quintile 3 | 7.859*** | 2.136 | −0.143 | 2.433 | −1.161 | −0.999 | 3.685 | 1.301* | 0.902 |
| Quintile 4 | 5.965** | 4.050** | −1.563 | 2.702 | −0.859 | −0.729 | 4.309 | 1.681* | 1.043 |
| Quintile 5 | 5.687** | 1.699 | −0.688 | 1.550 | 5.990 | 3.987 | 7.920* | 2.224** | 1.461 |
| Urban | −2.568* | −0.475 | 0.776 | −1.732 | −8.322* | −5.517** | −5.457** | −0.423 | −1.117* |
| **Woman's characteristics** | | | | | | | | | |
| **Ever tested for HIV** | – | 7.353*** | 8.196*** | 5.688*** | – | 9.929*** | 19.070*** | 2.380*** | 30.56*** |
| **Age** | | | | | | | | | |
| 18 | Ref | Ref | Ref | Ref | Ref | Ref | Ref | Ref | Ref |
| 19 | 0.069 | −0.738 | −2.513 | 1.873 | −0.390 | 2.904 | 2.617 | −0.0461 | −0.837 |

(*Continued*)

Table 3. (*Continued*)

| | BAN | BFA | DOM | DRC | EGY | ETH | GUI | IND | MLW |
|---|---|---|---|---|---|---|---|---|---|
| 20 | 0.547 | 0.816 | −3.008 | −2.856 | 4.438 | 7.548** | 3.465 | 0.29 | −1.980 |
| 21 | 4.634* | 0.402 | −4.596** | −0.155 | 2.916 | 6.095* | −2.812 | 0.818 | −0.281 |
| 22 | 4.611 | 0.353 | −5.649** | 1.885 | 7.936** | 5.078* | −1.469 | 0.0843 | −0.495 |
| 23 | 5.220** | 0.551 | −0.630 | −0.349 | 5.622 | 5.194 | 4.063 | 0.844 | −0.868 |
| 24 | 4.008* | 1.351 | −2.370 | −0.876 | 8.354** | 7.569** | 2.967 | 1.244 | −1.484 |
| **Woman works** | −0.129 | −3.273*** | −0.906 | 2.730* | 6.720** | −0.139 | 1.695 | 1.790*** | 1.929*** |
| **Regular paper reader** | 4.205* | 1.686 | 1.719* | 3.882** | 8.397** | 9.034 | −5.624* | 1.303* | 0.593 |
| **Regular radio listener** | 2.510 | 0.596 | 1.417 | 2.299 | 0.0127 | 0.726 | 3.094 | 0.394 | 0.643 |
| **Regular TV watcher** | 8.704*** | 2.748** | 0.742 | 1.102 | 5.312 | 0.218 | 4.247* | 0.439 | −1.112 |
| **Spousal age gap** | | | | | | | | | |
| Less than 5 years or younger | Ref | Ref | Ref | Ref | Ref | Ref | Ref | Ref | Ref |
| Between 5 and 9 years | 2.961 | −0.126 | 1.331 | −0.235 | 2.527 | 0.0534 | 0.104 | −1.192** | −0.086 |
| 10 years and above | 2.739 | 1.947 | 2.066* | 2.379 | 8.303*** | 1.424 | 1.481 | −0.476 | −1.602** |
| Sample size (final model) | 4162 | 2878 | 1065 | 2828 | 3588 | 2227 | 1582 | 10186 | 4436 |
| | MAL | MOZ | NEP | NIG | NGR | PAK | ROC | UGN | ZMB |
| **Child marriage** | | | | | | | | | |
| Married as adult | Ref | Ref | Ref | Ref | Ref | Ref | Ref | Ref | Ref |
| Married at <18 | −1.860 | −0.841 | 1.737 | 1.270 | 0.202 | 2.384 | −2.651** | 0.231 | −1.020 |
| **Leave-out-mean (LOM)** | | | | | | | | | |
| LOM HIV knowledge index | 0.589*** | 0.252*** | 0.867*** | 0.859*** | 0.735*** | 0.168** | 0.683*** | 0.227** | 0.308*** |
| **Woman's education** | | | | | | | | | |
| No education | Ref | Ref | Ref | Ref | Ref | Ref | Ref | Ref | Ref |
| Primary | 11.371*** | 4.873** | 20.07*** | 8.001*** | 1.597* | −0.280 | 8.581** | 1.002 | 0.478 |

(*Continued*)

**Table 3.** (*Continued*)

| | MAL | MOZ | NEP | NIG | NGR | PAK | ROC | UGN | ZMB |
|---|---|---|---|---|---|---|---|---|---|
| Secondary | 14.950*** | 6.108** | 43.16*** | 12.14*** | 4.217*** | 9.667*** | 12.79*** | 2.382** | 2.949 |
| Higher | 12.473*** | 13.17*** | 48.74*** | 19.94*** | 6.895*** | 38.79*** | 17.39*** | 2.030 | −1.244 |
| **Household demographics Wealth quintile** | | | | | | | | | |
| Quintile 1 | Ref | Ref | Ref | Ref | Ref | Ref | Ref | Ref | Ref |
| Quintile 2 | −6.747** | 4.398* | −5.347* | −0.0253 | 0.073 | −2.722* | 0.439 | 0.349 | −0.333 |
| Quintile 3 | −6.098** | 4.171* | −2.608 | −0.420 | 1.920 | −0.511 | 1.887 | 0.118 | −0.730 |
| Quintile 4 | −9.733*** | 4.496* | −2.37 | 6.542** | 2.550* | 2.606 | 0.898 | 0.324 | −1.240 |
| Quintile 5 | −11.751*** | 5.145* | −3.73 | 6.094* | 1.077 | 8.282** | 2.254 | −0.103 | −1.630 |
| Urban | 1.845 | −1.508 | −0.954 | −10.23*** | −0.912 | −2.156 | −6.134* | 0.963** | 1.147 |
| **Woman's characteristics** | | | | | | | | | |
| **Ever tested for HIV** | 14.28*** | 9.99*** | 12.98*** | 11.59*** | – | 49.69*** | 5.662*** | 6.127*** | 43.84*** |
| **Age** | | | | | | | | | |
| 18 | Ref | Ref | Ref | Ref | Ref | Ref | Ref | Ref | Ref |
| 19 | 7.047** | −4.000* | 5.72 | 5.170* | −1.554 | 4.119 | 1.068 | 2.010** | 1.247 |
| 20 | 3.233 | −1.242 | 4.177 | 5.938** | −0.804 | −0.953 | −1.106 | 1.769* | 2.976 |
| 21 | 5.689* | 0.856 | 6.688** | 9.599*** | −0.832 | 0.993 | 2.258 | 1.019 | 3.168 |
| 22 | 10.78*** | 0.609 | 6.329** | 2.409 | 0.327 | 1.874 | −0.0839 | 1.753** | 2.705 |
| 23 | 7.120** | −4.497 | 5.671* | 9.025*** | 2.016* | 4.485* | −1.794 | 2.379*** | 3.185* |
| 24 | 10.07*** | −1.935 | 6.032* | 8.781*** | 2.634* | 3.311 | −1.244 | 2.457*** | 2.584 |
| **Woman works** | −0.292 | 0.236 | 5.108*** | 7.056*** | 3.339*** | 0.432 | 4.561*** | −0.496 | 2.231*** |
| **Regular paper reader** | 0.967 | 3.929 | 1.17 | −0.0849 | −0.708 | 8.660* | 1.307 | 0.435 | −0.484 |
| **Regular radio listener** | 3.312* | −3.114** | 4.191*** | 3.317** | 1.637* | 5.359 | −0.835 | 0.701** | 1.405** |
| **Regular TV watcher** | 7.290*** | 3.792* | 3.940** | −4.034 | 0.419 | 1.701 | 2.145 | −0.707 | 0.183 |

(*Continued*)

**Table 3.** (*Continued*)

| | MAL | MOZ | NEP | NIG | NGR | PAK | ROC | UGN | ZMB |
|---|---|---|---|---|---|---|---|---|---|
| **Spousal age gap** | | | | | | | | | |
| Less than 5 years or younger | Ref | Ref | Ref | Ref | Ref | Ref | Ref | Ref | Ref |
| Between 5 and 9 years | 4.656* | 2.612* | −0.953 | 2.197 | 1.694 | −2.446* | 0.167 | 0.233 | −0.794 |
| 10 years and above | 3.816 | 1.881 | −0.297 | 0.385 | 1.618 | −0.731 | −2.525 | −0.103 | −0.996 |
| Sample size (final model) | 2080 | 2325 | 2296 | 2178 | 5408 | 2284 | 1312 | 2991 | 1754 |

Ethnicity, religion and region coefficients not shown
Country Abbreviations: Bangladesh(BAN); Burkina Faso(BFA); Dominican Republic(DOM); Democratic Republic of Congo(DRC); Egypt(EGY); Ethiopia(ETH); Guinea(GUI); India(IND); Malawi(MLW); Mali(MAL); Mozambique(MZB); Nepal(NEP); Niger(NIG); Nigeria(NGR); Pakistan(PAK); Republic of Congo(ROC); Uganda(UGN); Zambia(ZMB).
LOM = leave-out-mean. LOM HIV knowledge index = LOM mean HIV knowledge index for women in the PSU.
*Significant at $p < 0.10$; **$p < 0.05$; ***$p < 0.01$.

might receive targeted health interventions or education programmes specifically aimed at increasing HIV awareness due to the perception that these areas are more vulnerable or underserved. Not surprisingly, a woman that has been tested for HIV is more likely to score higher on the knowledge index. In many countries, HIV/AIDS awareness is carried out through mass media and as observed, being a frequent paper reader, radio listener, or TV viewer is associated with higher scores in many countries. On the other hand, there is no association between the spousal age gap and scores on the index. It is likely that, in many contexts, cultural norms around marriage may mean that no matter the size of the age gap, there are other factors that are more important for determining access to health information.

## Discussion

Child marriage does not seem to be associated in a systematic and direct way with lower knowledge about HIV/AIDS. Yet there is extensive evidence that marrying early curtains a girls' educational attainment (see e.g., Field & Ambrus, 2008; Nguyen & Wodon, 2014; Wodon *et al.*, 2016; Wodon *et al.*, 2017). Therefore, through its impact on educational attainment, child marriage may affect knowledge about HIV/AIDS indirectly. Indeed, the coefficients for educational attainment are statistically significant for secondary and higher education in many countries, although not for primary education in comparison with no education at all. Part of the effect of educational attainment on knowledge about HIV/AIDS could be related to the fact that in some countries, girls benefit from classes in sexual and reproductive health in secondary school. Overall, the results suggest that child marriage may affect knowledge about HIV/AIDS indirectly through its impact on educational attainment for girls who marry early, but not necessarily directly (controlling for educational attainment).

On average, if it is assumed that only a small proportion of women who marry early would have had the opportunity to attain secondary education had they not married young, the overall increase in HIV/AIDS knowledge from ending child marriage might be modest (Wodon *et al.*, 2017). This is because the majority of these women may still face other barriers to education and information access, limiting the broader impact. However, for those women who do manage to achieve higher levels of education as a result, the gains in HIV/AIDS knowledge could be significant. For these individuals, higher education would provide them with critical information, skills, and resources that could not only enhance their understanding of HIV/AIDS but also empower them to make informed health decisions, potentially leading to better health outcomes for themselves and their communities. Therefore, even if the aggregate effect is small, the personal impact on those who benefit could be profound. Therefore, delaying marriage until age 18 years, while beneficial in many respects, is unlikely to produce substantial gains in HIV/AIDS knowledge on its own. This limited effect is not surprising, as there are other broader determinants of HIV/AIDS knowledge, such as the public health infrastructure, media exposure, community-level factors like urban residence, and even the prevalence of HIV/AIDS in the population.

There are methodological limitations to consider when interpreting the findings from this study. First, the use of cross-sectional data prevents the establishment of causality, as a temporal sequence cannot be determined. Additionally, the reliance on self-reported variables introduces the potential for response and recall bias. However, the study's strengths lie in its use of large, nationally representative DHS samples from 18 countries, providing a robust and diverse sample of women aged 18–24 years. This allows for broad generalisability and the examination of a wide range of exposures, enabling a comprehensive analysis across diverse contexts.

To further unpack the association of child marriage with HIV/AIDs knowledge, future research can incorporate the use of qualitative methods such as interviews and focus groups to explore the lived experiences of women who married early. This can provide deeper insights into the barriers to accessing HIV/AIDS information and services. It would also provide an understanding of how

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cultural, economic, and social contexts influence the relationship between child marriage and HIV/AIDS knowledge in different regions. This can help identify region-specific factors and tailor interventions accordingly.

## Conclusion

The findings from this study suggest that child marriage does not substantially present a risk by itself for lack of comprehensive HIV knowledge. To improve HIV knowledge among women, particularly married girls, comprehensive strategies are needed. These include providing school-based sexual and reproductive health education early (before girls drop out of the school system). Since child marriage is associated with lower educational attainment, a means of reaching married girls with HIV prevention information is through non-schooling-based channels such as mass media (radio, television, and newspaper). Tailored educational programmes focusing on sexual and reproductive health should be designed for young married women and delivered through community-based workshops and trusted local leaders. Enhanced access to health services, such as mobile clinics and integrating HIV/AIDS education into existing maternal and child health services, is crucial. It is also necessary to have public health campaigns that target both urban and rural populations. Empowering women through peer education and using digital resources for health campaigns can further spread knowledge. Additionally, addressing underlying gender inequalities and ensuring that women, regardless of marital status or age, have equal opportunities to access health information and services would have a substantial impact on improving HIV/AIDS knowledge across the population.

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**Ethical standard.** This study was based on an analysis of publicly available secondary data (DHS datasets) with all identifier information removed. All DHS surveys are approved by ICF international as well as an Institutional Review Board (IRB) in each country to ensure that the protocols are in compliance with the US Department of Health and Human Services regulations for the protection of human subjects.

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