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The Economic Burden of Child Marriage in Nigeria

Xiangming Fang^{a,b*}, Deborah Fry^c, Jingru Ren^a, Wuwenhao Jin^a, Yuchen Zhu^a, Ibrahim Sesay^d, Hadiza Abba^d, Amandine Bollinger^d, Christine Wekerle^e

^a *College of Economics and Management, China Agricultural University, Beijing, China*

^b *School of Public Health, Georgia State University, Atlanta, USA*

^c *Childlight – Global Child Safety Institute, University of Edinburgh, Edinburgh, UK*

^d *Nigeria Country Office, United Nations Children's Fund, Abuja, Nigeria*

^e *The Offord Centre for Child Studies, McMaster University, Hamilton, Ontario, Canada*

*Correspondence: Xiangming Fang, College of Economics and Management, China Agricultural University, 17 Qinghua Dong Road, Haidian District, Beijing 100083, China; E-mail address: xmfang@cau.edu.cn; Tel.: +86(010)-62738705 (X. F.)

Author contributions:

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The Economic Burden of Child Marriage in Nigeria

(Abstract)

Background: Child marriage affects young boys and girls, especially in low and middle income countries, where it represents a dereliction of child rights, duty of care, and the promotion of public health. In Nigeria, child marriage presents a significant challenge, especially for girls, impacting education, health, and national development profoundly. Despite the importance of comprehending the effects of child marriage on health and education and quantifying its economic impact on Nigerian society through these crucial domains, there remains limited knowledge on this matter.

Objective: To estimate the economic burden of child marriage to Nigerian society through its impacts on selected health and education outcomes.

Participants and setting: This analysis utilized a nationally representative sample of approximately 42,000 Nigerian households from the 2018 Nigeria Demographic and Health Survey (NDHS).

Methods: Population attributable fractions were calculated to determine the proportion of health consequences attributable to child marriage. Subsequently, disability-adjusted life years (DALYs) lost due to child marriage-related health outcomes were estimated. DALY losses were monetized by assuming one DALY equals the country's per-capita GDP. Additionally, the study investigated the impact of child marriage on girls' educational attainment and its associated reduction in earnings.

Results: 42% of Nigerian women reported child marriage. In 2019, an estimated 3,489 girls died from pregnancy and childbirth resulting from child marriage. Nearly 40,000 children under the age of 5 years died in the context of child marriage. Child marriage is linked to

various maternal health consequences (e.g., anemia, intimate partner violence, miscarriage/abortion/stillbirth), as well as child health consequences (e.g., overweight, anemia, low birth weight, child mortality). Additionally, child marriage decreases a girl's likelihood of completing secondary or higher education by 22.98%, while earnings for women who married in childhood in Nigeria today are 12% lower than what they could have been without child marriage. Failing to address child marriage could cost Nigeria over US\$10 billion annually.

Conclusions: There is an urgent need to overcome obstacles and integrate efforts to end child marriage into national budgets to secure a prosperous future for Nigeria.

Keywords: child marriage, DALY loss, health, education, economic burden, Nigeria

Introduction

Child marriage in the modern world is an affront to our extensive knowledge of child development, and our understanding of the value of relationship health, from adolescence to early adulthood. Yet, child marriage persists particularly in low- and middle-income countries.

Child marriage was defined as being formally married or in an informal union before reaching the age of 18 (UNICEF, 2023). Child marriage may be facilitated by a variety of factors, including economic conditions, patriarchal attitudes regarding women's role as dependent on men, the emphasis on virginity, expectations of or restrictions on women's sexual and reproductive rights, and religious or traditional beliefs (Pourtaheri et al. 2024; Seth et al., 2018). In some contexts, female genital mutilation may occur before child marriage (UNICEF, 2021). Climate, conflict, and migration crises can lead to child marriage being perceived as a viable means to improve household well-being (Pastén et al., 2024; Peterman et al., 2020; Pope et al, 2023). Additionally, child marriage may facilitate illicit activities like sex trafficking and child labor (Bigio & Vogelstein, 2019). While child marriage is decreasing globally, high rates of about 4 in 10 young women are estimated in West and Central Africa (UNICEF, 2023).

Nigeria is Africa's most populous country, pointing to an opportunity to reckon with on the topic of child marriage. Child marriage poses a significant challenge in Nigeria, particularly for girls, with profound implications for education, health, and national development (Atim, 2017). Nigeria enacted the Child Rights Act in 2003, which prohibits marriage contracts for individuals under the age of 18 years, punishable by fines and imprisonment. Before the Child Rights Act of 2003, the minimum age for marriage for girls in Nigeria varied significantly due to the plural legal system. In the northern regions with

Islamic law (Sharia) and many rural communities, girls could be married as young as 12 or 13 upon reaching puberty (Atim, 2017).

Although the Child Rights Act of 2003 established a uniform minimum age of 18 years for marriage across Nigeria, not all states have adopted the Act. Twenty-seven states have adopted the Child Rights Act, while 9 still operate under older laws (Enweonwu, 2024). Additionally, Nigeria's legal system includes Sharia-based laws, rooted in Islamic tradition, which are not fully aligned with the Child Rights Act. Consequently, these laws may fail to recognize the rights and vulnerabilities of young people, leading to potential disparities in legal treatment (Enweonwu, 2024; Atim, 2017).

The eradication of child marriage is now an integral component of the Sustainable Development Goals, encompassing various targets (Girls Not Brides, 2020). Specifically, Sustainable Development Goal 5 (SDG 5), which focuses on gender equality, has set Target 5.3 to "eliminate all harmful practices, such as child, early and forced marriage and female genital mutilation" by the year 2030 (Girls Not Brides, 2020). A UNICEF report reveals that 43% of Nigerian girls and women were married or in a union before the age of 18 years ((UNICEF, 2022). Ending child marriage aligns with the SDGs, making it imperative to quantify the economic burden to guide policy formulation and prioritize interventions. While it is acknowledged that some boys also marry before turning 18 years old, the overwhelming majority of child marriages involve girls, frequently against their volition and with severe repercussions (UNICEF, 2023).

Child marriage has been consistently linked to various life-course outcomes (Atim, 2017; Koc, 2007). Extensive research has demonstrated its adverse impacts on maternal and child health, intimate partner violence, and education (Godha et al., 2013; Nguyen and Wodon, 2015, 2017; Raj et al., 2010a, 2010b; Wodon et al., 2017; Kidman, 2017). Child marriage is often considered a form of gender-based violence in itself, but is also a risk factor

for other forms of violence against children, including childhood sexual violence (Nasrullah et al., 2014). The repercussions extend to schooling and economic prospects as well, as indicated in studies by Parsons et al. (2015) and Wodon et al. (2017). Child marriage often forces girls out of school, thus increasing the likelihood of limited education and employment opportunities. Nguyen and Wodon (2015) found that child marriage contributed to 15 percent to 20 percent of secondary school dropouts in Nigeria. In a separate study, Nguyen and Wodon (2017) discovered that in Africa, each year of early marriage decreased the probability of literacy by 5.6 percentage points and secondary school completion by 6.5 points. As such, intergenerational transmission of risk may be facilitated by tolerance of child marriage and its concomitant de-emphasis on education and achievement.

Research underscores the association between child marriages and adverse reproductive outcomes such as stillbirth, miscarriage, stunting, underweight, unwanted pregnancies, and abortion (Godha et al., 2013). Early pregnancies pose significant risks to both the mother and her child, with adolescents under 16 years facing four times higher mortality rates due to pregnancy-related causes compared to women in their early twenties (Conde-Agudelo et al., 2005). Infants born to mothers under 18 years old face a 60 percent higher risk of mortality within their first year compared to those born to older mothers. Moreover, infants of young mothers are more likely to be born underweight, premature, and susceptible to severe health complications (Raj et al., 2010a). Child marriage has also been linked to increased incidence of intimate partner violence (Raj et al., 2010b; Kidman, 2017).

Health and education constitute integral facets of human capital. It is imperative to comprehend the repercussions of child marriage on health and education and subsequently quantify the economic toll it imposes on Nigerian society through its effects on these vital domains. This understanding is essential for raising awareness about the prevailing severity of child marriage, fostering advocacy with policymakers, and engaging stakeholders in

formulating and prioritizing policies and interventions dedicated to eradicating child marriage.

The objective of this study is to estimate the economic burden of child marriage in Nigeria, based on the hypothesis that it is negatively associated with maternal and child health outcomes and poor educational attainment. Since child marriage often arises from entrenched gender inequality and disproportionately affects girls, this study focuses exclusively on its economic impacts on females.

Methods

Sample

The study utilized data from the 2018 Nigeria Demographic and Health Survey (NDHS) to estimate the economic cost of child marriage. The 2018 NDHS provides data not only on child marriage prevalence but also on relevant health and educational outcomes (NPC and ICF, 2019). This enabled the study team to directly estimate the proportion of health consequences attributed to child marriage using Greenland and Drescher's (1993) method for calculating Population Attributable Fractions in cross-sectional studies.

The 2018 NDHS, conducted from August 14th to December 29th, 2018, is a nationwide survey providing contemporary demographic and health information (NPC and ICF, 2019). Utilizing a stratified, two-stage cluster design, the survey initially sampled 1,400 enumeration areas in urban and rural regions across 36 states and the Federal Capital Territory (NPC and ICF, 2019). Stratification was conducted by dividing the population into urban and rural areas within each state, resulting in 74 strata. Clusters, or primary sampling units, were selected from these strata, typically corresponding to census enumeration areas. Within each area, 30 households were selected through equal probability systematic sampling, amounting to

approximately 42,000 households. All women aged 15–49 years residing in the sampled households were included in the survey. Additionally, a survey of men was conducted in one-third of these households, encompassing all men aged 15–59 years. Within this subset, one eligible woman per household was randomly selected for additional questioning on domestic violence. Biomarker data collection was limited to households selected for the men's survey, encompassing height and weight measurements for women aged 15–49 years and children aged 0–59 months, hemoglobin testing for women aged 15–49 years and children aged 6–59 months, as well as malaria and sickle cell disease testing for children aged 6–59 months (NPC and ICF, 2019).

Measures

Child marriage was defined based on the participant's age at first marriage or union; those who reported getting married or entering a union before the age of 18 years were classified as having experienced child marriage. To ensure that health outcomes did not precede child marriage, the relationship analyses between child marriage and outcomes also utilized data from females aged 18–49 years and their children under 5 years of age, identified in the household schedule. The maternal health outcomes examined in this analysis included maternal deaths, underweight, obesity, anemia, whether the respondent ever had a pregnancy that terminated in a miscarriage, abortion or still birth (miscarriage/abortion/stillbirth), and whether the respondent had experienced any physical or sexual violence by an intimate partner. The child health outcomes included underweight, obesity, anemia, low birthweight and child mortality. These outcomes were selected based on data availability in the 2018 NDHS and were aligned with the available GBD disease/risk factor categories.

Maternal deaths related to pregnancy and childbirth are a significant component of mortality for girls aged 15–19 years worldwide. Save the Children developed a methodology

to estimate the number of maternal deaths for girls aged 15–19 years attributable to child marriage and estimated that more than 22,000 girls a year died from pregnancy and childbirth resulting from child marriage globally (Save the Children, 2021). The number of child marriage-related maternal deaths for girls aged 15–19 years was calculated using the following formula:

*No. of child marriage-related maternal deaths = adolescent birth date (per 1,000 adolescent women)/1000 * adolescent maternal mortality rate (per 100,000 live births)/100000 * adolescent female population * the percentage of adolescent mothers who were already married/in a union when they gave birth * percentage of adolescent mothers for which child marriage caused pregnancy*

The study team followed the methodology developed by Save the Children to estimate the number of child marriage-related maternal deaths for girls aged 15–19 years in Nigeria. The values of the parameters used in the above formula and the sources of these values are presented in Table 1.

The underweight and obesity variables for women were derived from BMI data. Each woman's BMI was calculated by dividing her weight in kilograms by the square of her height in meters. Women with a BMI of 30 or above were considered obese, while those with a BMI of less than 18.5 were classified as underweight. The anemia variable was defined as having a hemoglobin level below 12 grams per deciliter (g/dL) of blood. Whether the respondent ever had a pregnancy that terminated in a miscarriage, abortion, or still birth, i.e., did not result in a live birth. The variable "history of pregnancy termination" was coded as 1 if the respondent had ever experienced a pregnancy that ended in miscarriage, abortion, or stillbirth (i.e., did not result in a live birth); otherwise, it was coded as 0. Experiencing intimate partner violence was defined as any instance of physical, or sexual violence inflicted by a current or former intimate partner within the previous 12 months.

For child health outcomes, a child is classified as underweight if their BMI is below the 2nd percentile for their age and sex. This corresponds to a BMI-for-age Z-score of less than -2 standard deviations from the median of the reference population. Obesity was defined as having a BMI-for-age Z-score of 2 standard deviations or more above the median of the reference population. Low birthweight was defined as a birth weight of less than 2,500 grams (approximately 5.5 pounds). Child mortality was defined as death of a child from birth to the 59th month of life and coded as a dichotomous variable.

Data Analysis

To assess the economic burden of child marriage, we followed previous studies (Fang et al., 2017, 2015a, 2015b; Hu et al, 2024) to calculate the population attributable fractions (PAFs) for health consequences. We then estimated the disability-adjusted life years (DALYs) lost due to these health outcomes and converted these losses into monetary value, assuming one DALY equals the country's per-capita GDP (WHO, 2001; Brown, 2008). Additionally, we examined the reduction in earnings due to child marriage by analyzing its impact on girls' educational attainment. Methodology details are outlined below.

All analyses were performed using Stata SE version 17 (StataCorp, College Station, Texas), utilizing the SVY command to account for the complex sampling design, including the application of sample weights and adjustments for clustering and stratification. Sample weights were applied to produce weighted survey estimates—such as prevalence rates and relative risks—that are representative of the population. Taylor series linearization within the SVY framework was used to produce robust standard errors, reflecting the survey's complex design.

Economic value of DALYs lost to child marriage

The disability-adjusted life year (DALY) is a generalization of the well-known Potential Years of Life Lost measure to include lost good health. One DALY can be thought of as one lost year of ‘healthy’ life and the measured disease burden is the gap between a population’s health status and that of a normative reference population (WHO, 2017). DALYs formally capture this by adding together the sum of the years of life lost due to premature mortality (YLLs) from that cause and the years of years of healthy life lost due to disability (YLDs) for people living in states of less than good health resulting from the specific cause (WHO, 2017).

The main advantage of using DALY to measure the burden of child marriage is that DALYs provide a composite, internally consistent measure of population health which can be used to evaluate the relative burden of child marriage compared to other public health problems and compare the future potential economic cost due to child marriage by geographic region and over time. Using DALYs to assess burden of disease is increasingly recognized as being an important tool for assisting evidence-based decision making in health (WHO, 2017).

Using nationally representative data from the 2018 NDHS, four steps were taken to estimate the DALY loss of child marriage for selected health outcomes and the corresponding economic value of this loss.

Step One: Estimate the national prevalence of child marriage

Utilizing data from the 2018 NDHS, the prevalence of child marriage before the age of 18 among women aged 18–49 years was estimated within five-year age groups.

Step Two: Estimate relationships between child marriage and outcomes of child marriage

Generalized linear models (with Poisson-distributed errors) based on data from the 2018 NDHS were employed to analyze the relationships (represented by relative risk) between

child marriage and the aforementioned maternal and child health consequences. This analysis controlled for demographic factors, including women's age in 5-year groups (18-24, 25-29, 30-34, 35-39, 40-44, 45-49), de facto region of residence (North Central, North East, North West, South East, South South, and South West), area of residence (urban versus rural), current marital status of the respondent (never in union, married/living with partner, widowed/divorced/no longer living together/separated), family poverty (whether living in households in the lowest wealth quintile), and whether the women received no education. Additionally, child gender and age were included as control variables when examining child health outcomes.

The crude (or unadjusted) odds ratios were first calculated to directly compare the proportions of maternal and child health problems by child marriage status. The relative risks adjusted by demographic factors were then estimated for each of the health outcomes included in this analysis.

Step Three: Calculate PAFs

Population attributable fraction (PAF) is the proportional reduction in population outcomes (such as low birthweight) that would occur if exposure to a risk factor (in this case child marriage) were reduced to an alternative ideal exposure scenario (e.g., no child marriage). To estimate the proportion of health consequences attributable to child marriage, a method recommended by Greenland and Drescher (1993) was followed for estimating PAFs for cross-sectional studies. Stata software (using the command 'punaf' after an estimation command of 'glm') was used to estimate PAFs. This PAF estimation used two pieces of previously estimated data: the prevalence of child marriage and the relative risks of outcomes, given exposure to child marriage. Details on how to use the Stata command 'punaf' to estimate PAFs are available at <http://fmwww.bc.edu/repec/bocode/p/punaf.html>.

Step Four: Develop the costing model

For translation into public health policy and communication to stakeholders, it is important to convert the child marriage-induced losses into dollar terms; doing so will enable the observation of economic benefits in the absence of child marriage to be assessed. Following the work of WHO (2001) and Brown (2008), two steps were used to estimate the economic costs of child marriage:

1. Estimate the disability-adjusted life years (DALYs) lost from deaths, diseases and health risk behaviors attributable to child marriage;
2. Convert the DALY loss into monetary value assuming one DALY is equal to the country's per-capita GDP.

To estimate DALYs lost due to health outcomes associated with child marriage, PAFs representing the contribution of child marriage to these outcomes were multiplied by the corresponding DALY loss for each health condition. The cause-specific or risk-specific DALY data corresponding to these health outcomes were obtained from the Global Burden of Disease Study 2019, which provides the most up-to-date global health data ((GBDCN, 2020).

Given the potential co-morbidity between child marriage and health outcomes, DALY data were solely utilized for women aged 18 years and older to estimate disease-induced DALY losses, thereby reducing the risk of diseases preceding the occurrence of child marriage. Each individual PAF (e.g., 'anemia' or 'low birth weight') was matched with the closest corresponding cause category or risk factor from the GBD Study 2019. To prevent double counting, the contribution of cause categories to DALY loss under a specific risk factor was eliminated if PAFs for these cause categories were separately available.

Additionally, as child mortality under age 5 years old and child marriage-related maternal deaths for girls aged 15 to 19 years were considered distinct health outcomes, years of life lost for other maternal and child health outcomes were also excluded to prevent duplication of the years of life lost due to premature mortality.

PAFs for selected health outcomes (overweight, anemia, intimate partner violence, miscarriage/abortion/stillbirth, and low birth weight) were matched with definitions of 'high body-mass index', 'haemoglobinopathies and haemolytic anemias', 'intimate partner violence', 'maternal abortion and miscarriage', and 'low birth weight' from the Global Burden of Disease Study 2019 (GBDCN, 2020). Certain health outcomes (obesity for women and underweight for children) lacking significant adjusted relative risks were excluded from the analysis. As the Global Burden of Disease Study 2019 only includes 'child underweight' without a corresponding category for 'adult underweight', the health outcome 'underweight for women aged 15–19' was also omitted from the analysis. This exclusion may lead to an underestimation of the burden, reflecting a conservative approach.

A method employed by WHO (2001) and Brown (2008) was used to convert DALY losses into a monetary value. This method assumes that one DALY is equal to the country's gross domestic product per capita. In other words, it is assumed that one year lost due to either disability or mortality is one year lost from the productive capacity of a country's economy and can therefore, on average, be approximated by the gross domestic product per capita – the 'human capital' approach to valuing DALYs.

Data on population, 2019 gross domestic product (GDP), and 2019 GDP per capita for Nigeria were obtained from the World Bank (2023a). After merging the DALY loss, GDP and GDP per capita into a single database by health outcome, the economic value of DALYs lost due to child marriage from a specific health outcome was calculated by multiplying the estimated DALY loss in 2019 by the 2019 GDP per capita. In addition, the economic value of DALYs lost as a percentage of total GDP in 2019 was also calculated.

Reductions in earnings attributable to child marriage

In addition to the aforementioned health outcomes, this study also investigated the impact of child marriage on educational attainment. The World Bank has strongly advocated for the expansion of secondary education in developing nations, such as Nigeria, where secondary enrollments remain low, citing reasons of growth, poverty reduction, equity, and social cohesion (Galal, 2008). Therefore, the educational outcome in this study was defined as whether the respondent completed secondary education or attained a higher level of education.

Utilizing nationally representative data from the 2018 NDHS, the study team investigated the marginal effect of child marriage on children's educational attainment, specifically whether the respondent completed secondary education or achieved a higher level of education. The analysis controlled for women's age in 5-year groups, de facto region of residence (North Central, North East, North West, South East, South South, and South West), area of residence (urban versus rural), current marital status of the respondent (never in union, married/living with partner, widowed/divorced/no longer living together/separated), and family poverty (whether living in households in the lowest wealth quintile).

Marginal effects measure the expected instantaneous change in the dependent variable as a function of a change in a certain explanatory variable while keeping all other covariates constant. For instance, a marginal effect of -0.10 for child marriage on the obtainment of secondary or higher education indicates that child marriage decreases a girl's likelihood of obtaining secondary or higher education by 10 percent. By combining this with data on the annual income difference by educational attainment, the loss of earnings due to child marriage per case was calculated by multiplying the marginal effect of child marriage on educational attainment by the income difference across different levels of educational attainment.

However, data on income by educational attainment were not available from the Nigeria National Bureau of Statistics website or the World Bank. Upon review, the study team identified the General Household Survey (GHS) 2018–2019 data for Nigeria as suitable for estimating income by educational attainment (National Bureau of Statistics, 2019). The GHS sample comprised data from 5,000 households and was designed to be representative at both the national and zonal (urban and rural) levels. This survey included information on both education and wages.

To estimate how many women in the labor force had experienced child marriage in their lifetimes, the study team utilized child marriage prevalence data from the 2018 NDHS and labor force statistics from the World Bank (2023b). The total annual productivity loss attributable to child marriage in Nigeria in 2019 was estimated by multiplying the loss of adult earnings due to child marriage per case by the number of lifetime female victims of child marriage in the labor force.

Selection of a significance level and robustness check

The 2018 NDHS adopted a stratified, two-stage cluster design. Clustering, for a fixed cost, yields more precise population estimates compared to what a simple random design would achieve. However, for a fixed sample size, clustered designs tend to result in larger standard errors. This is because members of the same geographical sub-unit tend to exhibit greater similarities across many attributes compared to independently selected members of the total population. Given that some outcomes, such as child mortality and low birthweight, are low-incidence outcomes (<10%) and considering the clustered design of the 2018 NDHS, we opted for a significance level of 0.25 for all health outcomes. Only adjusted Relative Risks (RRs) meeting these significance levels were used to calculate PAFs.

Despite including numerous control variables in the regression, the statistical model employed may have omitted some relevant variables, potentially leading to omitted-variable bias. Additionally, child marriage and the investigated outcomes, such as educational attainment, could each act as a cause of the other, presenting a mutual causation problem that might introduce estimation bias. Following previous research (Nguyen and Wodon, 2017), the contemporaneous prevalence of child marriage in the area where a girl resides was utilized as an instrument to rerun the regressions and assess the risk of bias. For most outcomes, coefficient estimates obtained from the instrumental variable approach were larger than the study team's estimates without the use of instrumental variables. The robustness check indicated that even in the presence of bias, the team's estimates would more likely be biased downward, thus reflecting a conservative approach to estimation.

Results

Prevalence of child marriage

Based on the data from 2018 NDHS, about 42 percent of Nigerian women aged 18–49 years reported being married or in a union before the age of 18 years. The child marriage rate increases with age, with the highest rate being for the 45–49 years age group at 46.4 percent, compared with 39.8 percent for the 18–25 years age group (Table 2). In contrast, for males, the rate ranges from 2.2 percent to 4.3 percent across the same age groups (Table 2). This clearly indicates that girls are disproportionately affected by child marriage.

Associations between childhood marriage and health consequences

Table 3 summarizes the proportions of maternal and child health problems by child marriage status and the corresponding crude odds ratios. Table 4 presents the magnitude and significance of the relative risks obtained from the regressions, controlling for confounders.

For women, child marriage increases the risk of anemia, experiencing intimate partner violence, and miscarriage/abortion/stillbirth which put girls at risk of death, sterility and other health complications. For children, maternal child marriage increases the risk of overweight, anemia, low birth weight, and child mortality.

Table 5 presents the PAFs for health consequences associated with child marriage. For maternal health outcomes, 1.92 per cent of anaemia, 3.38 per cent of intimate partner violence and 5.66 per cent of miscarriage/abortion/stillbirth were attributable to child marriage. For child health outcomes, 5.54 per cent of overweight, 5.20 per cent of anaemia, 4.78 per cent of low birth weight and 5.10 per cent of child mortality were attributable to child marriage.

Economic burden

In 2019, an estimated 3,489 girls lost their lives due to complications from pregnancy and childbirth resulting from child marriage, equivalent to 254,697 DALYs lost. Additionally, nearly 40,000 children under 5 years died in Nigeria because their mothers were child brides, with a corresponding DALY loss of 3,458,487 (Table 6).

Table 7 presents the number of DALYs lost from non-fatal maternal and child health consequences associated with child marriage. In total, an estimated 24,575 DALYs were lost due to child marriage's impacts on non-fatal maternal health outcomes. The total number of DALYs lost to non-fatal child health outcomes associated with child marriage was 14,696. Combining the DALYs lost from child marriage-related deaths with those from non-fatal maternal and child health outcomes, the total number of DALYs lost to child marriage in Nigeria in 2019 was 3,752,454.

Table 8 presents the aggregate economic burden of child marriage by combining the economic value of DALYs lost from child marriage-related deaths with the economic value

of DALYs lost from maternal and child health outcomes. When converted to monetary value, the estimated economic value of DALYs that Nigeria lost to the selected health consequences of child marriage (including fatal and nonfatal outcomes) in 2019 amounted to ₦2,719 billion (US\$8.37 billion), representing 1.87 percent of the country's GDP.

Reduced earnings

Regarding the impact of child marriage on educational attainment, the marginal effect of child marriage on whether the respondent completed secondary or higher education was - 22.98 per cent (Table 9). This indicates that child marriage decreases a girl's likelihood of completing secondary or higher education by 22.98 per cent.

Based on the secondary analyses of the 2018–2019 GHS data of Nigeria (World Bank, 2019), it was found that the average annual income for women with primary or lower education in 2019 was ₦280,117, while the average annual income for women with secondary or higher education was ₦584,734, a difference of ₦304,617.

Combining these two pieces of data, the loss of earnings per female victim of child marriage in 2019 was ₦70,001 ($₦304,617 \times 22.98$ per cent). Through education, child marriage reduces women's earnings in adulthood by an average of 12 per cent in Nigeria ($₦70,001/₦584,734$). This means that the earnings of women who married in childhood in Nigeria are 12 per cent lower today than they would have been without child marriage.

To calculate the number of lifetime victims of childhood violence in the labour force, prevalence rates generated from the 2018 NDHS (see Table 2) were applied to the whole labour force population. In 2019, there were about 27.6 million Nigerian women aged 15–64 years in the labour force (World Bank Group, 2023b). The study team estimated that 11.62 million women in the labour force in 2019 were victims of child marriage (27.6 million \times 42.1 per cent). Thus, in 2019, the total loss of earnings attributable to child marriage was

₦813 billion (₦70,001 × 11.62 million) (US\$2.50 billion), accounting for 0.56 per cent of Nigeria's GDP (see Table 9).

Discussion

This is the first study to estimate the economic burden of child marriage in Nigeria, which is common in the lives of many Nigerian girls. The economic burden of the selected maternal and child health consequences of child marriage (including both fatal and nonfatal outcomes) totalled ₦2,719 billion (US\$8.37 billion) in 2019, accounting for 1.87 per cent of the country's GDP. The elimination of child marriage would have led to annual benefits of up to US\$8.37 billion through reduced maternal and child health consequences of child marriage. An estimate of the economic burden was conducted for Ethiopia and on the global level previously. The economic costs associated with selected impacts of child marriage (including reduced population growth, increased under-five mortality and increased under-five stunting) in Ethiopia were estimated to be US\$1.2 billion in 2015, accounting for 1.86 per cent of Ethiopia's GDP (Wodon et al., 2018). The economic burden estimate for Nigeria as a percentage of GDP is similar to that for Ethiopia. The global economic costs associated with the impacts of child marriage were estimated to be US\$73 billion in 2015 (Wodon et al., 2017). Updated to 2019 dollars using the GDP deflator, the estimate is equivalent to US\$80.6 billion. The economic burden of child marriage in Nigeria estimated is roughly 10 per cent of Wodon et al.'s estimate of the global economic burden.

The loss of earnings due to child marriage in 2019 in Nigeria totalled ₦813 billion (US\$2.61 billion), accounting for 0.56 per cent of Nigeria's GDP. On average, through education, child marriage reduces women's earnings in adulthood by 12 per cent in Nigeria, which is also close to the 9 per cent found in the Wodon et al. (2018) study. Earnings for

women who married in childhood in Nigeria today are 12 per cent lower than what they could have been without child marriage.

Child marriage leads to substantial economic costs and may have far-reaching social consequences, reinforcing cycles of gender inequality. Women who marry as children often face increased risks of poor health, intimate partner violence, limited education, and reduced lifetime earnings. These adverse maternal outcomes, along with the heightened risks of health complications for their children, perpetuate intergenerational cycles of poverty, inequality, and child marriage.

As with any research endeavor, it is essential to acknowledge several study limitations. Firstly, while the PAF-based approach is widely used and accepted for estimating attributable burdens in public health and epidemiologic literature, it can be sensitive to slight alterations in underlying parameters, such as prevalence and relative risk. These small changes can significantly affect the final results when multiplied by an aggregate outcome, potentially leading to overestimation of the economic burden. Additionally, since many diseases and health risk behaviors stem from multiple risk factors that may interact, PAFs for individual risk factors often overlap and could sum up to more than 100 percent, further contributing to overestimation.

Secondly, the assessment of child marriage relied solely on self-reports, making it susceptible to biases inherent in this form of measurement, including recall bias, social desirability bias, and reporting bias.

Thirdly, while the DALY measure has been instrumental in assessing disease burden, its validity for disability and its universal applicability have been subjects of debate. Therefore, caution is warranted when interpreting DALY results.

Fourthly, to convert DALY losses into a monetary value, the study employed a method assuming the economic value of one DALY equals one year of the country's GDP. Loss of earnings attributable to child marriage was estimated based on its impact on educational attainment. However, as both approaches are rooted in the concept of 'human capital', it's important to exercise caution when combining these two burden estimates to calculate the total economic impact of child marriage, as there is a risk of double-counting.

Fifthly, adjusted relative risks for associations between child marriage and related health outcomes were estimated based on cross-sectional survey data, which may not establish definitive cause-and-effect relationships. Thus, relative risks derived from cross-sectional studies might either overestimate or underestimate the actual relationships. While it's imperative to mitigate overestimation, there exist numerous sources of potential underestimation. Owing to unavailable data, several significant consequences of child marriage, such as heightened healthcare utilization, were omitted from the analysis. Moreover, costs associated with the legal system, self-harm, and chronic illnesses like diabetes, heart disease, and cancer were also excluded. Nigeria lacks dependable longitudinal data to ascertain the long-term repercussions of child marriage. The absence of high-quality cohort studies that adopt a lifetime perspective in economic data estimation may lead to substantial underestimation of the economic impact of child marriage.

Lastly, previous research has indicated a higher likelihood of disability among women who married during childhood in middle- and low-income countries (Emerson & Llewellyn, 2022). However, this association was not included in the economic burden estimation due to insufficient data in Nigeria. Future research should examine this connection further to better understand its implications.

Conclusion

A prosperous future for Nigeria, inclusive of girls, hinges on ending child marriage, as underscored by this study. This complex issue is driven by intertwined social values, cultural beliefs, and economic factors, necessitating an integrated, multisectoral approach across child protection, education, health, and related fields. This approach aligns with UNICEF's Adolescent Girls Programme Strategy (2022a) and emphasizes gender-transformative programs, behavior change initiatives, and collaborative partnerships. By preventing child marriage, young girls can achieve their potential, leading to societal benefits such as reduced maternal and child mortality, improved health outcomes, decreased violence, and enhanced education and earnings prospects. Overcoming budgetary obstacles and increasing investment in coordinated efforts are imperative to ending child marriage in Nigeria.

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Table 1: Value of parameters used to estimate the number of maternal deaths for girls aged 15-19 attributable to child marriage in Nigeria

Variable	Definition	Value	Source	Year	Age group
Teenage female population	Number of girls aged 15-19	10420692	World Bank	2019	Girls 15-19
Adolescent birth rate	Number of live births to adolescent women per 1,000 adolescent women	106	UNICEF	2017	Girls 15-19
Adolescent maternal mortality rate	Number of maternal deaths during a given time period per 100,000 live births during the same time period	780	The Lancet Global Health	2001-2008	Girls 15-19
Prevalence of child marriage among adolescent mothers	Percentage of adolescent births from adolescents who were already in a marriage/union	90%	UNFPA	2015	Adolescent mothers
Percentage of adolescent mothers for which child marriage caused pregnancy		45%	Save the Children	2021	Adolescent mothers

Table 2: The prevalence of child marriage before age 18 among 18-49 year old females, compared to males across the same age groups

Age group		18-49	18-24	25-29	30-34	35-39	40-44	45-49
Females	Prevalence (%)	42.1	39.8	42.8	43.4	39.4	44.6	46.4
	95% CI	40.8-43.5	37.8-41.9	40.9-44.6	41.4-45.4	37.5-41.4	42.5-46.8	44.5-48.4
Males	Prevalence (%)	3.4	2.2	3.1	3.7	4.3	4.0	3.4
	95% CI	3.0-3.8	1.6-3.0	2.3-4.1	2.9-4.9	3.4-5.6	3.0-5.2	2.4-4.9

Table 3: Proportions of maternal and child health problems by child marriage status

Health outcome	Child marriage status		Unadjusted OR	95% CI	
	Yes	No			
<i>Maternal health</i>					
Underweight	Total (n)	5384	7759		
	Yes (%)	11.3	7.6	1.56	[1.39, 1.76]
	No (%)	88.7	92.5		
Anemia	Total (n)	5343	7688		
	Yes (%)	60.5	55.5	1.23	[1.14, 1.32]
	No (%)	39.5	44.5		
Obesity	Total (n)	3273	5808		
	Yes (%)	10.3	13.1	0.76	[0.66, 0.87]
	No (%)	89.7	86.9		
IPV	Total (n)	908	23		
	Yes (%)	22.8	23.4	0.97	[0.88, 1.07]
	No (%)	77.2	76.6		
Miscarriage/abortion /stillbirth	Total (n)	15308	21293		
	Yes (%)	15.5	11.4	1.43	[1.34, 1.52]
	No (%)	84.5	88.6		
<i>Child health</i>					
Underweight	Total (n)	5434	5977		
	Yes (%)	6.9	5.4	1.30	[1.12, 1.52]
	No (%)	93.1	94.6		
Overweight	Total (n)	5434	5977		
	Yes (%)	15.6	13.6	1.17	[1.06, 1.30]
	No (%)	84.4	86.4		
Anemia	Total (n)	4881	5301	1.56	[1.43, 1.69]

	Yes (%)	73.7	64.3		
	No (%)	26.3	35.7		
	Total (n)	1780	5948		
Low birthweight	Yes (%)	9.0	6.8	1.36	[1.13, 1.65]
	No (%)	91.0	93.2		
	Total (n)	18069	15855		
Child mortality (0-4)	Yes (%)	11.4	7.3	1.62	[1.50, 1.75]
	No (%)	88.6	92.7		

Table 4: Relative risks (RRs) for maternal and child health outcomes associated with child marriage

	Health outcome						
	Underweight	Overweight/obesity	Anemia	IPV	Miscarriage/abortion /stillbirth	Low birthweight	Child mortality
	RR (95% CI)	RR (95% CI)	RR (95% CI)	RR (95% CI)	RR (95% CI)	RR (95% CI)	RR (95% CI)
Women (18-49)	-	-	1.05** [1.00, 1.09]	1.08* [0.98, 1.20]	1.13*** [1.05, 1.21]	N/A	N/A
Children (0-4)	-	1.12* [0.97, 1.29]	1.11*** [1.07, 1.16]	N/A	N/A	1.19* [0.90, 1.54]	1.09* [0.98, 1.20]

Note: All regressions controlled for women's age in 5-year groups, de facto region of residence (North Central, North East, North West, South East, South South, South West), area of residence (urban versus rural), current marital status of the respondent (never in union, married/living with partner, widowed/divorced/no longer living together/separated), family poverty (whether living in households in the lowest wealth quintile), and whether the women received no education. Additionally, child gender and age were included as control variables when examining child health outcomes.

*** p<0.01; ** p<0.05; * p<0.25.

Table 5: Population attributable fractions for maternal and child health outcomes associated with child marriage

	Health outcome						
	Underweight	Overweight/obesity	Anemia	IPV	Miscarriage/abortion /stillbirth	Low birthweight	Child mortality
Women (18-49)	-	-	1.92%	3.38%	5.66%	N/A	N/A
Children (0-4)	-	5.54%	5.20%	N/A	N/A	4.78%	5.10%

Table 6: Estimates of DALYs lost to child marriage-related deaths

	Child marriage-related deaths				
	Girls who died from pregnancy and childbirth resulting from child marriage		Child mortality (0-4)		Total DALYs lost to deaths
	# of deaths	DALYs lost to death	# of deaths	DALYs lost to death	
Child marriage	3,489	254,697	39,443	3,458,487	3,713,184

Table 7: Estimates of DALYs lost to health consequences associated with child marriage

	Health consequences					Total
	Overweight	Anemia	IPV	Miscarriage/abortion /stillbirth	Low birthweight	
Women (18-49)	-	5,026	13,147	6,401	N/A	24,575
Children (0-4)	148	6,728	N/A	N/A	7,819	14,696
Total	148	11,754	13,147	6,401	7,819	39,270

Table 8: Estimated economic value of DALYs lost to child marriage in 2019 and as a percentage of gross domestic product (GDP)

	Economic value of DALYs lost from deaths (billion NGN)	Economic value of DALYs lost from health outcomes (billion NGN)					Aggregate Costs	
		Overweight	Anemia	IPV	Miscarriage/abortion /stillbirth	Low birthweight	Billion NGN	% GDP
Women (18-49)	184.58	-	3.64	9.53	4.64	N/A	202.39	0.14%
Children (0-4)	2506.38	0.11	4.88	N/A	N/A	5.67	2517.03	1.73%
Total	2690.96959232816	0.11	8.52	9.53	4.64	5.67	2719.42	1.87%

Table 9: The total loss of earnings attributable to child marriage in 2019

	Marginal effect on whether obtaining complete secondary or higher education	Annual income difference (NGN)	Reduced earnings per victim (NGN)	# of lifetime victims of child marriage in the labor force	Total loss of earnings (billion NGN)	
					NGN	% GDP
Child marriage	-22.98%	304617	70001	11618404	813.30	0.56%