Early marriage, early childbearing and female height: Evidence from a large cross-country analysis

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Abstract:

Despite the concerted efforts to eliminate child marriages over the decades, globally, 19% of women (aged 20-24) are married before the age of 18. Child marriages are more prevalent in developing countries due to cultural norms and socio-economic poverty. Previous research from developing countries has confirmed the association between early marriage and pregnancy on female heights. This paper empirically analyses the association between child marriage, early childbearing and female height using the Demographic Health Surveys (DHS) conducted in 66 developing countries, covering nearly two million ever-married women who were born between 1950 and 1999. The methods of analysis include multivariate regression models controlling for an array of individual, household level and aggregate country-level socio-economic and demographic variables. We find a statistically significant association between child marriage, early childbearing and adult height. Women whose first birth was before 18 years of age are estimated to be 0.46 (cm) shorter than those whose first birth was after 20 years. These results are robust to a number of confounding factors and also to alternative specifications. Additionally, we tested for the 'mortality selection hypothesis'. However, the findings give no evidence for the same. The research emphasises the need for greater action to eliminate early marriage and adolescent pregnancies and raise awareness among poor communities about the adverse consequences of early pregnancies.

Key Words: Early marriage, early childbearing, adult height, mortality selection

Introduction:

Child marriage is a violent infringement on the child's right to achieve her or his full potential (UNICEF, 2018). The practices have continued to decline around the world, where the global number of child brides is now estimated at 650 million. However, South Asia is still home to the largest number of child brides, followed by sub-Saharan Africa (UNICEF, 2018). Besides being a violation of the human rights of children, early marriage and adolescent pregnancy adversely affect maternal and child health (Sunder,

2019; Goli, Rammohan, and Singh, 2015; Godha, Hotchkiss, and Gage, 2013; Raj, 2010). Early marriage and early pregnancy may constrain physical growth among women (Rah, Christian, Sahmim et al. 2008; Marphatia, Savilles, Manandhar et al. 2020). Studies also confirmed the intergenerational health benefits for children born to mothers who marry later in life. Stunted women may give birth to smaller-sized babies who, in turn, face difficulties in catching up with the growth trajectories of their counterparts (Sunder, 2019). Previous research from developing countries has found that child marriage and adolescent pregnancy are associated with shorter stature (Rah, Christian, Sahmim et al. 2008; Marphatia, Savilles, Manandhar et al. 2020; Allal, Sear, Prentice et al. 2004; Sear 2010). However, the aim of this paper is to empirically examine the association between child marriages, early childbearing and female height. Height being an important bio-marker of human well-being, is linked with greater life expectancy, and higher education and earnings (Deaton 2007, 2008). Previous research has posited a mortality selection hypothesis as a potential explanation for the observed increase in heights over time (Bozzoli, Deaton and Quintana-Domeque, 2009; Crimmins and Finch, 2006; Akachi and Canning, 2010). Therefore, we tested our main results for the potential 'mortality selection hypothesis'.

Objectives:

The study focuses on the role of early marriage and pregnancy in inhibiting growth among women in the second growth stage around puberty. The paper examines the association between early marriage, early pregnancy and adult female height. Additionally, we tested our main results for the potential mortality selection hypothesis (*i.e.* the proposition that in high mortality settings, healthier female children are more likely to survive, and this contributes to taller average height over time).

Data and Methodology:

The empirical investigation in the present study is based on a sample from Demographic and Health Surveys (DHS) data from 66 countries surveyed over the period 1990-2020. The final sample consists of 1,960,547 women aged 18-49 at the time of the survey and born during the period 1950-1999. The survey used the same questionnaires across all the countries, making it possible to conduct a cross-country analysis over a 30-year period.

In this study, the outcome variable is the height of the female respondent aged 15-49 years at the time of the survey, measured in centimetres, excluding the outliers (observations with heights falling outside the normal range of 130-220 (cm)) and women aged 50 years or above. The main explanatory variable for our analysis is early marriage, defined as a binary variable indicating whether a woman got married before the age of 18 (=1), 0 otherwise. We include control variables, which include the female respondent's characteristics and other socio-economic and demographic characteristics of households.

We estimate an Ordinary Least Squares (OLS) model which can be formally written as:

$$h_{ijt} = \beta_0 + \beta_1 EM_{ij} + \theta \sum Age\_FB_{ij} + \pi\, EM_{ij} * \sum Age\_FB_{ij} + \beta_j X_{ij} + yyb_t + c_j + \varepsilon_{ij} \qquad (1)$$

Where the dependent variable h_{ijt} indicates female height (h) measured in centimeters (cm) of individual i from country j at time t, which represents birth year cohort, grouped in 5-year categories. The term EM_{ij}, a measure of early marriage is a dummy variable taking on a value of 1 if the woman married before the age 18, 0 otherwise. X is a vector of explanatory variables, including the individual and socio-economic and demographic characteristics of the respondent. Finally, we include dummy variables for countries c_j.

Since early marriage affects female height through early pregnancy and childbirth, we add an interaction term between early marriage and female age at first birth (*Age_FB),* through a set of dummy variables indicating whether female age at first birth is below age 16, 17, 18 or 19 years. Finally, female heights may be affected by micronutrient deficiencies, indicated by female anaemia status.

The study also explores the 'mortality selection hypothesis' (*i.e.* the proposition that in high mortality settings, healthier female children are more likely to survive, and this contributes to taller average height over time) and the role of disease environment in influencing female height. To test this proposition, we included an additional variable to equation (1) that indicates the country-level child mortality rate in the year of the respondent's birth, using data over the period 1950-1990 from the Gapminder Foundation (Gapminder Foundation 2021). Furthermore, we include measures of GDP per capita (from Gapminder Foundation, 2021) and Co2 emission levels (from Global Carbon Budget 2020) to control for country-level economic development and environmental variables that may influence child height development at an early age.

Findings:

Table 1 presents the summary statistics of the main variables used in our empirical analysis. Approximately 44.8% of the sample were married before the age of 18. Among women who married before the age of 18, more than half gave first birth before the age of 18, including 18.9% whose first birth was before age 16 and 34.4% giving first birth at the age of 16 or 17 years. The empirical analysis (Table 2&3) shows that there is a statistically significant and positive relationship between early marriage and age at first birth and maternal height. Childbearing before the age of 18 was significantly associated with shorter stature, relative to women whose first birth was after 20 years of age. Women whose first birth was before 18 years of age are estimated to be 0.46 (cm) shorter than those whose first birth was after 20 years. This relationship persists even after controlling for an array of socio-economic and demographic variables. The analysis finds no evidence of a 'mortality selection hypothesis'. Better household economic status and female education are associated with higher female adult heights. Also, an improvement in national income and a reduction in gender gaps were associated with higher adult heights for women.

Conclusions:

Early marriage and childbearing are widely observed in many developing countries, and the possible mechanisms through which early marriage operates on female heights are both physiological and social. In summary, the women who married and had their first child before 18 years of age are significantly shorter than their counterparts. The research emphasizes the need for greater action to eliminate early marriage and adolescent pregnancies and raise awareness among poor communities about the adverse consequences of early pregnancies.

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Appendix

Table 1. Descriptive statistics of key variables

	Age at first marriage		
	<18	18 or higher	T-test
Dependent variable	(A)	(B)	(=B-A)
Women's height (cm)	154.6 (0.0)	155.3 (0.0)	0.74***
Explanatory variables (%)			
Age at 1st birth: below 16	18.9 (0.0)	1.1 (0.0)	17.9***
Age at 1st birth: 16-17	34.4 (0.1)	2.6 (0.0)	-31.8***
Age at 1st birth: 18-19	30.2 (0.0)	15.6 (0.0)	-14.6***
Age at 1st birth: 20+	16.5 (0.0)	80.1 (0.0)	64.2***
Women's education			
No education	45.2 (0.1)	23.0 (0.0)	-22.4***
Primary	30.1 (0.0)	23.3 (0.0)	-6.8***
Secondary +	24.4 (0.0)	53.7 (0.0)	29.3***
Household size			
1-3 persons	13.7 (0.0)	18.1 (0.0)	4.3***
4-5 persons	33.7 (0.1)	37.9 (0.0)	4.1***
6+ persons	52.5 (0.1)	44.1 (0.0)	-8.4***

Urban household	29.8 (0.0)	44.3 (0.0)	13.6***
Household head is male	84.9 (0.0)	82.7 (0.0)	-2.2***
Household head's age			
13-29	14.2 (0.0)	11.5 (0.0)	-2.7***
30-59	73.5 (0.0)	72.9 (0.0)	-0.6***
60+	12.3 (0.0)	15.6 (0.0)	3.3***
Anaemia level			
Severe/moderate	7.0 (0.0)	7.0 (0.0)	0.0
Mild	18.0 (0.0)	19.5 (0.0)	1.5***
No	29.5 (0.0)	36.0 (0.0)	6.5***
Missing	45.4 (0.1)	37.5 (0.0)	-8.0***
Partner's education			
No or primary education	51.4 (0.1)	31.5 (0.0)	-19.9***
Secondary +	27.3 (0.0)	44.2 (0.0)	16.9***
Don't know or missing	21.3 (0.0)	24.3 (0.0)	3.0***
Wealth index quintile			
Poorest	25.0 (0.0)	16.6 (0.0)	-8.4***
Poorer	23.3 (0.0)	18.2 (0.0)	-5.2***
Middle	21.0 (0.0)	19.6 (0.0)	-1.4***
Richer	17.8 (0.0)	21.1 (0.0)	3.3***
Richest	12.9 (0.0)	24.5 (0.0)	11.7***
Number of observations	878,393	1,082,154	

Source: Authors' own calculation; values in parentheses are standard deviations.
Notes: the statistics are mean weighted by household weight; the sample consists of 66 countries. The observations of women married at the age of 18+ include those who were never married at the time of the survey. T-test is the test of the difference between non-child-married groups and child-married groups (unweighted); *** indicates the difference is statistically significant at a 1% level.

Table 2. OLS estimation – early marriage, early childbearing and female heights

	Dependent variable: Women's height in cm
Child marriage	-0.165*** (0.036)
Age at first birth (ref: aged 20+ or never giving birth)	
<=15	-0.513*** (0.065)
16-17	-0.145*** (0.047)
18-19	-0.060*** (0.020)
[Child marriage] * [age at first birth]	
<=15	0.214*** (0.065)
16-17	0.114** (0.054)
18-19	0.146*** (0.033)
Women's education	
Primary	0.023 (0.047)
Secondary +	0.900*** (0.095)
Household size (ref: 1-3 persons)	
4-5 persons	0.090*** (0.023)
6+ persons	0.097*** (0.035)
Urban household	-0.231*** (0.086)
Household head is male	-0.206*** (0.038)
Age of household head (ref: 13-29)	
30-59	0.410*** (0.031)
60+	0.458*** (0.037)
Wealth index (ref: 1st/poorest quintile)	
2nd quintile	0.376*** (0.057)
3rd quintile	0.787*** (0.107)
4th quintile	1.267*** (0.158)
5th quintile	2.152*** (0.226)

Anaemia level (ref: severe/moderate)	
Anaemia: Mild	-0.001 (0.019)
Anaemia: No	0.148*** (0.031)
Anaemia: Missing	-0.049 (0.038)
Partner's education	
Secondary+	0.505*** (0.036)
Don't know/missing	0.328*** (0.044)
Birth year cohort (ref: 1950-54)	
1955-59	0.146 (0.118)
1960-64	0.392*** (0.116)
1965-69	0.592*** (0.100)
1970-74	0.697*** (0.096)
1975-79	0.739*** (0.095)
1980-84	0.707*** (0.103)
1985-89	0.670*** (0.114)
1990-94	0.588*** (0.114)
1995-99	0.246* (0.137)
Country Dummies	Yes
N	1,960,547

Robust standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3. Additional checks – OLS estimations of female height with interaction terms, and aggregate data on gender equality and mortality.

	Dependent variable: Women's height in cm	
	(1)	(2)
Age at marriage	(ref: >=19)	(ref: >=18)
14 or below	-0.258*** (0.055)	-
15-18	-0.102*** (0.031)	-
<=17		-0.161*** (0.039)
Age at first birth (ref: >=20)		
Below 16	-0.552*** (0.086)	-0.531*** (0.074)
16-17	-0.123** (0.058)	-0.165*** (0.053)
18-19	-0.118*** (0.033)	-0.065*** (0.022)
[Age at marriage]*[age at first birth]		
[14 or below]*[below 16]	0.345*** (0.094)	-
[14 or below]*[16-17]	0.151** (0.074)	-
[14 or below]*[18-19]	0.182*** (0.061)	-
[15 - 18]*[below 16]	0.211** (0.093)	-
[15 - 18]*[16 - 17]	0.057 (0.063)	-
[15 - 18]*[18 - 19]	0.163*** (0.039)	-
Early marriage*age at first birth		
<=15	-	0.241*** (0.074)
16-17	-	0.154*** (0.058)
18-19	-	0.160*** (0.034)
Under 5 Mortality Rate	-0.050*** (0.012)	-0.050*** (0.012)
Ln(GDP per head)	0.242* (0.139)	0.241* (0.139)
Ln(CO2 emission)	0.046 (0.061)	0.047 (0.061)
Gender equality index	0.020*** (0.006)	0.020*** (0.006)
Women's education (ref: no)		
Primary	-0.040 (0.049)	-0.038 (0.049)
Secondary +	0.804*** (0.101)	0.808*** (0.100)
Household size (ref: 1-3 persons)		
4-5 persons	0.084*** (0.024)	0.084*** (0.024)
6+ persons	0.066* (0.034)	0.066* (0.034)
Urban household	-0.300*** (0.087)	-0.300*** (0.087)
Household head is male	-0.168*** (0.041)	-0.168*** (0.041)
Age of household head (ref: 13-29)		

30-59	0.411*** (0.033)	0.411*** (0.033)
60+	0.441*** (0.040)	0.441*** (0.040)
Wealth index (ref: 1st/poorest quintile)		
2nd quintile	0.450*** (0.058)	0.451*** (0.058)
3rd quintile	0.910*** (0.111)	0.910*** (0.111)
4th quintile	1.431*** (0.167)	1.431*** (0.167)
5th quintile	2.397*** (0.233)	2.398*** (0.233)
Anaemia level (ref: severe/moderate)		
Anaemia: Mild	0.000 (0.018)	0.000 (0.018)
Anaemia: No	0.182*** (0.026)	0.182*** (0.026)
Anaemia: Missing	-0.042 (0.041)	-0.042 (0.041)
Partner's education (Ref: no)		
Secondary+	0.513*** (0.040)	0.514*** (0.040)
Don't know/missing	0.326*** (0.047)	0.327*** (0.047)
Birth year cohort (ref: 1950-54)		
1955-59	0.041 (0.127)	0.041 (0.127)
1960-64	0.123 (0.121)	0.123 (0.121)
1965-69	0.184 (0.124)	0.184 (0.124)
1970-74	0.189 (0.131)	0.188 (0.131)
1975-79	0.100 (0.146)	0.100 (0.146)
1980-84	-0.044 (0.171)	-0.044 (0.171)
1985-89	-0.212 (0.195)	-0.213 (0.195)
1990-94	-0.383* (0.209)	-0.383* (0.209)
1995-99	-0.855*** (0.241)	-0.857*** (0.242)
Country Dummies	Yes	Yes
N	1,673,742	1,673,742

Robust standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$