Role of child marriage and adolescent childbearing on hysterectomy among married women in India: a cross-sectional and survival analysis

Biplab Kumar Datta[1] and Ashwini Tiwari[1]

[1]Augusta University

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Abstract

Objective: Child marriage forces a girl into adult roles before physical and psychological maturity, which can take a toll on women's health over the life course. This paper aims to assess whether child marriage and adolescent childbearing are associated with elevated risk of gynecologic disorders leading to hysterectomy. **Design**: Cross-sectional and survival analysis. **Setting**: India, nationally representative survey. **Population**: 528,816 ever married women, aged 20-49 years. **Methods**: Women were grouped in four mutually exclusive categories – i) married adult – not an adolescent mother (reference category), ii) married adult – adolescent mother, iii) married child – not an adolescent mother, and iv) married child – adolescent mother. Multivariable logistic regressions were fitted to assess the odds of hysterectomy for these groups. Non-parametric Kaplan-Meier survivor functions were estimated to evaluate survival rates across the groups. **Main outcome measures**: Whether had a hysterectomy and age when hysterectomy was performed. **Results**: Compared to women married as adult – not an adolescent mother, women married in childhood and who gave birth in adolescence were 1.87 (95% CI: 1.78–1.96) times more likely to have a hysterectomy and had the lowest survival rate for hysterectomy. Women married as children but not an adolescent mother also had higher odds of hysterectomy (AOR = 1.40, 95% CI: 1.31–1.50). These results were robust across sub-groups including geographic regions, urban/rural residence, education, and income. **Conclusions**: Our results, showing a strong relationship between child marriage and hysterectomy, contribute to the literature on later-life health consequences of child marriage and call for strengthening efforts to eradicate child marriage.

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Biplab Kumar Datta[1,2*] and Ashwini Tiwari[1,3]

[1] Institute of Public and Preventive Health, Augusta University, Augusta, GA, USA. [2] Department of Health Management, Economics and Policy, Augusta University, Augusta, GA, USA.[3] Department of Community & Behavioral Health Sciences, Augusta University, Augusta, GA, USA.

[*]Corresponding author. Email: bdatta@augusta.edu. Address: 1120 15th Street, Augusta, GA 30912, United States. Tel. +1 706-721-8794.

Running title: Child marriage, adolescent childbearing and hysterectomy

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Funding

None.

Keywords

Hysterectomy; Gynecologic diseases; Pregnancy in Adolescence; Marriage age; India.

Introduction

Child marriage, defined as marriage or union before the age of 18 years, is an abrupt and immature transition from girlhood to womanhood. It forces a girl to perform adult roles in the absence of the needed physical or mental preparation. Such a precocious transition entailing early sexual intercourse and subsequent childbearing can take a toll on women's health over the course of time. The literature on health consequences of child marriage mostly examined its association with immediate reproductive health outcomes including fertility, birth intervals, adverse pregnancy outcomes, contraceptive use, and antenatal care utilization.[1] Health consequences of child marriage over the life course, especially in the context of later-life gynecologic health are comparatively less explored.

This paper examines the role of child marriage and subsequent childbearing during adolescent age (i.e., by age 19 years) on having a hysterectomy, one of the most common surgical procedures for women with benign and malignant gynecological diseases,[2] among women in India, home to one third of the world's child brides.[3]

Studies on hysterectomies in India primarily assess prevalence rates,[4-6] spatial and regional patterns,[7, 8] sociodemographic determinants,[4, 9-11] preference for healthcare facility to perform hysterectomy,[12] and women's perception and decision on undergoing hysterectomy.[13]A few studies also explored the association between hysterectomy and health outcomes such as hypertension, high cholesterol, diabetes, etc.[14, 15] Although some studies report a lower prevalence of hysterectomy among women who were married after age 15 years,[6, 8, 9] no studies have offered any critical assessment of the relationship between gynecological disorders leading to hysterectomy and child marriage and adolescent childbearing.

The aim of this paper is to assess the likelihood of hysterectomy in general (i.e., all cause hysterectomy), and specific gynecological problems (e.g., excessive menstrual bleeding, fibroids/cysts, uterine rapture, cancer, and other) as reasons of hysterectomy in relation to child marriage and adolescent childbearing among ever married women aged 20 to 49 years in India.

Methods

Data

Data were from the 2019-21 National Family Health Survey (NFHS-5) of India. The NFHS-5 is a nationally representative survey that provides sociodemographic and health information of reproductive-aged women in India.[16] Our sample comprised 528,816 ever married women aged 20-49 years. We used publicly available anonymized data that met the definition of the NIH exempt human subject research (exemption 4). Therefore, ethics committee approval was not required for this study.

Measures

Child marriage and Adolescent Childbearing Exposure Variable : Based on the NFHS-5 report of respondent's age at first marriage and detailed record of births, we identified women who were married before the age of 18 years and who gave birth by the age of 19 years. Our exposure variable was a categorical variable that took four mutually exclusive categories – i) married as adult – did not give birth in adolescence (reference category), ii) married as adult – gave birth in adolescence, iii) married as child – did not give birth in adolescence, and iv) married as child – gave birth in adolescence.

Hysterectomy Outcome Variables. In the NFHS-5, women were asked if they had undergone an operation to remove their uterus. Those who answered yes to this question were determined to have a hysterectomy. As such, our outcome variable is a binary variable indicating whether a women did or did not undergo a hysterectomy. Women who reported to have hysterectomy by age 19 years (N=257 – 0.05% of the total sample, 1.23% of all hysterectomies) were excluded in line with our goal of examining the role of marriage before age 18 years and childbearing by age 19 years on likelihood of hysterectomy between age 20 to 49 years.

Those who had a hysterectomy were further asked how many years ago the procedure was performed. Subtracting this period from the respondent's current age (in years), we calculated the age at which the hysterectomy was performed. This age construct was used for survival analyses.

Respondents who had a hysterectomy were also asked about the reason for the hysterectomy. These options included: i) excessive menstrual bleeding and/or pain, ii) fibroids/cysts, iii) uterine rapture, iv) cancer, and v) other (uterine prolapse, sever postpartum hemorrhage, cervical discharge, and other). We separately examined the likelihood of hysterectomy due to each of these causes.

Statistical analysis

We first estimated percentage of women who underwent a hysterectomy by the four categories of child marriage and adolescent childbearing. We performed adjusted Wald tests to examine whether the percentages varied across the groups.

Next, we estimated binomial logistic regression models to obtain the odds ratios of hysterectomy for child marriage and adolescent childbearing categories compared to the reference category of married as adult and did not give birth in adolescence. We fitted the models for all cause hysterectomy as well as for five cause-specific hysterectomy (e.g., hysterectomy because of uterine rapture) outcomes. Of note, when one gynecologic problem specific hysterectomy was assessed, hysterectomy due to other problems were excluded from the analysis. For example, in the model where hysterectomy due to uterine rapture was the outcome variable, hysterectomy due to all other causes, i.e., excessive menstrual bleeding, fibroids/cysts, cancer, and other were excluded.

We estimated the models both with and without covariates. In the multivariable specification, we accounted for sociodemographic attributes including age, educational attainment, religion, caste. urban/rural residence, and household wealth index quintiles. Further, we accounted for women's body mass index (BMI) categories and parity (i.e., number of children born), which are regarded as risk factors for hysterectomy. Lastly, to account for state-specific differences in women's health issues, we controlled for state of residence fixed

effects. These covariates were included in the model to enhance the internal validity of our estimates of the relationship between hysterectomy and child marriage and adolescent childbearing.

Next, to mitigate the influence of socioeconomic heterogeneities on the relationship, we estimated the models by sub-groups of household wealth, women's educational attainment, urban/rural residence, and geographic regions (North, Central, East, Northeast, West, and South). All models were estimated using the complex survey weights of the NFHS-5. These results are presented in the Supplementary Materials file.

Lastly, we estimated non-parametric Kaplan-Meier (K-M) survivor functions for the event of having a hysterectomy for the four child-marriage and adolescent-childbearing groups. We performed log-rank tests to examine the equality of survivor functions across the groups. Statistical analyses were performed using Stata 18.0 software.

Results

In our study population, 41.0% (N=203,281) women were married in childhood and 38.8% (N=195,707) gave birth during adolescence. Adolescent childbearing was more likely among women wo were married as children. Approximately 79.4% of the women married in childhood gave birth by age 19 years, while only 10.7% of the women married as adults gave birth during adolescence. Table 1 presents characteristics of the study population by child marriage and adolescent childbearing groups. Larger percentages of women married in childhood and who gave birth in adolescence were from poor households, with lower educational attainment, and living in rural areas. While the distribution of BMI categories was comparable across the groups, the percentage of women giving birth to 5 or more children was significantly higher among women who were married before age 18 years and gave birth by age 19 years.

Prevalence of all-cause hysterectomy in our study population was 4.3% (N=20,659). Among women married as adults, prevalence of all-cause hysterectomy was 2.7% (95% CI: 2.6 – 2.8) for those who did not give birth in adolescence, and 4.4% (95% CI: 4.1 – 4.8) for those who gave birth in adolescence. Among women who were married in childhood, the prevalence of hysterectomy was 5.5% (95% CI: 5.2 – 5.8) and 6.7% (95% CI: 6.5 – 6.8) for those who did not and did give birth in adolescence, respectively. Figure 1 presents the prevalence rates of hysterectomy by the child marriage and adolescent childbearing groups across respondents' demographic and socioeconomic (e.g., religion, household wealth) characteristics and risk-factors (e.g., BMI). Results of the adjusted Wald tests suggest that across all attributes, women who were married in childhood and who gave birth in adolescence had a significantly higher prevalence of hysterectomy than that of the reference group (i.e., women who were married as adults and did not give birth in adolescence). In general, the prevalence rates were also higher among women who were married in childhood and did not give birth in adolescence and women who were married as adults but gave birth in adolescence, compared to their counterparts in the reference group.

Unadjusted and adjusted odds ratios of hysterectomy for the child marriage and adolescent childbearing groups are presented in Table 2. After accounting sociodemographic attributes and risk factors (such as parity), women married in childhood who gave birth in adolescence were 1.87 times more likely to have a hysterectomy compared to women who were married as adults and did not give birth in adolescence. The adjusted odds were 1.53 and 1.40 times higher for women who were married as adults but gave birth in adolescence, and women who were married in childhood and did not give birth in adolescence, respectively.

The results for gynecologic problem specific hysterectomy outcomes were very similar to those of all-cause hysterectomy outcome (Table 2). For example, adjusted odds of hysterectomy due to excessive menstrual bleeding or due to fibroids/cysts were 1.82 and 1.71 times higher, respectively, for women who were married in childhood and gave birth in adolescence compared to their counterparts who were married as adults and did not give birth in adolescence.

Table S1 (in supplementary material) presents the results by sub-samples of household wealth index quintiles. Of note, compared to women from wealthier household, women from poorer households were more likely to get married before age 18 years and to give birth by age 19 years. We found that across all different wealth

levels, women who were married in childhood and/or gave birth in adolescence had a significantly higher likelihood of having hysterectomy compared to women who were married as adults and did not give birth in adolescence.

Along with wealth, educational attainment and urban/rural residence were other factors considered to influence child marriage and adolescent childbearing. To mitigate the influence of such heterogeneities, models were also estimated by sub-samples of educational attainment and urban/rural residence, results of which are presented in Table S2. The greater likelihood of hysterectomy among women who were married in childhood and/or gave birth during adolescent age was evident across all educational levels and in both urban and rural areas.

Previous studies also indicated regional variations in hysterectomy prevalence in India.[8, 9] Table S3 presents the results by samples of geographic regions in India. The relationship between child marriage, adolescent childbearing, and hysterectomy persisted across all regions despite differences in hysterectomy prevalence rates across the regions. For example, in the Southern region where the prevalence of hysterectomy was the highest, women who were married in childhood and gave birth in adolescence were 1.99 times more likely to undergo a hysterectomy compared to women who were married as adults and did not give birth in adolescence. The odds of hysterectomy were also higher (AOR: 1.56) for women who were married in childhood and gave birth in adolescence in the Northeastern region, where the prevalence of hysterectomy was the lowest.

Lastly, the K-M survivor functions for the event of having a hysterectomy by child marriage and adolescent childbearing groups are presented in Figure 2. Survival rates among women married as adults and not giving birth in adolescence were 98.1%, 96.3%, 94.4% and 92.5% at ages 35, 40, 45, and 44 years, respectively. Survival rates among women married in childhood who gave birth in adolescence were 95.8%, 93.6%, 91.3%, and 89.0%, respectively. Results of the log-rank test suggested that the survivor functions for different groups were not the same (i.e., the null hypothesis of equality of survivor functions across the groups was rejected). At any age (between 20 and 49), the survival probability was the lowest for women who were married before the age of 18 years and gave birth by the age of 19 years.

Discussion

Main findings

In this study, we examined whether child marriage and adolescent childbearing were associated with a greater risk of undergoing a hysterectomy later in life among ever married women in India. Our results suggested that women who were married in childhood and/or gave birth during adolescent age had a significantly higher likelihood of hysterectomy compared to women who were married as adults and did not give birth during adolescence. The relationship was robust in sub-samples of household wealth, educational attainment, urban/rural residence, and geographic regions. Relationships were not differentially impacted by gynecologic problem specific hysterectomy outcomes experienced. Further, non-parametric estimates of survivor functions for the event of having a hysterectomy suggested a lower survival probability for women who were married in childhood and/or gave birth during adolescence.

Interpretation

Of note, a previous study by Meher & Sahoo (2020) reported lower odds of hysterectomy for women who were married during age 15-20 years and after age 20 years compared to women who were married before age 15 years.[8] Similar results were reported by Kumari & Kundu (2022).[9] Our study differs from those studies in several ways. First and foremost, those studies did not model child marriage as a risk factor for hysterectomy. The category denoting marriage between age 15 to 20 years included both women married as children and as adults. Further, neither of the studies extensively explored the association within socioeconomic sub-groups with varying prevalence rates of hysterectomy, nor did they consider adolescent childbearing as a potential risk factor of hysterectomy.

Our findings indicate that risk of hysterectomy was the highest among women who were married in childhood

and gave birth in adolescent age compared to both women who were married in childhood but did not give birth in adolescence, as well as women who were married as adults but gave birth in adolescence. The risks of hysterectomy were similar across the latter two groups. These findings suggest that early marriage and early childbearing independently influence the risk of undergoing a hysterectomy later in life. However, it is likely that the compounding effect of adopting adult roles after child marriage with physical toll of childbearing during adolescence age may elevate the odds of hysterectomy. Future research must further explore the relative contributions of these life events to the risk of hysterectomy.

Our results were in accordance with the extant findings from studies across multiple settings (England, Scotland, and Wales) suggesting that earlier age at menarche, earlier age at first birth, and having 3+ children were associated with greater risk of hysterectomy among women.[17] Studies also reported positive associations between early age at menarche and child marriage and early pregnancy in women in low- and middle- income countries.[18]

A notable contribution of our study was that while previous studies on hysterectomy among Indian women assessed all-cause hysterectomy only, we extended the analysis to assess the risk for gynecologic problem specific incidents of hysterectomy. The higher risk of hysterectomy among women married in childhood and/or gave birth in adolescence was evident for hysterectomy due to leading causes such as excessive menstrual bleeding, and fibroids or cysts, as well as due to less common causes in the Indian population such as cancer. These results indicated that child marriage and adolescent childbearing were associated with greater risk of different types of gynecologic disorders leading to hysterectomy.

We also found that across all geographic regions, child marriage and adolescent childbearing were associated with a higher risk of hysterectomy. Previous studies on hysterectomy in Indian women have demonstrated notable regional variation in prevalence of hysterectomy.[8, 9] For example, higher prevalence of hysterectomy was observed in the South, whereas the rates were lower in the Northeast. Studies also reported differential prevalence rates of hysterectomy by household wealth, educational attainment, and urban/rural.[4, 8, 9] In our analyses, the higher odds of hysterectomy for women who were married in childhood and/or gave birth in adolescence were persistent across all sub-groups of wealth, education, residence, and regions. Our results thus provided compelling evidence that child marriage and adolescent childbearing might increase the risk of hysterectomy in later life.

Strengths and limitations

Our findings, however, should be cautiously interpreted due to some data limitations. First, information on hysterectomy was self-reported and was not validated by medical records. Reporting of age at hysterectomy and reasons for hysterectomy could be subject to some recall bias. Second, we did not have data on participants' socioeconomic conditions before marriage, which could influence the selection on child marriage. Third, data on age at first marriage and childbearing were also self-reported. On the other hand, our study had some notable strengths. First, we not only assessed the all-cause hysterectomy, but also examined the relationship for gynecologic problem specific hysterectomy. Second, we performed sub-sample analyses by socioeconomic status and geographic regions across which the prevalence of hysterectomy as well as the practice of child marriage varied. We observed a strong and robust relationship between child marriage, adolescent childbearing, and hysterectomy among ever-married women in India across all these sub-groups. Lastly, we employed survival analysis techniques to assess the risk of hysterectomy at an age (between 20 to 49), which further showed the lower survival rates (for the event of hysterectomy) for women married in childhood and gave birth in adolescence.

Conclusion

Using nationally representative data from India, this study examined whether early marriage and early childbearing play a role in risk of hysterectomy during later life. By demonstrating a robust link between marriage before the age of 18 years, childbearing by the age of 19 years, and later-life risk of hysterectomy, this study expands the growing literature on the long-term health consequences of girl child marriage and subsequent adolescent childbearing.[19-21]Taken together, findings from the current study, not only reiterate

the ongoing call to prevent child marriage but emphasize the need for secondary and tertiary prevention strategies addressing adequate gynecologic care for women who experienced marriage and/or childbearing at an early age, particularly in low resource settings. Future funding research is warranted to strategize appropriate policies aimed at providing needed healthcare services and support to these women.

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Disclosure of interests

Authors have no conflicts of interest to disclose.

Author contributions

Conceptualization: BKD and AT. Methodology: BKD. Formal analysis: BKD. Investigation: BKD and AT. Validation: AT. Writing – original draft: BKD. Writing – review & editing: AT. All authors reviewed and approved the final version of the manuscript.

Ethics approval

Our study did not require an ethical board approval because we used publicly available anonymized data for analyses. The dataset used in this study meet the definition of National Institutes of Health (NIH) Exempt Human Subjects Research under the following exemption criteria: "Exemption 4: involves the collection/study of data or specimens if publicly available, or recorded such that subjects cannot be identified". The original survey protocol was approved by the institutional review boards of International Institute for Population Sciences (IIPS) and ICF. The survey complied with the U.S. Department of Health and Human Services regulations for the protection of human subjects (45 CFR 46).

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Figure 1. Share of women having a hysterectomy by child marriage and adolescent childbearing, and sociodemographic and anthropometric variables

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Figure 2. Kaplan-Meier survivor functions for the event of a hysterectomy, by child marriage and adolescent childbearing

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Note: CM_0 denotes married as adult and CM_1 denotes married as child. ACB_0denotes did not give birth in adolescence and ACB_1denotes gave birth during adolescence. Adjustments were made for age, household wealth, education, religion, caste, urban/rural residence, BMI, parity (i.e., number of children born), and state fixed effects.

Table 1. Descriptive statistics by child marriage and adolescent childbirth

	Percentage of women	
	All	Child marriage and adolescent childbirth groups

		CM_0 ACB_0	CM_0 ACB_1	CM_1 $ACB_$
	N=528,816	N=291,387	N=34,148	N=41,722
Residence				
Rural	67.99	62.20	70.05	77.79
Urban	32.01	37.80	29.95	22.21
Wealth Index				
Poorest	18.57	14.03	18.65	27.26
Poorer	19.89	16.47	20.92	24.60
Middle	20.58	19.22	22.35	20.83
Richer	20.91	22.93	21.40	17.13
Richest	20.06	27.34	16.68	10.18
Education				
No education	28.72	19.46	27.60	43.01
Primary	14.20	10.57	14.90	17.28
Secondary	44.33	48.10	52.38	36.11
Higher	12.76	21.87	5.13	3.60
Religion				
Hindu	82.03	81.46	80.52	86.37
Muslim	12.91	12.15	14.55	10.96
Christian	2.27	2.84	2.20	1.13
Other	2.79	3.54	2.72	1.54
Caste				
Scheduled caste	22.14	20.04	22.60	24.22
Scheduled tribe	9.22	8.59	9.97	9.78
Other backward class	42.91	43.30	43.31	45.07
None	25.74	28.08	24.13	20.93
BMI				
Normal	57.68	57.30	57.69	58.27
Underweight	13.06	12.30	14.02	14.95
Overweight	21.42	22.23	20.57	19.52
Obese	7.84	8.17	7.72	7.27
Parity				
0	7.71	12.56	0.00	12.91
1-2	18.31	24.96	15.60	16.40
3-4	36.29	37.42	41.45	29.40
5+	37.69	25.05	42.95	41.29

Note: CM_0 denotes "married as adult",CM_1 denotes "married as child",ACB_0 denotes "no adolescent childbirth", andACB_1 denotes "adolescent childbirth". Estimates were obtained using complex survey weights. BMI was missing for 15,444 observations.

Table 2. Unadjusted and adjusted odds ratios of hysterectomy for child marriage and adolescent childbirth

	All cause hysterectomy	Hysterectomy by cause			
		Excessive menstrual bleeding	Fibroids/ cysts	Uterine rapture	Cancer
A. Unadjusted					
CM_0 ACB_0	Ref.	Ref.	Ref.	Ref.	Ref.
CM_0 ACB_1	1.688***	1.663***	1.579***	1.683***	1.882***
	(1.558, 1.830)	(1.484, 1.865)	(1.354, 1.842)	(1.350, 2.097)	(1.330, 2.6
CM_1 ACB_0	2.119***	2.189***	1.819***	2.181***	2.496***

	(1.986, 2.261)	(2.005, 2.390)	(1.600, 2.067)	(1.822, 2.611)	(1.897, 3.2
CM_1 ACB_1	2.596***	2.671***	2.401***	2.457***	2.765***
	(2.489, 2.709)	(2.519, 2.832)	(2.208, 2.611)	(2.180, 2.769)	(2.277, 3.3
Obs.	528,816	526,195	525,730	524,974	524,562
B. Adjusted					
CM_0 ACB_0	Ref.	Ref.	Ref.	Ref.	Ref.
CM_0 ACB_1	1.526***	1.421***	1.450***	1.503***	1.719**
	(1.402, 1.661)	(1.261, 1.600)	(1.237, 1.701)	(1.196, 1.888)	(1.199, 2.4
CM_1 ACB_0	1.401***	1.389***	1.325***	1.418***	1.324
	(1.306, 1.503)	(1.264, 1.527)	(1.157, 1.518)	(1.174, 1.712)	(0.991, 1.7
CM_1 ACB_1	1.869***	1.822***	1.709***	1.761***	1.988***
	(1.782, 1.959)	(1.708, 1.945)	(1.556, 1.876)	(1.549, 2.000)	(1.605, 2.4
Obs.	513,372	510,841	510,386	508,340	508,400

Note: CM_0 denotes "married as adult", CM_1 denotes "married as child", ACB_0 denotes "no adolescent childbirth", and ACB_1 denotes "adolescent childbirth". Other causes include uterine prolapse, severe post-partum hemorrhage, cervical discharge, and any other issues. Estimates were obtained using complex survey weights. *** p<0.001, ** p<0.01, * p<0.05. 95% confidence intervals are in parenthesis. Adjustments were made for age, household wealth, education, religion, caste, urban/rural residence, BMI, parity (i.e., number of children born), and state fixed effects.

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