The impact of early marriage on the life satisfaction, education and subjective health of young women in India: A longitudinal analysis

Shireen Kanji[1], Fiona Carmichael[2], Christian Darko[2], Richmond Egyei[3], and Nicholas Vasilakos[4]

[1] Brunel Business School, Brunel University London, UB8 3PH
[2] Birmingham Business School, University of Birmingham, B15 2TT
[3] King's Business School, Kings College London, WC2R 2LS
[4] Norwich Business School, University of East Anglia, NR4 7TJ, Norwich, UK

Address for correspondence: shireen.kanji@brunel.ac.uk

Abstract

Despite progress in reducing rates of early marriage, it is still a widespread practice in India accounting for 30% of the world's early marriages. Understanding its impacts is thus of high importance to global gender equality goals. This article examines the impact of early marriage on multi-dimensional aspects of well-being: life satisfaction, subjectively assessed health and educational attainment. Difference-in-differences analysis with propensity score matching examines causal effects using Young Lives Survey data. The analysis shows women who married early experience a trajectory of lower life satisfaction which is in evidence before marriage, at age 12, persisting until the latest survey at age 22. There is no evidence of a causal negative effect of early marriage on life satisfaction; the relationship is more complicated, linked to trajectories of deprivation which commence from a very young age. In contrast, early marriage negatively affects women's self-reported health and educational attainment by age 22.

Keywords: child/early marriage, India, women's well-being, subjective health, life satisfaction, education, gender inequality

1. Introduction

Ending child marriage has become a prominent gender equality goal on the international development agenda, included as a specific item in the Sustainable Development Goals (SDGs). The Gender Equality Goal (item 5.3) sets the target date of 2030 to eliminate "child, early and forced marriages" (UN, 2015). Progress towards achieving this goal has been slow (Lo Forte, Plesons, Branson, and Chandra Mouli, 2019; Bongaarts, Mensch, and Blanc, 2017; Wodon et al., 2017; Nguyen and Wodon, 2015). Marriage practices are often resistant to change because they are culturally and socially embedded and, in many countries, intermixed with patriarchal social norms. Poverty is also a key factor: poor households tend to see the costs of education and delayed marriage of girls as too high (Schuler, Bates, Islam, and Islam, 2006) explaining why the negative income shock from Covid-19 caused 'irreversible setbacks and lost progress' in ending early marriage, according to Save the Children (Edwards and Szabo, 2020:4).

Despite the consensus on ending early marriage, there is nonetheless debate on whether it necessarily worsens the well-being of those who marry early (Schaffnit, Urassa, and Lawson, 2019; Fan and Koski, 2022). In some contexts, remaining unmarried for longer also presents risks to adolescent girls and women (Schaffnit, Wamoyi, Urassa, Dourdoumpa, and Lawson, 2021) which could be reduced by early marriage (Schaffnit et al., 2019). In constrained circumstances some young women 'choose' to marry early, as has been found, for example, in Honduras (Murphy-Graham and Leal, 2015), India, Peru, Zambia and Ethiopia (Crivello and Mann, 2020) and Tanzania (Schaffnit, et al., 2021).

We contribute to this debate, taking the case of India where strong social norms lead to the early marriage of girls, that is before age 18. Sex outside marriage is highly stigmatized (Lal, 2015) raising the potential risks of being unmarried. Furthermore, poorer parents marry their daughters early because dowry costs increase with a girl's age (Paul, 2019; Srinivas,

1984). To unravel the pathways to wellbeing, we distinguish the effects of poor circumstances prior to marriage which contribute to adverse trajectories of well-being from the effects of early marriage per se. In order to explore this issue, we ask first, if early marriage is already associated with lower well-being before marriage and second, whether early marriage of itself worsens multi-dimensional aspects of well-being.

We explore both subjective and objective dimensions of well-being, bringing new insight to the well-being of young women in India, and in particular, women who marry early. The use of individual level measures avoids the need to make assumptions about intra-household allocation practices. The subjective measures are self-rated health and life satisfaction, which have been validated across contexts, including India (Antaramian, Kamble, and Huebner, 2016; Cullati, Mukhopadhyay, Sieber, Chakraborty, and Burton-Jeangros, 2018). The objective dimension is educational grade attained. Studies have shown that early marriage negatively influences education in Bangladesh (Field and Ambrus, 2018) and is negatively associated with education in India, Nepal and Pakistan (Raj, McDougal, Silverman, and Rusch, 2014).

To shed light on whether there is a causal impact of early marriage on well-being we utilise longitudinal data from the Young Lives survey which has followed young children in its older cohort from age eight up until age 22. The analysis first uses regression models that include variables recording girls' pre-teen circumstances, to examine the antecedents of early marriage and age of marriage. Secondly, we investigate the causal links between early marriage and self-evaluated life satisfaction, educational attainment and subjective health in young adulthood. Deeply entrenched patriarchal norms result in multiple adverse outcomes for women (Rathore and Das, 2022) and could affect both the probability of early marriage and adverse well-being outcomes. To address this potential endogeneity on observed variables we use propensity score matching with difference-in-differences analysis.

4

Employing Oster's (2013) bounding method we find that the results are robust to potential omitted variable bias from unobservable factors.

The results indicate that lower life satisfaction prior to marriage is associated with early marriage and that the effects are more pronounced at younger ages of marriage. Girls' subjective health status and educational attainment at younger ages do not predict early marriage. Early marriage has no causal effect on life satisfaction at age 22 but does have a negative causal effect on subjective health and educational attainment.

The next section provides an overview of child marriage in India and evidence on early marriage and well-being. Sections 3 and 4 describe the data and empirical strategy. The results are presented in section 5 and discussed in section 6. Section 7 concludes.

2. Context and literature

2.1 Research Context

India remains the location of 30% of total early marriages in the world (UNICEF, 2021) although the mean age of first marriage has risen from 17.4 to 19 years between 2005-2006 and 2015-2016 (IIPS and ICF, 2022). There has been a substantial decline in the early marriage rate of those aged 20-24 from 47% in 2005-2006 to 23% in 2019-21 according to the latest National Family Health Survey 5 (UNFPA, 2022). Although the early marriage rate is decreasing, it remains high and is elevated further amongst the poor (Crivello and Mann, 2020; Paul, 2019; Santhya et al., 2010; Psaki et al., 2021; UNICEF, 2014), those in the lowest wealth quintile and in rural areas (UNFPA, 2022). The absolute number of women still undergoing early marriage is large because of population growth (Wodon et al., 2017). Parents and their children avoid community censure by adhering to established marriage practices such as dowry (Singh and Vennam, 2016; Parsons et al., 2015). Although not permitted by law since 1961, the dowry system has even extended to the south of India where

it was not previously practised (Srinivasan, 2005). A low dowry can downgrade a girl's standing in her husband's family, while living with in-laws already diminishes girls' control over resources. The systems of early marriage and dowry are interlinked, with studies finding that early marriage increases the already high risk of violence against women (Yount, Krause, and Miedema 2017; Speizer and Pearson, 2011; Raj, Saggurti, Lawrence, Balaiah, and Silverman, 2010; Santhya et al., 2010; Jensen and Thornton, 2003; Fan and Koski, 2022). Roychowdhury and Dhamija (2021) find a younger age of marriage is linked to a heightened risk of physical violence, although not sexual or emotional violence.

2.2 Early marriage and well-being

Against this background, it is clear that girls in India are vulnerable (Rose-Clarke et al., 2019) and early marriage prematurely forces them out of adolescence (Pandya and Bhanderi, 2015). Complicated interdependencies in relation to poverty, violence and within household distribution drive well-being which makes subjective measures particularly useful. Children's own reports acknowledge their agency and for this reason are increasingly preferred in assessments of their well-being and development (Lippmann et al., 2011). Life satisfaction has the advantage of covering both positive and negative functioning providing a cognitive assessment of life as a whole rather than only mental health difficulties; it is increasingly utilised (Proctor, Linley, and Maltby, 2008) and validated for use in India (Kamble and Huebner, 2016).

Similarly, self-rated measures of health provide a wide-ranging assessment of health status encompassing psychological and biological well-being and are validated in India for children and adolescents (Cullati et al., 2018). Self-rated health conveys important information about biological processes through an individual's sensations feelings and emotions as well as predicting objective states such as mortality (Jylhä, 2009). Existing evidence on the effects of early marriage on both objective and subjective health is weak and

findings on health consequences are mixed according to a systematic review (Fan and Koski, 2022). Differences between a girl's natal and married household are particularly relevant to well-being outcomes. Zahra et al. (2021) found that girls who had experienced domestic violence perpetrated by their parents were more likely to experience a decrease in depressive symptoms after early marriage in Uttar Pradesh (UP) and less likely to experience an increase in Bihar. However, a higher proportion of girls experience an increase rather than a decrease in depressive symptoms after marriage relative to no change in symptoms in both states.

Early transitions to motherhood have been found to have detrimental effects on self-rated health (Bennett and Waterhouse, 2018). Many of the adverse health consequences of early marriage relate to early fertility, which heightens the risk of maternal mortality (WHO, 2014) and the probability of a home birth, which is associated with adverse health consequences (Chari, Heath, Maertens and Fatima, 2017). According to analysis of the Indian National Family Health Survey (2005-2006) early marriage is significantly associated with repeat childbirth within 24 months, multiple unwanted pregnancies, pregnancy termination and sterilisation (Raj et al., 2009). Early marriage is also associated with higher risks of sexually transmitted diseases including HIV, a situation often overlooked because of the girls' married status (Santhya and Jejeebhoy, 2015).

Findings on early marriage and education are more conclusive. Across the world, higher levels of education correlate with reduced rates of early marriage (Bongaarts et al., 2017). Child marriage is associated with girls dropping out of school (Lloyd and Mensch, 2008), while girls who are not in school are more likely to get married. Studies find a negative correlation between child marriage and educational outcomes (Sekhri and Debnath, 2014; Raj et al., 2014). Schooling, marriage and fertility are jointly determined so studies that do not account for this interdependency overestimate the effects of education on age at marriage (Glick et al., 2015). Field and Ambrus (2008) address the endogeneity of education

in Bangladesh, by instrumenting age at marriage with age at menarche, finding that early marriage brings an end to education. Studies adopting the same approach with data from the India Human Development Survey find that early marriage has a detrimental effect on the education of the children of early-married women (Sekhri and Debnath, 2014; Chari et al., 2017).

Drawing on mechanisms derived from the literature discussed above, we expect that girls who marry early are more likely to come from poor and rural households. In view of the constrained circumstances of those who marry early, we expect lower life satisfaction and educational attainment to predict early marriage but there is no reason to expect that girls in poorer health would be in a position to marry early. Early marriage may enhance or diminish life satisfaction depending on prior circumstances in the natal household compared with circumstances in the marital (in-laws) home, for example whether there is more or less access to personal and household resources and whether and where girls are exposed to domestic violence. Early marriage could diminish subjective health through causes including early fertility, sexual disease, violence and access to nutrition. In line with other studies, marriage is predicted to halt education, in part through its association with fertility. The poor labour market prospects of young women reinforce the likelihood of girls stopping education. This reasoning led us to examine two hypotheses:

H1: Girls with more difficult circumstances at younger ages, as reflected in lower life satisfaction and educational attainment, have a higher likelihood of marrying early.

H2: Child marriage has a causal negative effect on self-evaluated life satisfaction, subjective health and education.

3. Data and sample

This article uses data for India from Young Lives (Boyden, 2018) a longitudinal cohort study of Andhra Pradesh and Telangana which oversamples poor households to facilitate analysis of childhood poverty (Young Lives, 2017). The region had the ninth-highest population of married children in India (Office of the Registrar General, 2011) while 36% of women aged 18-29 in Andhra Pradesh and 31% in Telangana were married by age 18 (Crivello and Mann, 2020).

We use data for 1,008 children from the older cohort who were aged eight in round 1 in 2002, reaching age 22 by round 5 in 2016. Other survey rounds were in 2006, 2009 and 2013. Only five boys married before age 18. The sample is restricted to 486 out of 517 girls (94 per cent) who were in the survey in Rounds 1 and 5 for whom there are complete records for marital status and age of marriage where applicable. In this sample, 56.38% (n=274) were married by age 22, 28.6% (n=139) before age 18 and the youngest age of marriage was 11 (Table 1). The sample is reduced further due to item missing values and by the propensity score matching procedure.

Table 1: Age at marriage

Age married	Number of girls/women married at each age
11	3
12	3
13	11
14	14
15	34
16	43
17	31
18	37
19	39
20	40
21	18
22	1
Married by age 22	274 (56.38%)
Married before age 18	139 (28.6%)
Not married at age 22	212 (43.62%)
Total	486

4. Empirical model

4.1 Antecedents of child marriage

To address H1, we examine the link between early marriage and earlier life circumstances using logit to estimate the likelihood that a girl married early. The dependent variable, *ChildMarriage,* takes the value one if the individual married before age 18 and zero otherwise. To understand the associations with the specific age of marriage before 18, we estimate a Tobit model in which the dependent variable, *AgeMarriage,* records the participant's age at marriage from the earliest age of 11 to 23 or over (the Tobit upper limit censors above age 22). The risk of harm associated with marrying at age 17 clearly differs from that of marrying at age 13. The expectation from H1 is that *ChildMarriage* is negatively related to life satisfaction and education while *AgeMarriage* is positively related to life satisfaction. The structural model equations, in which *i* represents the *ith* individual are as follows:

$$Pr(ChildMarriage_i = 1) = \alpha_0 + \alpha_w LifeSatisfaction_i + \alpha_e Education_i + \alpha_x X_i + \varepsilon_i \quad (1)$$

$$AgeMarriage_i = \alpha_0 + \alpha_w LifeSatisfaction_i + \alpha_e Education_i + \alpha_x X_i + \varepsilon_i \quad (2)$$

LifeSatisfaction, is first available in round 2, at age 12. The question asks respondents where they feel they stand on a ladder where the ninth step represents the best possible life and the bottom step the worst. *Education* records the highest grade achieved at entry to the survey in round 1 at age 8.

X is a vector of variables recording characteristics and circumstances associated with early marriage, when first surveyed at age 8. Appendix table A1 provides definitions for all variables. The indicator of subjective health categorises poor, average or good health. There are controls for rural location, which is strongly associated with both poverty and early marriage (Pandya and Bhanderi, 2015), household wealth, age in months, gender and education of the household head, household composition (number of adults and children, gender of the eldest older sibling) and exposure to family shocks in the previous four years. Additional variables control for region, religion, caste and early childhood nutritional status measured by height for age and BMI for age standardised z-scores (following the WHO Growth Reference). The α are coefficients. ε is the error term.

4.2 *Propensity score matching and Difference-in-Differences analysis of well-being*

We use difference-in-differences (DiD) analysis with propensity score matching (PSM) to investigate whether the life satisfaction, educational attainment and health of those who marry early worsens over time relative to others who are matched on conditions and attributes (H2).

The regression estimates of equations (1) and (2) indirectly test if early life-course differences in observable characteristics between those who marry early and other young women, explain divergences in well-being at age 22. Differences in observed characteristics at the outset could affect both the likelihood of early marriage and its well-being effects, biasing the effects of early marriage found in the DiD analysis. To address this issue, we select a control group matched to the treated group on observable characteristics by using the propensity scores, the predicted conditional probabilities of marrying early, constructed from the baseline characteristics. Matching on the baseline characteristics included in equations (1) and (2), excluding the outcome measures of life satisfaction, health, and education, ensures that any post-treatment (early marriage) divergence in the outcome variables is more reliably attributable to early marriage. We employ the method of nearest-neighbour 1-to-1 matching with no replacement to construct the propensity scores, using the Leuven and Sianesi (2003) Stata code. The matched sample comprises 274 women who either married early or were close matches. The kernel distributions of propensity scores before and after the matching indicate good matching (Figure A1 in the appendix).

The pre-treatment baseline data for education and subjective health are from the first survey at age 8 and for life satisfaction from age 12 survey. The post-treatment data are at age 22 (round 5) which allows sufficient time for any negative effects on well-being to manifest (Peterman et al, 2015). The difference-in-differences calculation derives from a regression in which the independent variables include dummy variables for the later time period (round 5), the treated group (those who married early) and an interaction term between the two, as in equation (3) where the dependent variable, Y, is a measure of well-being, either self-reported life satisfaction *(LifeSatisfaction),* highest grade achieved *(Education)* or subjective health *(Health):*

12

$$Y_i = \alpha_0 + \alpha_1 Round5 + \alpha_2 ChildMarriage + \alpha_3 Round5 * ChildMarriage + \alpha_x X_i + \varepsilon_i \text{ (3)}$$

In equation (3) the coefficient on the interaction, α_3, captures the average difference-in-differences effect of child marriage between the baseline and round 5. A significant difference-in-differences coefficient provides evidence of a treatment (i.e. causal) effect of early marriage on the measure of well-being. Underlying this estimation is a function relating the latent variable actual well-being to reported well-being (Powdthavee and Vernoit, 2013) where the former is assumed to depend on individual circumstances that include whether or not the individual married early.

PSM does not account for unobserved characteristics which could, as with observable characteristics, result in both a higher probability of a young woman marrying early and reporting lower educational attainment, subjective health or life satisfaction at an older age. To address concerns regarding the bias stemming from unobservable variables, we estimate the magnitude of unobserved variable bias necessary to overturn the results, following Oster (2019). This method assumes that selection on unobservables is proportional to selection on observable factors; the degree of proportionality is given by δ as explained further in the results.

5. Results

Table 2 provides sample means for all variables used in the analysis for all girls, the sub-samples of those married early and for those who did not. At age 12 girls who were to marry early reported lower life satisfaction. At the earlier age of 8, neither their reported school grade achieved nor their subjective health differed significantly from those who did not marry early, but by age 12 those who married early had already attained a lower average grade in

education. The subjective health of those who married early was (weakly) significantly better at age 12.

Girls who went on to marry early were more likely to live in rural locations, in poorer and smaller households with a less educated household head. Having a brother as the eldest sibling is positively correlated and an eldest sister is (weakly) negatively associated with early marriage, supporting Singh and Vennam's (2016) argument that an older brother's contribution to household earnings facilitates marriage-related expenses while an elder sister, who by custom should marry first, delays marriage. Exposure to family shocks is not significant. Girls who married early were more likely to be categorised as Hindu and in the economically and socially backward (BC) castes, the largest category, and less likely to fall in the other or open (OC) castes category which records the highest wealth index. Out of the three distinct agro-climatic regions the Young Lives data distinguish (Young Lives, 2014), girls who married early were less likely to be living in Coastal Andhra Pradesh, more likely to be living in Rayalaseema and no more or less likely to be living in Telangana. Girls who married early recorded higher height for age standardised z-scores possibly suggesting better nutritional status although there is no significant difference in the BMI for age z-scores.

Table 2 points to differences in the circumstances of girls who married early. Regression analysis is required to measure effects while controlling for other influences.

Table 2: Summary statistics

	(1) All girls (n=486)		(2) Girls married before age 18 (n=139)		(3) Girls not married before age 18 (n=347)	
	Mean	SD	Mean	SD	Mean	SD
Life satisfaction, educational attainment and health						
Life satisfaction age 12[a]	3.63	1.67	3.08***	1.41	3.85	1.71
Child's educational attainment age 8 (highest grade: 0-4)	1.87	0.89	1.88	0.84	1.87	0.90
Child's educational attainment age 12 (highest grade: 0-9)	5.61	1.28	5.40**	1.35	5.70	1.24
Child's subjective health age 8	1.39	0.66	1.43	0.65	1.38	0.66
Child's subjective health age 12	1.36	0.65	1.42*	0.62	1.33	0.66
Child and household characteristics (round 1[b])						
Age in months	95.9	3.76	96.09	3.71	95.82	3.79
Location: Urban	0.23	0.42	0.09***	0.29	0.29	0.45
Location: Rural	0.77	0.42	0.91***	0.29	0.71	0.45
Wealth index	0.40	0.21	0.35***	0.16	0.43	0.22
Household head: Female	0.08	0.28	0.06	0.23	0.09	0.29
Household Head: Male	0.92	0.28	0.94	0.23	0.91	0.29
Household Head Education: None	0.60	0.49	0.78***	0.41	0.53	0.50
Household Head Education: Basic	0.22	0.41	0.14***	0.35	0.25	0.44
Household Head Education: Secondary or above	0.18	0.38	0.08***	0.27	0.21	0.41
Household size	5.6	1.95	5.34*	1.54	5.64	2.08
Eldest older sibling is brother	0.34	0.47	0.45***	0.5	0.29	0.46
Eldest older sibling is sister	0.31	0.46	0.25*	0.44	0.33	0.47
Family shock (previous 4 years): Yes	0.31	0.46	0.34	0.48	0.29	0.46
Child's religion: Hindu	0.88	0.33	0.91*	0.29	0.86	0.35
Child's religion: Other	0.13	0.33	0.09*	0.29	0.14	0.35
Child's caste: SC (scheduled)	0.21	0.42	0.22	0.42	0.20	0.40
Child's caste: ST (scheduled tribes)	0.13	0.33	0.14	0.34	0.12	0.33
Child's caste: BC (economically and socially backward classes)	0.44	0.50	0.52**	0.50	0.41	0.49
Child's caste: OC (other/open category)	0.22	0.42	0.12***	0.33	0.27	0.44
Child's region: Coastal Andhra Pradesh	0.34	0.48	0.26***	0.44	0.38	0.49
Child's region: Rayalaseema	0.30	0.46	0.37**	0.49	0.27	0.45
Child's region: Telangana	0.36	0.48	0.37	0.48	0.35	0.48

Height for age standardised z-score	-1.58	0.99	-1.42**	1.04	-1.64	0.97
BMI for age standardised z-score	-1.29	0.93	-1.29	-1.45	-1.30	0.91

Notes:

[a] Life satisfaction unavailable round 1, first recorded in round 2 (age 12).

[b] All reported characteristic means are for round 1 at age 8.

Significance in difference in means t tests for girls who did/did not marry before age 18: *** p<0.01; ** p<0.05; *p<0.10:

5.1. Antecedents of early marriage

Table 3 reports average marginal effects for the logit estimate of equation (1) and coefficients for the Tobit estimation of equation (2). Life satisfaction at age 12 is associated negatively with early marriage and age of early marriage. Our interpretation is that lower life satisfaction and early marriage are both factors associated with relatively poor life chances which unfold in multiple ways over time. In model (i), a one-unit higher score on the nine-point life satisfaction index is associated with a 0.042 lower probability of early marriage. At the mean predicted probability of early marriage (0.285) this implies a 15% lower probability of earlier marriage. In model (ii) the dependent variable, *AgeMarriage,* enables consideration of differences by age of early marriage. The results show that higher scores for life satisfaction at age 12 are associated with older age of marriage: a standard deviation increase in the life satisfaction index (equal to 1.663) is associated with a 1.063 increase (just over a year) in *AgeMarriage*. These results tend to support H1 for life satisfaction. In contrast, educational attainment at age eight is not significant when other factors are controlled, offering no support for H1, most probably because there is little variation in grade attained at this age.

Turning to the other variables, subjective health at age eight is not significant when other factors are controlled for. Rural location is positively associated with early marriage. but wealth is not significant which is explained by its strong negative correlation with rural location. Although linked to wealth, rural location seems more relevant in capturing structural constraints. Girls living with a more educated household head (versus no formal education) have a lower likelihood of early marriage. Having an eldest male sibling is

associated positively with early marriage. Having a male household head and household size are negatively significant in estimation (ii) only, suggesting that girls with a male household head and those in larger households marry at younger ages below 18 but are no more or less likely to marry before age 18. Similarly, caste is significant only in estimation (ii); relative to girls in the reference category (scheduled castes) girls in "backward" castes marry at younger ages. Girls in Rayalaseema and Telangana marry earlier than those in Coastal Andhra Pradesh (the reference region). Higher height and BMI for age z-scores are associated negatively with age of marriage and height for age is also positively associated with early marriage suggesting that girls who marry early have higher nutritional status.

Table 3. Antecedents of early marriage

Independent variables[a]	Dependent variable	(i) ChildMarriage (logit)	(ii) AgeMarriage (tobit)
Life satisfaction		-0.042***	0.639***
		(0.014)	(0.157)
Education (highest grade attained)		0.003	-0.223
		(0.024)	(0.288)
Subjective Health		-0.015	-0.060
		(0.031)	(0.389)
Age(months)		0.003	-0.023
		(0.005)	(0.066)
Location: Rural		0.141**	-1.423*
		(0.064)	(0.847)
Wealth Index		-0.026	1.310
		(0.149)	(1.756)
Household head (HH): Male		0.083	-2.882***
		(0.066)	(1.077)
HH Education: Basic		-0.103*	1.033
		(0.053)	(0.637)
HH Education: ≥Secondary		-0.152***	3.379***
		(0.058)	(0.861)
Household size		-0.013	0.269**
		(0.010)	(0.129)
Eldest Older Sibling: brother		0.108**	-1.487***
		(0.044)	(0.554)
Eldest Older Sibling: sister		0.016	-0.265
		(0.051)	(0.629)
Family shock		0.006	-0.436
		(0.044)	(0.553)
Child's religion: Hindu		-0.000	0.121
		(0.064)	(0.835)
Child's caste: ST		0.031	-0.913
		(0.075)	(0.954)
Child's caste: BC		0.062	-1.799***
		(0.051)	(0.674)
Child's caste: OC		-0.046	-0.153
		(0.061)	(0.854)
Child's region: Rayalaseema		0.184***	-2.750***
		(0.055)	(0.700)
Child's region: Telangana		0.083*	-2.062***
		(0.050)	(0.662)
Height for age standardised z-score		0.073***	-0.862***
		(0.020)	(0.233)
BMI for age standardised z-score		0.023	-0.449*
		(0.022)	(0.258)
Constant		-	24.183***
		-	(6.489)
Observations		474	488
(Pseudo) R-squared		0.157	0.0676
X^2, F		76.17***	7.79***

Notes:

Figures are average marginal effects in estimation (i); coefficients in estimations (ii).

Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

[a]All independent variables except life satisfaction recorded at age 8 (life satisfaction first recorded at age 12).

As explained, the baseline in Table 3 is at age eight (except for life satisfaction, first measured at age 12). We re-estimated equations (1) and (2) using the independent variables at age 12 to check if these measures better predict life trajectories. The results for these estimations are very similar to those in Table 3 and are available in the Supplementary Materials, Table S1.

5.2 Difference-in-differences in well-being

The results in panel (a) of Table 4 show that the difference in life satisfaction between the treated and control groups is significant pre-treatment (at age 12), in line with the regression results in Table 3, supporting H1. The difference is weakly significant post-treatment (at age 22) but the difference in these differences is not significant. There is no evidence of a causal treatment effect of early marriage on life satisfaction, leading to rejection of H2 in respect of life satisfaction.

Panels (b) and (c) of Table 4 show that for the matched sample neither the difference in education nor subjective health was significant pre-treatment (at age eight) but both were negatively significant post-treatment (at age 22) and both difference-in-differences are significant. This evidence indicates a causal negative treatment effect of early marriage on educational attainment and subjective health, supporting hypothesis 2 in relation to education and H3 in relation to health.

Table 4. Difference-in-differences – Matched female sample

Panel (a): Life satisfaction (N=542)

	Before	After	Total
Control	133	135	268
Treated	135	131	266
Total	268	266	

Outcome var.	Life satisfaction	S. Err.	T	P>t
Pre-treatment (age 12)				
Control	3.722			
Treated	3.067			
Diff (T-C)	-0.655	0.177	-3.69	0.00***
Post-treatment (age 22)				
Control	5.015			
Treated	4.679			
Diff (T-C)	-0.335	0.178	-1.88	0.060*
Difference-in-Differences	0.320	0.251	1.27	0.204
R^2	0.22			

Panel (b): educational attainment (N=550)

	Before	After	Total
Control	137	136	273
Treated	135	134	269
Total	272	270	

Outcome var.	Educational attainment	S. Err.	T	P>t
Pre-treatment (age 8)				
Control	1.869			
Treated	1.881			
Diff (T-C)	0.013	0.281	0.05	0.964
Post-treatment (age 22)				
Control	11.669			
Treated	8.373			
Diff (T-C)	-3.296	0.282	-11.67	0.000***
Difference-in-Differences	-3.309	0.399	-8.30	0.000***
R^2	0.77			

Panel (c): Subjective health (N=548)

	Before	After	Total	
Control	137	135	272	
Treated	137	131	268	
Total	274	266		

Outcome var.	Subjective health	S. Err.	T	P>t
Pre-treatment (age 8)				
Control	1.372			
Treated	1.431			
Diff (T-C)	0.058	0.078	0.75	0.454
Post-treatment (age 22)				
Control	1.622			
Treated	1.420			
Diff (T-C)	-0.202	0.079	-2.56	0.011**
Difference-in-Differences	-0.261	0.111	-2.35	0.019**
R^2	0.02			

Notes: *** p<0.01; ** p<0.05; * p<0.1

Again, as a robustness check we ran the difference-in-differences for educational attainment and subjective health with the baseline at age 12 instead of age 8. The results are very similar to those in Table 4 (available in the Supplementary Materials, Table S2), other than the difference-in-differences for subjective health in panel (b) is larger and more strongly significant suggesting a greater deterioration in subjective health between the ages of 12 and 22 than between the ages of eight and 22. The substantive results were unchanged after re-running all three difference-in-differences without the six sample members who had married at age 11 or 12.

Figure 1 provides visual support for these results from local polynomial regressions. There is no clear evidence of a widening gap in life satisfaction (between ages 12 and 22) by age of marriage, although there is clearly a positive relationship between life satisfaction and age of marriage. For education, the graph shows no relation between educational attainment and age of marriage at age eight as one might expect. By age 22 a positive relationship

between age of marriage and educational attainment is suggested (the three young women who married at age 11 are outliers in this respect). The graph for subjective health clearly shows that at age eight subjective health was associated negatively with age of marriage (those who went on to marry early had better health), but by age 22 those who had married early had worse health, an important finding.

Figure 1: Relationship between life satisfaction, education, health, and age at marriage
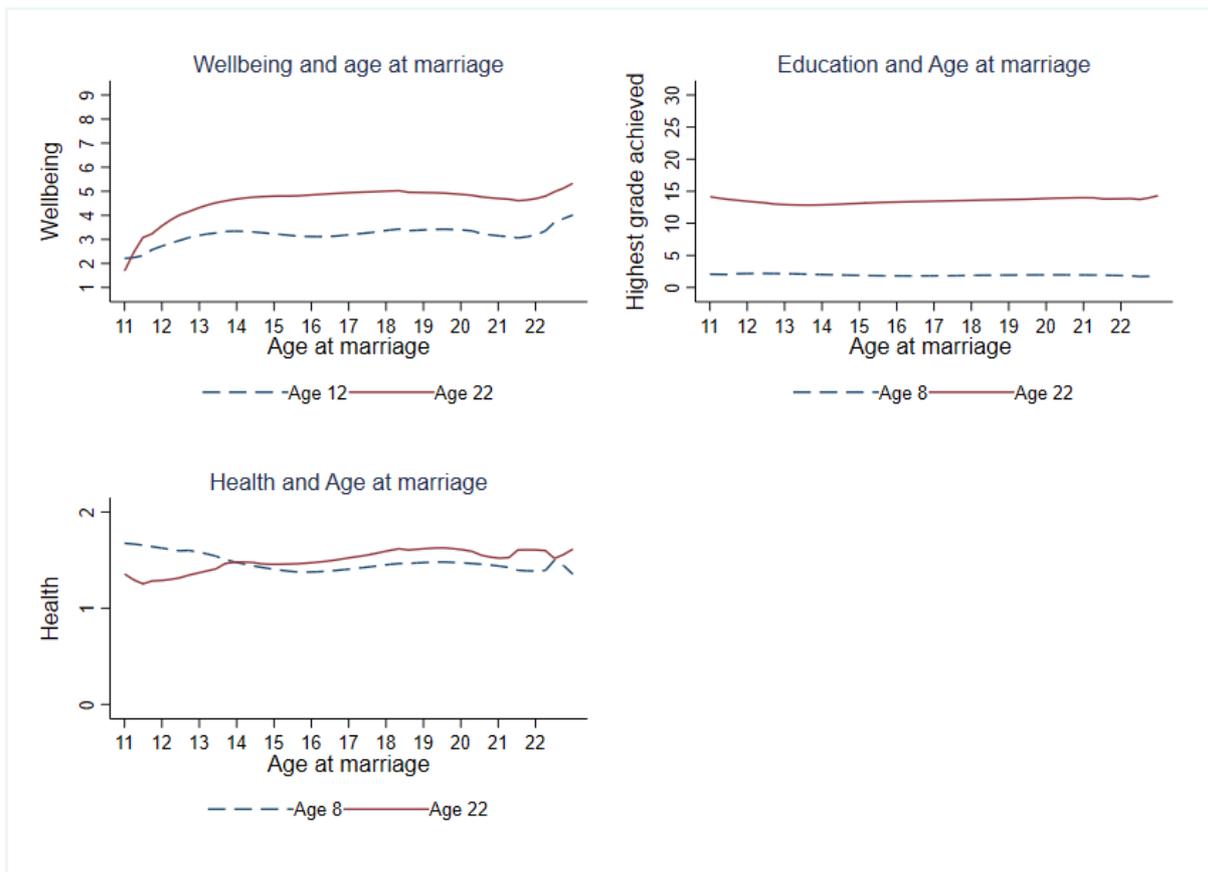
In further robustness checks we re-ran the PSM with replacement providing a larger matched sample for the analysis. We also re-ran the analysis with the unmatched female sample, with and without the covariates used in the matching process. The results were robust to these changes. In particular, the treatment effect for life satisfaction remained insignificant.

A limitation of PSM is that it only matches on observables. Unobserved factors could also affect both the probability of early marriage and well-being outcomes. However, the insignificance of education and subjective health pre-treatment in the early marriage equation reported in Table 3 and in the baseline estimation in the difference-in-differences equation (at age 8 and age 12, Table 4) provides some assurance that unobserved factors are not affecting both early marriage and subsequent well-being. The differences in education and subjective health found at age 22 are therefore more likely to result from early marriage than unobserved differences in characteristics.

We also conducted an exercise to estimate a measure of the level of bias in the unobserved variables necessary to overturn the results. The test is based on the procedures in Oster (2019) building on Altonji, Elder, & Taber (2005) and applied in previous research on India in this journal (Rathore and Das, 2022; Dhamija et al. 2022). The test estimates values for the delta ratio (or proportionality coefficient) needed to drive the point estimate of the early marriage effect on education and subjective health to zero. The larger the absolute value of delta, the larger the degree of selection on unobservables in relation to observables needs to be for the early marriage effect to be fully explained by unobservables. The estimated delta values for separate regressions for the education and health outcomes are shown in Appendix Table A2.

The absolute delta values are all greater than one implying that a higher degree of selection on unobservables than observables would be needed to completely explain the estimated effect. For example, for the education outcome, the delta value of 23.87 indicates that to completely eliminate the observed effect of early marriage the effect of unobserved variables would need to be 23.87 times stronger than the effect of the observed variables (with the most conservative R^2_{max} value of one). For the health outcome the effect of the unobservables has to be 1.508 times that of the observables to eliminate the effect of early

marriage (with $R^2_{max} = 1$). In addition, the identified sets in Table A2 all exclude zero. These results provide support for our estimates, suggesting that omitted variables are not the driving force behind the results.

6. Discussion

In using subjective measures of well-being this article contributes new insight into the effect of early marriage in India. We used life satisfaction because it recognises the agency of girls and young women, which is of importance against the backdrop of India's patriarchal society in which men are privileged in intrafamilial allocation and women denied independence and voice (Malhotra, Vanneman, and Kishor, 1995). As a global measure of well-being based on the direct report of the individual, life satisfaction is a measure that is increasingly advocated to understand children and young people's well-being (Lippmann et al., 2011). However, its use has been relatively limited in academic research in low-and middle-income countries.

Women's experiences of violence underlie many of the well-being findings for girls during childhood through adolescence and early adulthood in India. Previous research has found conflicting mechanisms at work in relation to intimate partner and domestic violence. On the one hand, young women's limited bargaining power within their new households exposes them to greater risk of domestic violence (Fan and Koski, 2022; Parsons et al., 2015), on the other hand later marriage can be associated with violence from a male backlash (Roychowdhury and Dhamija, 2021). As a global measure, life-satisfaction provides a net evaluation which takes into account satisfaction in different domains. Furthermore, the linkages between different aspects of well-being prompted the multidimensional approach to well-being taken in this article, which examines education and self-rated health as well as life satisfaction as indicators of well-being. All three outcome measures employed in the study are taken at the individual level, which is in contrast to objective household measures of

income or wealth which rarely account for unequal distribution within the household (Main et al. 2019). The importance of household composition and distribution is underlined by the finding in this research that having an older brother is associated with earlier age of marriage for girls.

Lower life satisfaction at age 12 is an antecedent of early marriage and younger age of early marriage even after controlling for other factors known to affect adversely both life satisfaction and early marriage. A key finding from the difference-in-differences analysis is that marriage per se does not cause the already lower life satisfaction of women subject to early marriage to diminish further, consistent with studies concluding that early marriage was not necessarily a poor option but rather a symptom of girls living in already difficult circumstances (Schaffnit et al., 2021; Schaffnit et al., 2019). The implication is that intervention to avert trajectories of lower well-being needs to commence at early ages.

The difference-in-differences analysis of self-reported health suggests a clear negative causal effect of early marriage. In contrast, before marriage had taken place there was no significant difference in the health status of those who married early and those who did not. These findings contribute clear evidence of the causal effects of early marriage in India. Fan and Koski's (2022) review identified a strong need for causal studies of the health effects of early marriage and evaluated existing cross-sectional studies as subject to extensive bias due to the failure to control for differences such as in income between those who married early and those who did not. Our study contributed to filling this deficit in relation to self-rated health, which has been validated as a measure in relation to India (Cullati et al., 2018) and used to identify the worse outcomes of those subject to early marriage in South Africa (Bennett and Waterhouse, 2018).

Consistent with Chari et al. (2017) those who married early had lower educational attainment by age 22. This could have implications for their future employment, although

Dhamija and Roychowdhury (2020) find that age of marriage has no significant effect on labour market outcomes in India, most probably because opportunities for women's employment have contracted in line with the decline in agriculture (Mehrotra and Parida, 2017), while expectations around unpaid domestic work remain are gendered from a young age (Carmichael et al., 2023), a matter of deep concern for women's livelihoods. Education also matters in relation to the household head: if the head has primary or secondary level education relative to not having education lowers the likelihood of early marriage. As household wealth was a control, it seems that education works through its ideational effect, by changing beliefs and preferences, which can be very powerful in explaining family formation and marriage patterns (Axinn, Ghimire, and Barber, 2008). Indeed, interventions at a community level to change attitudes and beliefs have been found to reduce violence against adolescent girls (Yount et al., 2017).

Rural area is a key predictor which is consistent with findings across contexts, such as Ghana (Ahonsi et al., 2019) and Indonesia (Rumble et al., 2018). The relevance of rural area persists even controlling for wealth, although the two are connected. This finding suggests effective intervention needs to encompass or even focus on the rural areas. Paul's (2019) study found only a modest effect of level of urbanization in a district on child marriage, whereas our study suggests that rural location is salient.

The data in Table 1 indicated that the incidence of early marriage is still high in India. We calculated from the Young Lives data that the prevalence of marriage before age 18 among young women aged 22 is 28.65%, which is higher than the 23.3% calculated from NHS5 which covers 2019-21 (UNFPA, 2022). We cannot be confident of continuing declines in early marriage because of the increased poverty brought by Covid-19 (Dang, Lanjouw, and Vrijburg, 2021) while population growth is maintaining the absolute number of young girls subject to it.

These results may not present the full picture because further effects are likely to unfold over time as these young women age. Future research using longitudinal studies would benefit from data enabling a comparison of these causal effects over a longer time frame and across different states of India. The analysis could also be enhanced using measures of educational attainment that capture educational quality more effectively than highest grade attained. Richer data on early childhood characteristics and circumstances would also help to address concerns relating to sample selectivity bias. Future analysis using different measures of physical and mental health would contribute further to this stream of research.

7. Conclusion

This article examined the impact of early marriage on girls' life satisfaction, self-rated health and education in India using longitudinal data. Higher life satisfaction of girls at age 12 was associated with a lower probability of child marriage and later ages at marriage. There was no similar association between higher subjective health and child marriage or marrying at a younger age and only weak evidence of an association between the latter and educational attainment. In contrast to most previous studies the data permitted the examination of causal effects through difference-in-differences analysis.

The results find evidence of a causal negative treatment effect of child marriage on educational attainment and subjective health, which is in evidence by age 22, but no causal effect of child marriage on life satisfaction. These results may seem contradictory, in that the causal effects on education and health do not manifest in lower life satisfaction. However, since life satisfaction for those who marry early is already lower, some of these later-life impacts on other dimensions of well-being may already be factored in through lower expectations. Interestingly the programme, *Apni Beti Apna Dhan* or 'Our Daughter, Our

28

Wealth', implemented in Haryana between 1994 and 1998, was successful in raising the age of marriage through offering cash incentives to families and a long-term savings bond when the girl reached the age of 18 (Nanda, Datta, and Das, 2016; Biswas and Das, 2021) which underscores the relevance of household wealth, although as our findings suggest, this needs to be considered in conjunction with rural location. One evaluation of that programme was that it had no discernible effects on labour market opportunities and empowerment (Biswas and Das, 2021). Clearly a necessary accompanying step to expand young women's agency in India is to expand their formal employment possibilities, which are at the present time extremely limited.

References

Ahonsi, B., Fuseini, K., Nai, D., Goldson, E., Owusu, S., Ndifuna, I., … Tapsoba, P. L. (2019). Child marriage in Ghana: Evidence from a multi-method study. *BMC Women's Health, 19*(126).

Antaramian, S., Kamble, S. V., & Huebner, E. S. (2006). Life satisfaction and coping in Hindu adolescents in India. *Journal of Happiness Studies*, *17*, 1703–1717.

Altonji, J., Edler, T., & Taber, C. (2005). Selection on observed and unobserved variables: Assessing the effectiveness of Catholic schools. *Journal of Political Economy*, *113*, 151-184.

Axinn, W. G., Ghimire, D. J., & Barber, J. (2008). The influence of ideational dimension of social change on family formation in Nepal. In R. Jayakody., A. Thornton, and W. Axinn, (Eds.), *International family change: Ideational perspectives* (pp. 251–80). New York: Taylor and Francis.

Bennett R., & Waterhouse P. (2018). Work and family transitions and the self-rated health of young women in South Africa. *Social Science & Medicine*, *203*, 9–18.

Biswas, S., & Das, U. (2021). What's the worth of a promise? Evaluating the longer-term indirect effects of a programme to reduce early marriage in India. *Global Development Institute Working Paper*, 2021–055, University of Manchester.

Bongaarts, J., Mensch, B. S., & Blanc, A. K. (2017). Trends in the age at reproductive transitions in the developing world: The role of education. *Population Studies*, *71*(2), 139–154

Boyden, J. (2018). *Young Lives: An international study of childhood poverty: Rounds 1-5 Constructed Files, 2002-2016*. [data collection]. *3rd Edition.* UK Data Service. SN: 7483

Carmichael, F., Darko, C., Kanji, S., & Vasilakos, N. (2023). The contribution of girls' longer hours in unpaid work to gender gaps in early adult employment: Evidence from Ethiopia, India, Peru and Vietnam. *Feminist Economics*, *29*(1), 1-37.

Chari, A. V., Heath, R., Maertens, A., & Fatima, F. (2017). The causal effect of maternal age at marriage on child wellbeing: Evidence from India. *Journal of Development Economics*, *127*, 42–55.

Crivello, G., & Mann, G. (2020). *Young Marriage, Parenthood and Divorce: A Comparative Study in Ethiopia, India, Peru and Zambia*, Research Report, Oxford: Young Lives. Retrieved from https://www.younglives.org.uk/sites/default/files/migrated/YL-ComparativeReport-Feb20-LowRes.pdf

Cullati, S., Mukhopadhyay, S., Sieber, S., Chakraborty, A. & Burton-Jeangros, C. (2018). Is the single self-rated health item reliable in India? A construct validity study. *BMJ Global Health*. *3*(6), e000856.

Dang, H. A., Lanjouw, P., & Vrijburg, E. (2021). Poverty in India in the face of Covid-19: Diagnosis and prospects. *Review of Development Economics*, *25*(4), 1816–1837.

Dhamija, G., & Roychowdhury, P. (2020). Age at marriage and women's labour market outcomes in India. *Journal of International. Development*, *32*(3), 342–374.

Dhamija, G., Ojha, M. & Roychowdhury. P. (2022). Hunger and health: Reexamining the impact of household food insecurity on child malnutrition in India, *The Journal of Development Studies*, *58*(6):1181-1210.

Edwards, J., & Szabo. G. (2020). *The global girlhood report 2020*. London: Save the Children International. https://resourcecentre.savethechildren.net/pdf/global_girlhood_report_2020_africa_version_2.pdf/ (accessed 11 Jun 2022)

Evans, B. J. (2019). How College Students Use Advanced Placement Credit. *American Educational Research Journal*, *56*(3):925–954.

Fan, S., & Koski, A. (2022). The health consequences of child marriage: A systematic review of the evidence. *BMC Public Health*, *22*(1), 309.

Field, E., & Ambrus, A. (2008). Early marriage, age of menarche, and female schooling attainment in Bangladesh. *Journal of Political Economy*, *116*(5), 881–929.

Glick, P., Handy, C., & Sahn, D. E., (2015). Schooling, marriage, and age at first birth in Madagascar. *Population Studies, 69*(2), 219–236.

IIPS and ICF. 2022. *India National Family Health Survey* NFHS-5 (2019-21). Mumbai, India: IIPS and ICF. Retrieved from

https://www.dhsprogram.com/pubs/pdf/FR375/FR375.pdf.

Jensen, R., & Thornton, R. (2003). Early female marriage in the developing world. *Gender and Development*, *11*(2), 9–19.

Jylhä, M. (2009). What is self-rated health and why does it predict mortality? Towards a unified conceptual model. *Social Science & Medicine*, *69*, 307–316

Lal, B. 2015. Child marriage in India: Factors and problems. *International Journal of Science and Research*, *4*(4), 2993–2998.

Leuven, E., & Sianesi, B. (2003). *PSMATCH2: Stata module to perform full Mahalanobis and propensity score matching, common support graphing, and covariate imbalance testing*. Retrieved from http://EconPapers.repec.org/RePEc:boc:bocode:s432001

Lippman, L. H., Moore, K. A. & McIntosh, H. (2011). Positive indicators of child well-being: A conceptual framework, measures, and methodological issues. *Applied Research Quality Life*, *6*, 425–449 https://doi.org/10.1007/s11482-011-9138-6

Lo Forte, C., Plesons, M., Branson, M., & Chandra-Mouli, V. (2019). What can the global

movement to end child marriage learn from the implementation of other multi-sectoral

initiatives? *BMJ Global Health*, *4*(5). https://doi.org/10.1136/bmjgh-2019-001739

Lloyd, C. B., & Mensch, B. S. (2008). Marriage and childbirth as factors in dropping out

from school: An analysis of DHS data from sub-Saharan Africa. *Population Studies*,

62(1), 1–13. https://doi.org/10.1080/00324720701810840

Malhotra, A., Vanneman, R., & Kishor, S. (1995). Fertility, dimensions of patriarchy, and

development in India. *Population and Development Review*, *21*(2), 281–305.

https://doi.org/10.2307/2137495

Mehrotra, S., & Parida, J. K. (2017). Why is the labour force participation of women

declining in India? *World Development*, *98*(C), 360–380.

https://doi.org/10.1016/j.worlddev.2017.05.003.

Murphy-Graham, E., & Leal, G. (2015). Child marriage, agency, and schooling in rural

Honduras. *Comparative Education Review, 59*(1), 24–49. https://doi.org/10.1086/679013

Nanda, P., Datta, N., Lamba, S., & Pradhan, E. (2016). *Impact of a conditional cash transfer*

program on girls' education and age of marriage in India. A process evaluation.

Washington DC: International Center for Research on Women (ICRW) Retrieved from

https://www.icrw.org/wp-

content/uploads/2016/10/IMPACCT_ProcessBrief_Webready.pdf (accessed 11 June

2022)

Nguyen, M. C., & Wodon, Q. (2015). Global and regional trends in child marriage. *Review of*

Faith and International Affairs, 13(3), 6–11.

https://doi.org/10.1080/15570274.2015.1075756

Office of the Registrar General. (2011). *2011 Indian Census*. Office of the Registrar General,

India. Retrieved from https://censusindia.gov.in/census.website/

Oster, E. (2013). PSACALC: Stata module to calculate treatment effects and relative degree
of selection under proportional selection of observables and unobservables. *Statistical
Software Components S457677, Boston College Department of Economics*, revised 18
Dec 2016.

Oster, E. (2019). Unobservable selection and coefficient stability: Theory and evidence.
National Journal of Business & Economic Statistics, 37(2):187-204. DOI:
10.1080/07350015.2016.1227711

Pandya, Y. P., & Bhanderi, D. J. (2015). An epidemiological study of child marriages in a
rural community of Gujarat. *Indian Journal of Community Medicine: official publication
of Indian Association of Preventive and Social Medicine*, *40*(4), 246–251.
https://doi.org/10.4103/0970-0218.164392

Parsons, J., Edmeades, J., Kes, A., Petroni, S., Sexton, M., & Wodon, Q. (2015). Economic
impacts of child marriage: a review of the literature. *The Review of Faith and
International Affairs*, *13*(3), 12–22.

Paul, P. (2019). Effects of education and poverty on the prevalence of girl child marriage in
India: A district-level analysis. *Child and Youth Services Review, 100*, 16–21.
https://doi.org/10.1016/j.childyouth.2019.02.033

Peterman, A., Bleck, J., & Palermo, T. (2015). Age and intimate partner violence: An
analysis of global trends among women experiencing victimization in 30 developing
countries. *Journal of Adolescent Health*, *57*, 624–30.

Powdthavee, N., & Vernoit, J. (2013). Parental unemployment and children's happiness: A
longitudinal study of young people's well-being in unemployed households. *Labour
Economics*, *24*, 253–263. https://doi.org/10.1016/j.labeco.2013.09.008

Proctor, C. L., Linley, P. A. & Maltby, J. (2009). Youth life satisfaction: A review of the
literature. *Journal of Happiness Studies*, *10*, 583–630.

Psaki, S. R., Melnikas, A. J., Haque, E., Saul, G., Misunas, C., Patel, S. K., … Amin, S. (2021). What are the drivers of child marriage? A conceptual framework to guide policies and programs. *Journal of Adolescent Health*, *69*(6), S13–S22.

Raj, A., Saggurti, N., Lawrence, D., Balaiah, D., & Silverman, J. G. (2010). Association between adolescent marriage and marital violence among young adult women in India. *International Journal of Gynecology and Obstetrics, 110*(1), 35–39.

Raj, A., Saggurti, N., Balaiah, D., & Silverman, J. G. (2009). Prevalence of child marriage and its effect on fertility and fertility-control outcomes of young women in India: a cross-sectional, observational study. *The Lancet*, *373*(9678), 1883–1889.

Raj A., McDougal L., Silverman J. G., & Rusch, M. L. A. (2014). Cross-sectional time series analysis of associations between education and girl child marriage in Bangladesh, India, Nepal and Pakistan, 1991-2011. *PLoS ONE,* 9(9):e106210. https://doi.org/10.1371/journal.pone.0106210

Rathore, U. & Das, U. (2022) Health Consequences of patriarchal kinship system for the elderly: Evidence from India, *The Journal of Development Studies*, *58*:1: 145-163.

Rose-Clarke, K., Pradhan, H., Rath, S., Rath, S., Samal, S., Gagrai, S. … Prost, A. (2019). Adolescent girls' health, nutrition and wellbeing in rural eastern India: a descriptive, cross-sectional community-based study. *BMC Public Health, 19*, 673.

Roychowdhury, P., & Dhamija, G. (2021). The causal impact of women's age at marriage on domestic violence in India. *Feminist Economics*, *27*(3), 188–220.

Rumble, L., Peterman, A., Irdiana, N., Triyana, M., & Minnick, M. (2018). An empirical exploration of female child marriage determinants in Indonesia. *BMC Public Health, 18*, 407.

Santhya, K., Ram, U., Acharya, R., Jejeebhoy, S., Ram, F., & Singh, A., (2010). Associations between early marriage and young women's marital and reproductive health outcomes:

evidence from India. *International Perspectives on Sexual and Reproductive Health, 36*, 132–39.

Santhya K. G., & Jeejebhoy S. J. (2015). Sexual and reproductive health and rights of adolescent girls: evidence from low- and middle-income countries. *Global Public Health*, *10*(2), 189–221. doi: 10.1080/17441692.2014.986169.

Schaffnit, S. B., Wamoyi, J., Urassa, M., Dardoumpa, M., & Lawson, D. W. (2021). When marriage is the best available option: Perceptions of opportunity and risk in female adolescence in Tanzania. *Global Public Health*, *16*(12), 1820–1833. https://doi.org/10.1080/17441692.2020.1837911

Schaffnit, S. B., Urassa, M., & Lawson, D. W. (2019). "Child marriage" in context: exploring local attitudes towards early marriage in rural Tanzania. *Sexual and reproductive health matters*, *27*(1), 93–105. https://doi.org/10.1080/09688080.2019.1571304

Schuler, S. R., Bates, L. M., Islam, F., & Islam M. K. (2006). The timing of marriage and childbearing among rural families in Bangladesh: choosing between competing risks. *Social Science and Medicine*. *62*(11), 2826–37. https://doi.org/10.1016/j.socscimed.2005.11.004.

Sekhri, S., & Debnath, S. (2014). Intergenerational consequences of early age marriages of girls: Effect on children's human capital. *The Journal of Development Studies*, *50*(12), 1670–1686.

Singh, R., & Vennam, U. (2016). Factors shaping trajectories to early marriage. *Young Lives Working Paper 149*. https://www.younglives.org.uk/sites/www.younglives.org.uk/files/YL-WP149-Trajectories%20to%20early%20Marriage.pdf (accessed 19 February 2022)

Speizer, I. S., & Pearson, E. (2011). Association between early marriage and intimate partner violence in India: a focus on youth from Bihar and Rajasthan. *Journal of Interpersonal Violence*, *26*(10), 1963–1981.

Srinivas, M. (1984). *Some reflections on dowry*. New Delhi: Oxford University Press.

Srinivasan, S. (2005). Daughters or dowries? The changing nature of dowry practices in south India, *World Development*, *33*(4), 593–615.

UNFPA. (2022). Child marriage in India: Key insights from the NFHS-5 (2019-21). https://india.unfpa.org/sites/default/files/pub-pdf/analytical_series_1_-_child_marriage_in_india_-_insights_from_nfhs-5_final_0.pdf

UNICEF. (2021). Towards ending child marriage. Retrieved from https://www.unicef.org/india/what-we-do/end-child-marriage.

United Nations General Assembly. (2015). *Transforming our world: The 2030 agenda for sustainable development* (A/Res. 70/1). New York: United Nations. Retrieved from https://sdgs.un.org/2030agenda.

Wodon, Q., Male, C., Nayihouba, A., Onagoruwa, A., Savadogo, A., Yedan, A. … Petroni, S. (2017). Economic impacts of child marriage: Global synthesis report. Retrieved from https://documents1.worldbank.org/curated/en/530891498511398503/pdf/116829-WPP151842-PUBLIC-EICM-Global-Conference-Edition-June-27.pdf

World Health Organization. (2014). *Health for the world's adolescents: A second chance in the second decade*. http://apps.who.int/adolescent/second-decade/

Young Lives. (2014). Young Lives survey design and sampling in India, younglives-india.org, https://www.younglives.org.uk/sites/default/files/migrated/INDIA-UAP-SurveyDesign-Factsheet.pdf (accessed May 2022)

Young Lives. (2017). *A guide to Young Lives research*, Oxford: Young Lives.

> https://www.younglives.org.uk/sites/www.younglives.org.uk/files/GuidetoYLResearch-
> S5-Sampling.pdf (accessed June 12 2022).

Yount, K. M., Krause K. H., & Miedema, S. S. (2017). Preventing gender-based violence

> victimization in adolescent girls in lower-income countries: Systematic review of reviews.
> *Social Science and Medicine*, *192*, 1–13.

Zahra, F., Austrian, K., Gundi, M., Psaki, S., & Ngo, T. (2021). Drivers of marriage and

> health outcomes among adolescent girls and young women: Evidence from Sub-Saharan
> Africa and South Asia. *Journal of Adolescent Health*, *69*(6), S31-S38.

Appendix

Figures

Figure A1: Matching process
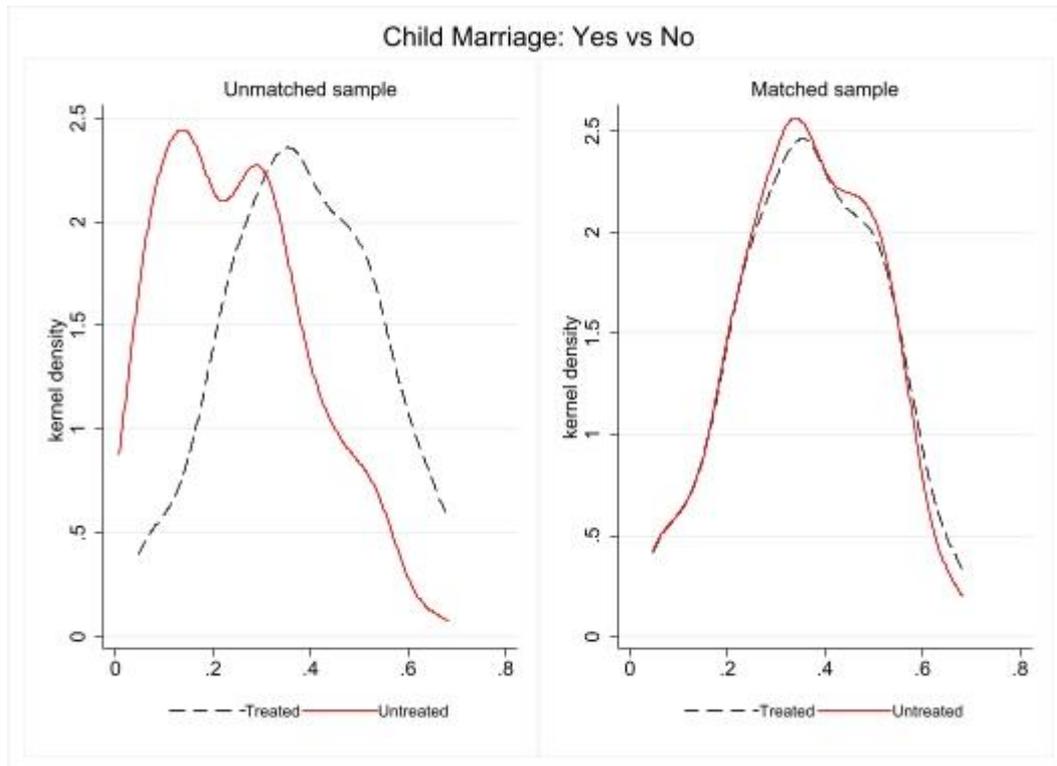
Figure A2. Relationship between education, health, and age at marriage
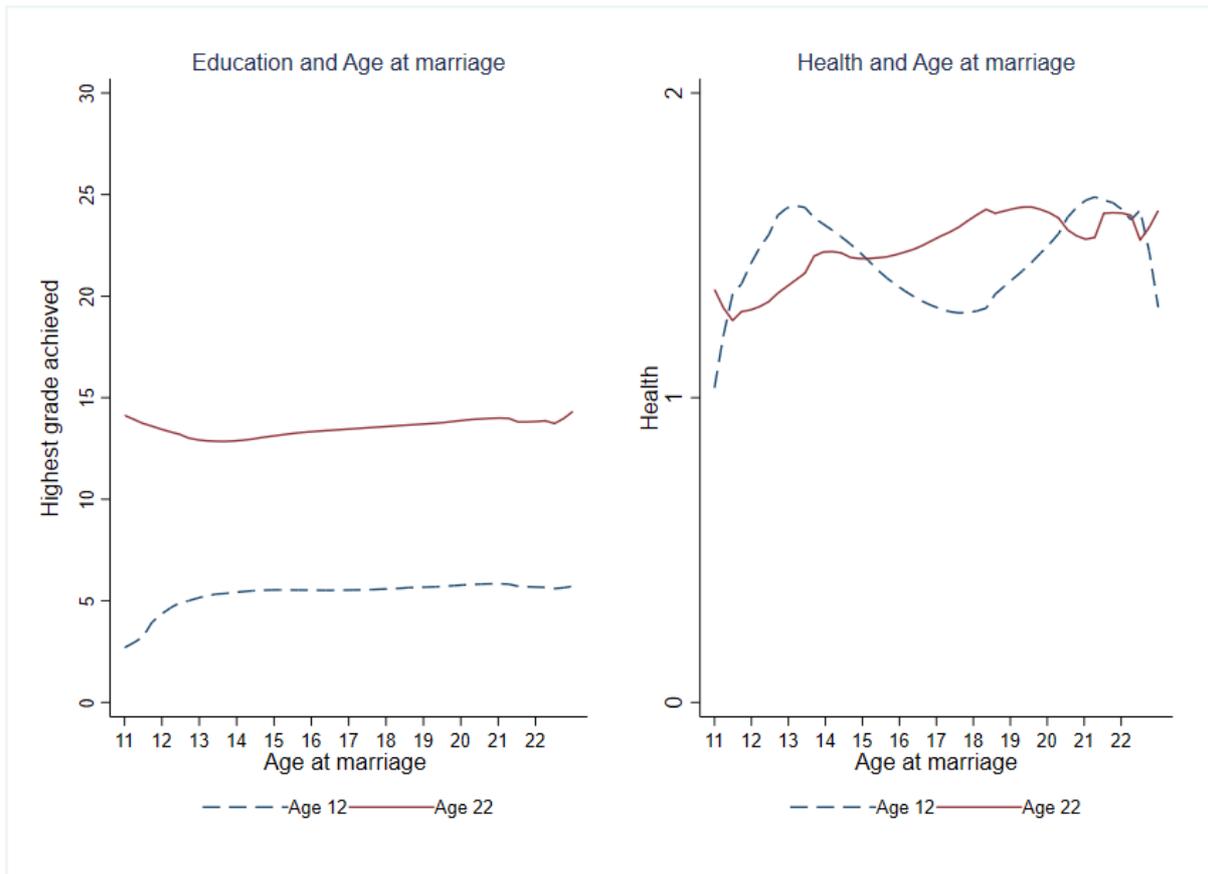
Tables

Table A1. Variable definitions

Variable	Definition
ChildMarriage	Married before age 18:1 yes, 0 No. Dependent variable in Logit.
AgeMarriage	Age married; from age 11 to 23 or over, with 23 recording not married by age 22. Dependent variable in upper-limit censored Tobit.
LifeSatisfaction	Self-evaluated life satisfaction on a nine-point scale with 9 best possible life and 0 worst possible life.
Education (highest grade)	Educational attainment. Highest grade achieved at time surveyed; scale from 0 (none) to15 (post-graduate)
Subjective Health	Subjective health on a 3-point Likert scale with1 poor health, 2 average health, 3 good health (recorded age 8-12 by parent/main carer, thereafter by the child)
Age(months)	Age of individual in months.
Female	Female gender: 1 female, 0 male.
Location: Rural	Area of residence is rural: 1 rural; 0 urban.
Wealth index	Composite index of household wealth on a continuous scale between 0 and 1. Measures housing quality, access to services (electricity, piped drinking water and adequate fuels for cooking) and ownership of consumer durables (e.g., a television, automobile or mobile phone).
Household Head: Male	Gender of head of household: 1 male, 0 female.
Household Head Education: Basic	Educational attainment of head of household is basic (below secondary): 1 yes, 0 no (no education or at least secondary).
Household Head Education: Secondary and above	Educational attainment of head of household is at least secondary; 1 yes, 0 no.
Household size	Number of people living in the household.
Eldest older sibling: brother	Eldest older sibling is male; 1 yes, 0 no (eldest older sibling is female or no older siblings).
Eldest older sibling: sister	Eldest older sibling is female; 1 yes, 0 no
Family shock	Exposed to family shocks (illness or death of a family member) since last surveyed: 1 yes, 0 no)
Child's religion	Childs religion; 1 Hindu, 0 all other religions
Child's caste	Childs caste or ethnic group: SC scheduled castes; ST scheduled tribes including Adivasis; BC economically and socially backward classes; OC other/open category (general class)
Region	Agro-climatic region of residence: Telangana, Rayalaseema or Coastal Andhra Pradesh
Height for age	Standardised z-score (based on WHO standards)
BMI for age	Standardised z-score (based on WHO standards)

Table A2: Bias analysis for early marriage

Outcome	δ ($\beta = 0$, $R^2_{max} = 0.8$)	δ ($\beta = 0$, $R^2_{max} = 1$)
Education	105.732	23.875
	(-1.627, -1.473)	(-1.627, -1.432)
Subjective Health	-1.905[a]	-1.508
	(-0.61, -0.151)	(-0.61, -0.192)

Using the method of Oster (2019) delta, δ, provides estimates of the magnitude of omitted variables bias such that the estimated average treatment effect of early marriage in OLS regressions for each outcome goes to zero ($\beta = 0$). Delta is estimated using psacalc in Stata (Oster, 2013). R^2_{max} specifies the maximum R^2 for the full model with all potential unobservables. Figures in parenthesis define the identified set ($\hat{\beta}$ in the uncontrolled regression and the controlled hypothetical regression with $\delta=1$). The covariates in the controlled regressions are those used in the PSM (consistent with the estimates in Table 4).

[a]The negative sign for δ means that to overturn the results the unobservables need to be correlated with early marriage in the opposite direction to the direction of the observable characteristics and early marriage (Evans, 2019). For illustration, $\delta= -1.508$ ($R^2_{max}=1$) implies that to eliminate the observed effect of early marriage on subjective health the effect of the unobservables needs to be 1.508 times the effect of the observed variables.