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Beyond the vows: Understanding the causal link between age at marriage and anxiety in Nepal

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August 2, 2025

Abstract

This paper investigates the causal effect of age at marriage on women’s mental health in Nepal, focusing specifically on anxiety. Using nationally representative data from the latest round of the Nepal Demographic and Health Survey (NDHS), we address endogeneity in marriage timing by instrumenting age at marriage with age at menarche, motivated by sociological evidence that menarche strongly influences parental decisions about the timing of girls’ marriages. Our findings show that a one-year delay in age at marriage reduces anxiety levels by 0.08 standard deviation. We find additional evidence that delayed marriage is associated with significant reductions in marital stress, suggesting that it is a key pathway through which delayed marriage lowers anxiety. These findings contribute to growing evidence on the mental health implications of early marriage and highlight the importance of policies that delay marriage age.

JEL Classifications: J12, I12, C26

Keywords: age at marriage, age at menarche, marital stress, anxiety, mental health, Nepal

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1 Introduction

Early marriage persists as a critical social concern across much of the developing world, with South Asia bearing a disproportionate 40% of the global burden (UNICEF, 2018). Early marriage is associated with a host of poor outcomes for females, including lower use of contraceptives before the first delivery, high fertility, and repeated pregnancies (Raj et al., 2009). Further, the adverse consequences extend to the next generation, with studies showing that children born to young mothers, often a direct result of early marriage, face significant health disadvantages (Branson et al., 2015; Chari et al., 2017). Studies also show that early marriage is linked with a higher prevalence of physical and sexual domestic violence, lower decision-making power (Cameron et al., 2023; Nasrullah et al., 2014a), higher incidence of death during childbirth, preterm birth, depression, and greater risk of sexually transmitted diseases (Irani and Roudsari, 2019; Santhya, 2011). Given these severe negative repercussions, governments across developing countries have enacted policies outlawing child marriage or introducing economic incentives, like compulsory education, financial support and community awareness programs, aimed at delaying marriage.

In Nepal specifically, early marriage remains particularly problematic, with the annual welfare gains from ending child marriage estimated to be almost USD 1 billion (Wodon et al., 2017). The problem is exacerbated due to the country’s low levels of development, pervasive poverty, and rigid societal norms. Estimates from the Nepal Demographic Health Survey (2022) indicate that around 33% of girls are married before the age of 18 and 8% before the age of 15 (Ministry of Health and Population, Nepal et al., 2023). The practice is prominent in rural areas, where 83% of Nepal’s population resides, despite the legal marriage age for women being 20 (or 18 with parental consent). While much of the existing literature has focused on the consequences of early marriage on health or lost economic and educational opportunities for women, its implications on women’s mental health remain underexplored. Recognizing mental health as an increasingly crucial component of overall well-being, we examine the impact of age at marriage on the anxiety levels for married women in Nepal.

Mental health has emerged as a critical public health issue in Nepal, with recent data highlighting an alarming 72% rise in suicide rates over the past decade, documenting mental health disorders as a major contributor (Ians, 2024). Despite the increasing prevalence of conditions such as anxiety and stress, limited public awareness and pervasive cultural stigma often prevent open discussions and help-seeking behaviour (Lacey et al., 2025). As a result, individuals experiencing mental health challenges may face discrimination and social exclusion, further discouraging them from seeking necessary support. Adolescent girls or those who marry early are more likely to face challenges such as premature and potentially misinformed introduction to sexual relations and reduced life opportunities (Jensen and Thornton, 2003; Mardi et al., 2018), which can contribute to higher anxiety¹. Given that interpersonal stressors such as marital dynamics can influence anxiety levels, we also investigate marital stress as a potential mechanism of how the timing of marriage affects anxiety.

¹Unlike depression, which often manifests as a lingering sense of sadness and hopelessness, anxiety is more sensitive to daily stressors, manifesting in the form of worry and fear, thus making it a more relevant outcome in the context of our study (Holland and Raypole, 2018).

Our paper contributes to two strands of literature. First, we add to the literature examining the adverse consequences of early marriage for women. Early marriage has well-documented detrimental impacts on women, like risk of early pregnancy, childbirth complications, and sexually transmitted infections (including HIV), alongside a higher likelihood of experiencing intimate partner violence (Raj et al., 2009; United Nations Fund for Population Activities and others, 2012; UNICEF, 2005). Furthermore, Datta et al. (2022) finds that women who marry early face greater difficulties in accessing healthcare in adulthood and are more susceptible to adverse physical health outcomes such as higher maternal mortality and inadequate prenatal care. Economically, it carries substantial costs at individual, household, and national levels, contributing to increased fertility rates, higher healthcare expenditures, reduced educational attainment and earning potential for women, and hindered economic development (Sekine and Hodgkin, 2017; Wodon et al., 2017). More recently, research has begun to highlight the link between early marriage and increased mental health challenges (Jayawardana, 2022; Uche and Uche, 2024), low self-esteem and limited autonomy (Abdallah et al., 2023; Burgess et al., 2023; Jensen and Thornton, 2003), and increased risks of self-harm (Gage, 2013). We add to this literature by examining the social costs of early marriages in the form of marital stress, leading to higher anxiety.

The second strand of literature that our paper contributes to is a growing but still limited body of empirical evidence on mental health in developing countries, with a specific focus on Nepal. An estimated 80% of individuals with mental illness in low and middle-income countries lack access to effective treatment, as mental health often ranks among the lowest priorities in healthcare within these regions (Kohn et al., 2004; Luitel et al., 2015; WHO, 2008). Poor mental health can perpetuate poverty traps in such settings by limiting economic opportunities (Edmonds et al., 2025). However, a significant portion of the extant research on mental health faces methodological challenges, particularly the risk of systemic bias arising from confounding variables, as noted by Chaulagain et al. (2019). To address such endogeneity concerns, some studies have employed Instrumental Variable (IV) techniques. Yet, the application of such rigorous IV methodologies to examine mental health consequences like anxiety remains less common, particularly in the South Asian context. In this paper, we fill this gap by investigating the causal effect of age at marriage on women’s anxiety in Nepal, by building on the previous use of age at menarche as an IV for age at marriage to assess its causal impacts on various outcomes such as education (Field and Ambrus, 2008), child wellbeing (Chari et al., 2017; Sekhri and Debnath, 2014), labor market outcomes (Dhamija and Roychowdhury, 2020), and domestic violence (Roychowdhury and Dhamija, 2021).

Theoretically, the relationship between age at marriage and women’s anxiety is not ex-ante clear, as several competing pathways could be at play. On the one hand, marrying at an older age may reduce anxiety by lowering marital stress. Lower anxiety could stem from greater psychological maturity in both partners with improved and more open communication, better conflict resolution skills and the ability for the woman to express her needs. Such factors help navigate early marital adjustments and reduce feelings of ‘inner loneliness’ or stress that can contribute to anxiety (Santhya et al., 2010; Shaud and Asad, 2020). Younger brides might face greater difficulties adapting to marital life and premature reproductive responsibilities, potentially leading to higher stress and anxiety. Besides, delayed marriage

is also often associated with increased opportunities for education and employment, which can enhance a woman’s empowerment, autonomy and bargaining power (Kjelsrud et al., 2024). As a result, they may be better equipped to assert their preferences, and resist controlling behaviors, which, in turn, can contribute to lower levels of anxiety.

On the other hand, empowerment, in contexts with rigid patriarchal norms, could paradoxically lead to higher anxiety if it is perceived as a challenge to traditional gender roles, potentially triggering marital tensions or male backlash (Jewkes, 2002; Ojha and Babbar, 2024; Singh and Babbar, 2022). Given these competing theoretical possibilities - where delayed marriage might decrease anxiety through enhanced maturity and communication leading to lower marital stress, or through empowerment leading to better self-efficacy, but could also potentially increase anxiety through backlash against empowerment - the overall effect on women’s anxiety in a specific context like Nepal remains an empirical question.

Identifying the causal impact of marriage timing on anxiety is challenging due to the endogeneity of age at marriage. Unobserved characteristics like parental preferences for the groom, social and household norms, or even childhood shocks could simultaneously affect both the timing of marriage and anxiety. To address such concerns, we utilize an IV approach as in Field and Ambrus (2008) and instrument a woman’s age at marriage with her age at menarche. The idea behind this identification stems from the socio-cultural norm prevalence in Nepal and many similar contexts, where girls are typically considered for marriage once they reach puberty. Menarche often triggers social pressure for early marriage as it is seen as a means of preventing premarital sexual activity, thereby protecting family honour. This largely natural and biologically driven exogenous variation in the timing of menarche introduces quasi-random variation in the earliest possible age at which a girl might marry.

We utilize nationally representative data from the 2022 round of the Nepal Demographic Health Survey (Ministry of Health and Population, Nepal et al., 2023), where, for the first time, a comprehensive module on mental health was incorporated. Our results are noteworthy and indicate that a one-year delay in a woman’s marriage leads to a 0.08 standard deviation reduction in anxiety, measured on a Generalized Anxiety Disorder-7 (GAD-7) scale. Our findings are robust to alternative measures of anxiety and falsification analysis. We also explore potential mechanisms for our impacts and find that reduced marital stress captured by emotional abuse is a key pathway through which delayed marriage improved anxiety.

The remainder of the paper is organized as follows. Section 2 describes the data and provides descriptive statistics. Section 3 outlines the empirical strategy, including the IV approach. Section 4 presents the baseline results, and robustness in Section 5. Section 6 discusses the potential mechanism of marital stress. Finally, Section 7 concludes with a discussion of the findings, policy implications, and limitations of the study.

2 Data

2.1 Nepal Demographic Health Survey

We utilize the 2022 round of the Nepal Demographic Health Survey ([Ministry of Health and Population, Nepal et al., 2023](#)) collected between January-June 2022. The NDHS 2022 provides information on various topics such as population demographics, health and nutrition status, mental health, women empowerment, marital histories, and domestic violence. It is a nationwide cross-sectional demographic health survey conducted by the New ERA administered under the Ministry of Health and Population (MoHP), Government of Nepal. The technical assistance was provided by the ICF through The Demographic and Health Surveys (DHS) Program.² The sample was drawn using stratified random sampling (additional details on the survey methodology are available in [Ministry of Health and Population, Nepal et al. \(2023\)](#) report).

A separate woman’s questionnaire was administered to collect data from 15-49 years old eligible women in 13,786 surveyed households. We utilize data from the women’s module of the survey, which includes one record per respondent, yielding a total sample of 11,722 ever married women. However, mental health data was collected from only 5,857 ever-married women drawn from a subsample of households selected for the mental health module. Further, the data on marital stress is available for 4,377 ever-married women selected for the domestic violence module. Our final analytical sample consists of 4,043 currently married women, accounting for missing observations and outliers in other variables.³

2.1.1 Generalized Anxiety Disorder (GAD) - 7 Score

Our outcome variable captures symptoms of anxiety, measured using the GAD-7 scale. The GAD-7 is a validated screening tool designed to assess generalized anxiety disorder through a set of seven items ([Spitzer et al., 2006](#)). These items evaluate the frequency of the following symptoms experienced over the two weeks preceding the survey: *(1) feeling nervous, anxious, or on edge; (2) being unable to stop or control worrying; (3) worrying excessively about various things; (4) difficulty relaxing; (5) restlessness; (6) irritability or becoming easily annoyed; and (7) fear that something awful might happen.*

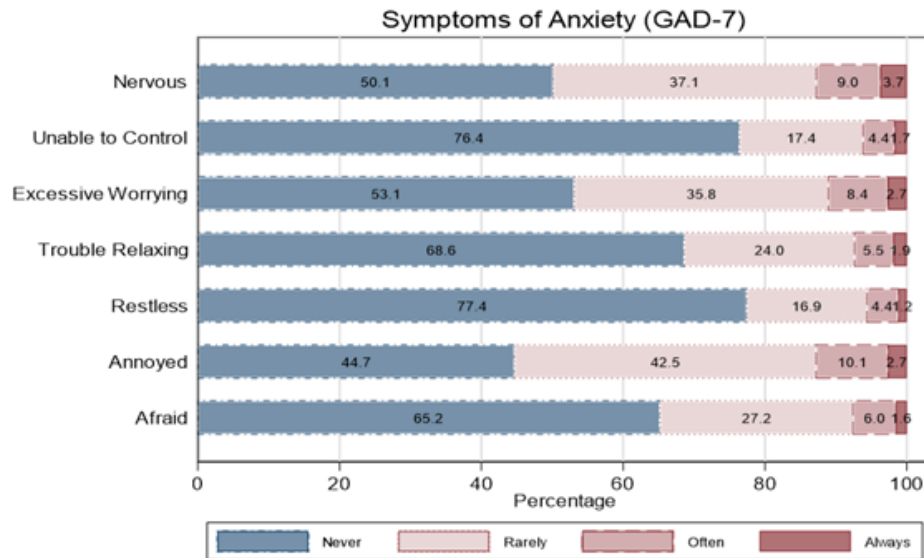
The severity of symptoms for each item is depicted using a Likert scale in which scores of 0, 1, 2, and 3 are assigned to the response categories ‘not at all’ (never), ‘several days’ (rarely), ‘more than half the days’ (often), and ‘nearly every day’ (always). Figure 1 shows the distribution of these seven items. It suggests that around 50% of the women have reported symptoms of feeling nervous during the last two weeks. Similarly, a significant proportion of women have reported symptoms of inability to control worrying (24%), worrying excessively (47%), difficulty in relaxing (31%), restlessness (23%), irritability (55%), and being afraid (35%). The GAD-7 score, which ranges from 0 to 21, is calculated as the sum of the individual item scores and serves as our primary outcome variable. Figure 2 shows the distribution of

²The DHS program is funded by the United States Agency for International Development (USAID). The data for NDHS 2022 is available at: <https://dhsprogram.com/methodology/survey/survey-display-585.cfm>

³Specifically, we drop women whose current marital status is widowed, divorced, separated or living with partner (179 observations), women whose age at menarche falls outside the range of 9 to 21 years (154 observations), and missing data for anxiety (1 observation).

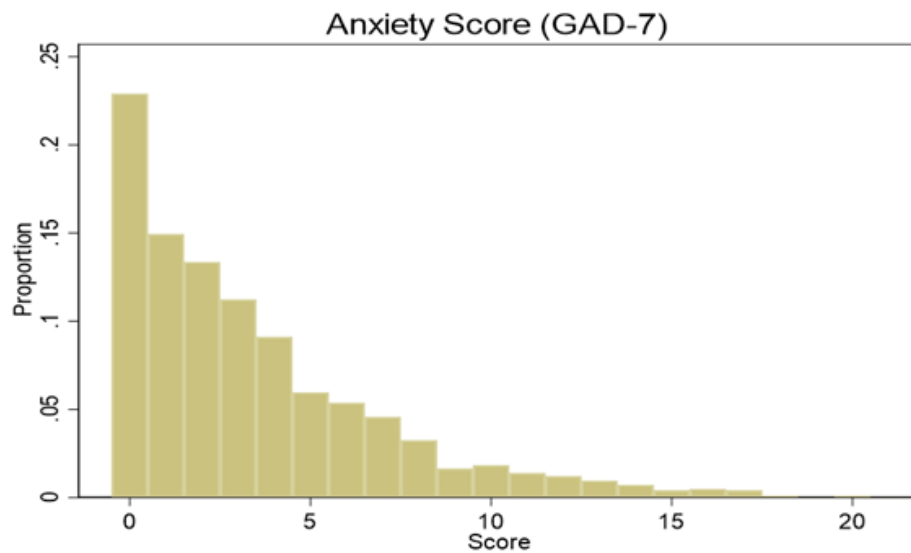
the GAD-7 score. In additional analyses, we use a threshold score of 5 to identify cases of mild anxiety, consistent with the guidelines established by [Spitzer et al. \(2006\)](#).

Figure 1: Distribution of anxiety on GAD-7 scale



Notes: The figure shows the distribution of anxiety on the GAD-7 scale in our analytical sample

Figure 2: Symptoms of anxiety



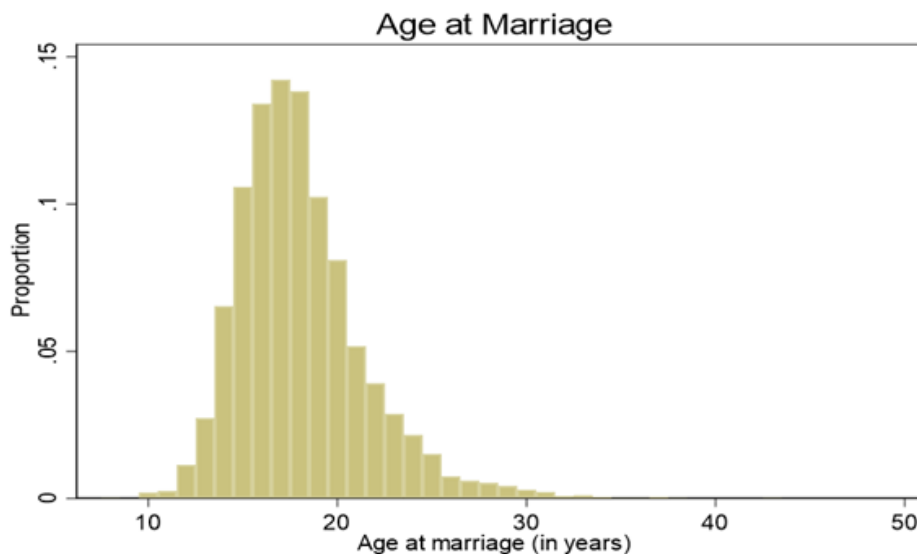
Notes: The figure depicts the symptoms of anxiety as measured on a GAD - 7 scale.

2.1.2 Marriage Age

The main variable of interest is woman's age at marriage, *MarriageAge*, and we use the data on woman's age at first cohabitation to capture this. Figure 3 shows the distribution of woman's age at

marriage for our analytical sample.

Figure 3: Distribution of age at marriage



Notes: The figure shows the distribution of our main variable of interest, age at marriage in our analytical sample

2.1.3 Control variables

Our control variables include the woman's current age (in years), her general health status (=1 if good or very good and 0 otherwise), her exposure to mass-media (=1 if good or very good and 0 otherwise), her household level characteristics such as wealth status (=1 if poor or poorest and 0 otherwise), social group (=1 if backward group including Dalit, Janajati, Muslim, and 0 if forward group including Brahmin, Chhetri, or other caste groups in Terai region), household size, difficulty in accessing health facility (=1 if yes and 0 otherwise), type of residence (=1 if urban and 0 otherwise), region dummies (Mountain, Hill and Terai), and state dummies (Koshi, Madhesh, Bagmati, Gandaki, Lumbini, Karnali, and Sudurpaschim).

2.1.4 Descriptive Statistics

Table 1 presents the summary statistics of our analytical sample. On average, women report an anxiety score of 3.43. Regarding demographic characteristics, the mean age at marriage is 18.06 years, and the average age at menarche is 13.88 years. The average age of women in the sample is 32.44 years. Approximately 28% of women report their health status as good or very good, while 79% have some exposure to media. Half of the women belong to the poorest or poorer wealth quintiles, and 52% are from socially disadvantaged (backward) groups. Furthermore, 46% report difficulty in accessing healthcare facilities, and 52% reside in urban areas. The average household size is 4.58 members. With respect to regional distribution, 46% of respondents reside in the hilly region, while the remaining are located in either the mountain (10%) or Terai (44%) regions.

3 Empirical framework

3.1 Estimation strategy

We use the following empirical specification to investigate the effect of women’s age at marriage on their mental health captured by anxiety levels captured through GAD-7 score:

$$Anxiety_i = \beta_0 + \beta_1 MarriageAge_i + \beta_2 \mathbb{X}_i + \beta_3 \mathbb{H}_i + \theta_r + \lambda_s + \epsilon_i \quad (1)$$

where $Anxiety_i$ refers to the outcome of interest for woman i ; $MarriageAge_i$ denotes the woman i ’s age at first cohabitation; \mathbb{X}_i is the vector of woman specific controls; \mathbb{H}_i is the vector of woman i ’s household characteristics; θ_r are the region dummies and λ_s denotes state dummies. Our parameter of interest, β_1 captures the effect of woman’s age at marriage on her anxiety levels. All standard errors are clustered at the district level. Our estimation strategy includes household-level controls and women-level characteristics as described in Section 2. We also include state fixed effects to account for any systematic state-level time-invariant unobservables that may affect age at marriage and anxiety.

A causal interpretation of β_1 would require that, conditional on our controls, there are no unobserved variables that are correlated with both $MarriageAge_i$ and our outcome variable, $Anxiety_i$. The presence of endogeneity would render a simple OLS estimate of β_1 to be biased and inconsistent. For instance, women from patriarchal households are more likely to marry at a younger age and experience higher levels of anxiety due to various gender-based restrictions. Consequently, the OLS estimates may be biased downwards due to the omission of these unobserved confounding factors. To alleviate this concern, we adopt an IV approach to estimate the effect of a woman’s age at marriage on her mental health, captured through anxiety.

3.2 Instrumental variable estimation

We estimate a two-stage IV model, which is specified as follows:

$$MarriageAge_i = \alpha_0 + \alpha_1 MenarcheAge_i + \alpha_2 \mathbb{X}_i + \alpha_3 \mathbb{H}_i + \phi_r + \gamma_s + \eta_i \quad (2)$$

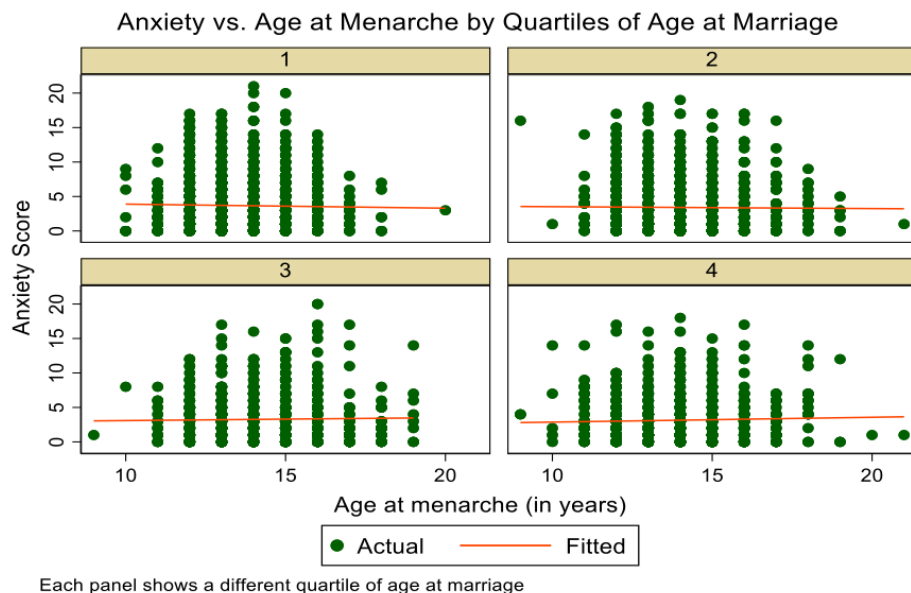
$$Anxiety_i = \beta_0 + \beta_1 MarriageAge_i + \beta_2 \mathbb{X}_i + \beta_3 \mathbb{H}_i + \theta_r + \lambda_s + \epsilon_i \quad (3)$$

We follow the empirical strategy originally proposed by [Field and Ambrus \(2008\)](#), and subsequently applied by [Chari et al. \(2017\)](#), [Roychowdhury and Dhamija \(2021\)](#) and [Sekhri and Debnath \(2014\)](#) amongst others, who instrument women’s age at marriage using their age at menarche. This instrumental variable is grounded in sociological and anthropological observations that parents often become anxious to marry off their daughters soon after menarche, largely due to concerns about avoiding premarital pregnancies ([Caldwell et al., 1983](#)). [Field and Ambrus \(2008\)](#) argue that a substantial portion of the variation in the timing of menarche is random, particularly due to genetic factors, making it a strong candidate for an instrument for age at marriage. This is supported by studies on twins that have shown that random genetic variation accounts for the single largest source of menarcheal timing ([Kaprio et al.,](#)

1995). Thus, for age at menarche to serve as a valid instrument, the exclusion restriction must hold, that is, conditional on our control variables, age at menarche should affect anxiety only through its impact on the timing of marriage.

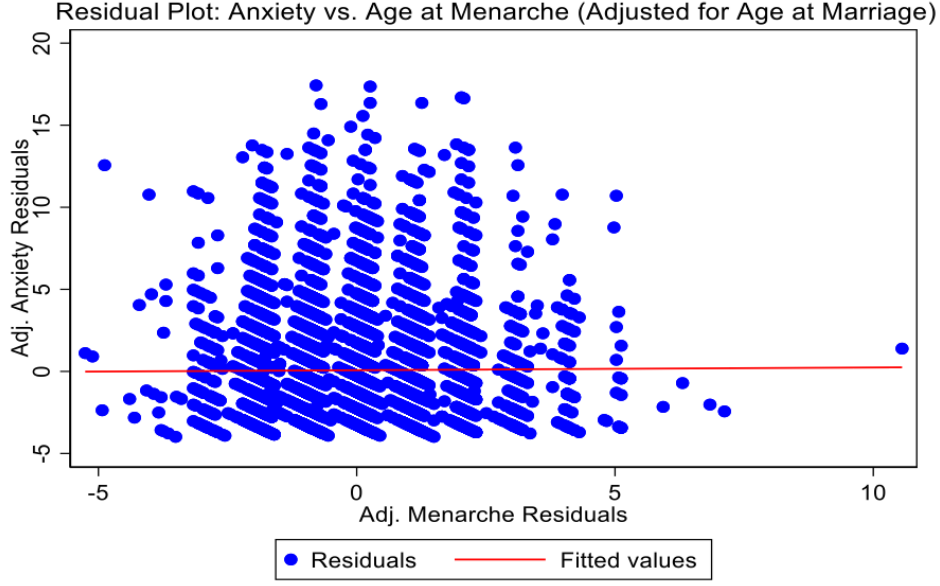
Jayawardana (2022) document a potential association between menarcheal timing and depressive symptoms among adolescent girls in the context of Indonesia. However, emerging evidence per Askelund et al. (2024) suggests that while age at menarche maybe linked to depression, its relationship with other mental health outcomes like anxiety remains inconclusive. This distinction between anxiety and depression as mental health issues reinforces the validity of our IV. That said, to alleviate any remaining concerns about a potential association between anxiety and age at menarche, we conduct some additional analyses for our analytical sample of Nepal. First, we examine the relationship between anxiety scores and age at menarche across different bins of age at marriage. Fig. 4 illustrates that the fitted line of average anxiety score by age at menarche remains largely flat within each quartile of age at marriage, suggesting no systematic relationship. Second, we implement a residual-based check to visually explore the association. Specifically, we regress anxiety on age at marriage and obtain the residuals from this regression. We also obtain the residuals from the regression of age at menarche on age at marriage. Fig. 5 presents the plot of these residuals revealing no discernable pattern or association between them. This reinforces our claim that, conditional on age at marriage, age at menarche does not have a direct effect on anxiety in our context.

Figure 4: Relationship between anxiety vs age at menarche



Notes: The figure shows the relationship between fitted values of anxiety score and age at menarche for different quartiles of age at marriage in our analytical sample

Figure 5: Residual plots: Anxiety vs age at menarche



Notes: The figure plots residuals from a regression of anxiety on age at marriage and residuals from a regression of age at menarche on age at marriage, and finds no relation.

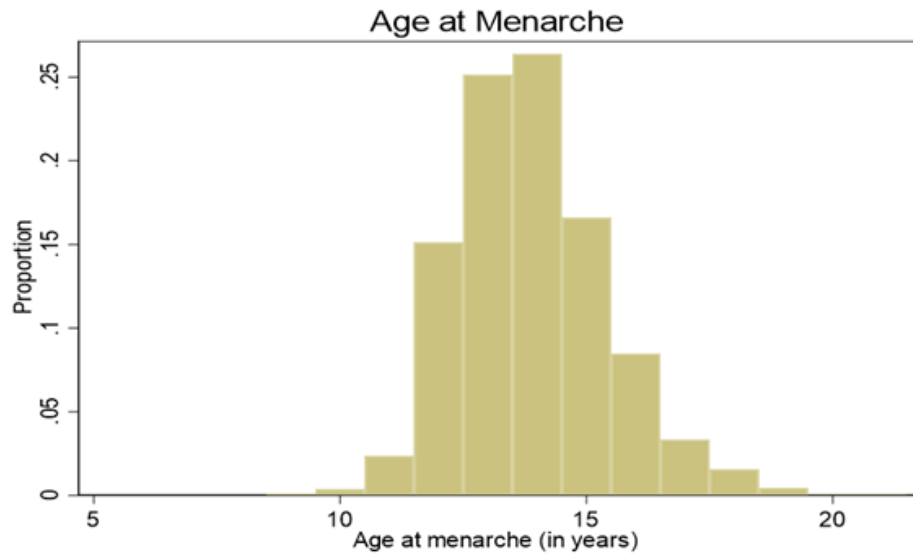
Furthermore, literature finds that environmental influences - such as childhood nutrition ([Karlberg, 2002](#)), physically demanding labour ([Pellerin-Massicotte et al., 1987](#)), and geographical factors ([Lehrer, 1986](#)) - can delay the onset of menarche. Conversely, exposure to certain environmental toxins has been associated with increased hormonal levels, potentially leading to earlier menarche ([Blanck et al., 2000](#)). These environmental factors could affect both the timing of marriage and mental health outcomes, raising concerns about potential violations of the exclusion restriction if they are not properly accounted for.

We undertake three strategies to minimize the potential endogeneity of menarche. Given Nepal's highly diverse topography, which implies variation in both climate and elevation that may systematically affect the onset of menarche, we control for indicators for different geographies (Terai, Hills, and Mountains) to account for spatial variation in exposure to such factors that affect menarche. Second, we consider the woman's general health status as a proxy for childhood nutrition. Third, we consider women's exposure to media as an additional control given the growing evidence that media exposure is highly correlated with early menarche ([Fuadah, 2020](#); [Novianti and Ardila, 2021](#)).

3.3 Validity of the IV

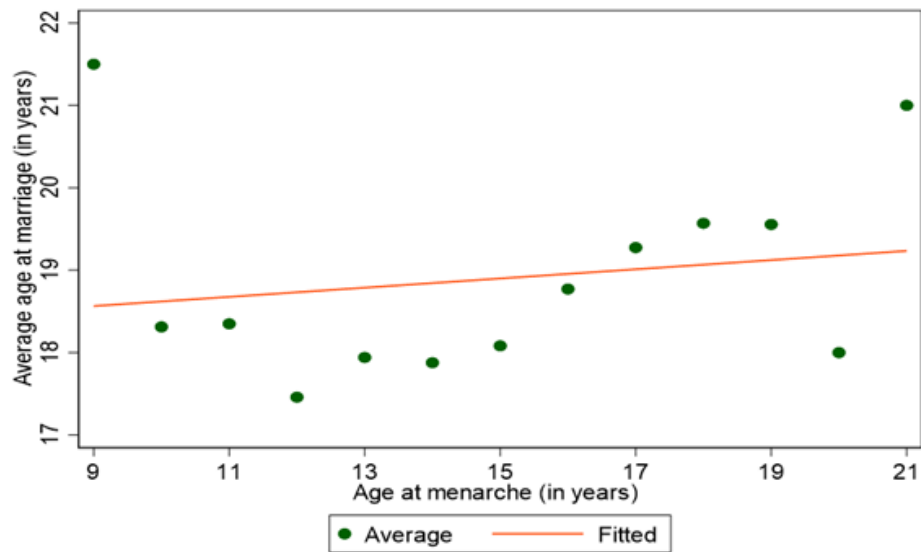
Identification requires a strong correlation between age at marriage and age at menarche. Figure 6 shows the distribution of age at menarche in our analytical sample which closely mimics the distribution of age at marriage as shown in Figure 3. Figures 7 and 8 present further evidence of a strong correlation between our variable of interest and our IV.

Figure 6: Distribution of age at menarche



Notes: The figure shows the distribution of our instrumental variable, age at menarche in our analytical sample

Figure 7: Correlation between age at marriage and age at menarche



Notes: The figure shows the strong correlation between age at marriage and menarchial age

Figure 8: Distribution of age at marriage and age at menarche



Notes: The figure shows the distribution of age at marriage for different categories of age at menarche. Early menarche includes women who attained menarche between the age of 9 and 13 years. Late menarche includes women who attained menarche between the age of 14 and 21 years

Table 2 presents our first-stage results based on Equation (2). We begin with a naive regression of $MarriageAge_i$ on $MenarcheAge_i$ with no controls in column (1) and find a strong positive coefficient of 0.233 between them. This coefficient is statistically significant at 1% level of significance and the F-Statistic for the regression specification is 27.824. We progressively add controls in the following specifications in columns (2) to (5). In column (2), we first add the woman's general health status which serves as a proxy for her childhood nutrition. Again, we find a strong positive and statistically significant relationship between age at menarche and age of marriage. In column (3), we extend the controls to also include a woman's media exposure and note that the relationship consistently remains significant at 1% level. As we move to column (4), we also include the woman's socioeconomic status captured by wealth status, type of residence and social group. The coefficient is 0.274 and remains statistically significant at 1% level with the F-stat being 39.547 and the Kleibergen-Paap rK-LM Statistic being 24.590. In column (5), we extend the set of controls to also include region dummies and state fixed effects in our specification. Age at menarche continues to be a strong predictor of age at marriage with the coefficient being 0.261 and statistically significant at 1% level and the tests of weak and under-identification are rejected. This indicates that a one-year delay in menarche is associated with approximately a 0.26-year delay in the age at marriage. These results support the relevance of age at menarche as a valid instrument for age at marriage.

4 Results

Table 3 presents the OLS and IV-TSLS results of the effect of a woman's age at marriage on her anxiety in columns (1)-(3) and (4)-(6), respectively. Columns (1) to (3) present the estimates with

the set of controls sequentially extended starting with no controls, demographic controls, and then region dummies and state fixed-effects, respectively. Column (1) captures the initial negative association between marriage age and anxiety, with no controls, with a coefficient of -0.069. The association is statistically significant at 1% level of significance. As we add additional controls, we note that the relationship between a woman’s age at marriage and her anxiety levels remains negative, albeit smaller in magnitude, indicating that a one-year delay in her age at marriage leads to a decline in her anxiety levels. Column (3) shows that one-year delay in her age at marriage is associated with a reduction of 0.047 units in her anxiety levels. In terms of standard deviations (sd), a one year increase in $MarriageAge_i$ is associated with a 0.013 sd reduction in a woman’s anxiety level measured on the GAD scale. Overall, the OLS estimates suggest that a delay in marriage reduces women’s anxiety.

We present the IV-TSLS estimates in columns (4) to (6) in the same progression as our OLS specifications. Based on the specification in which we do not include any controls, we find that a one-year delay in marriage age leads to a 0.064 decrease in anxiety but the effect is not statistically significant. In column (5), as we add additional controls including an indicator for women’s health status, media exposure, indicator for social groups, wealth status and type of residence, we observe that the effect of age at marriage on anxiety becomes statistically significant at 10% level. We find that anxiety reduces by 0.254 units (0.07 sd) with an additional year delay in the woman’s marriage age. Upon inclusion of region dummies and state fixed effect in our final and most preferred IV specification (column (6)), we note a statistically significant and negative effect of $MarriageAge_i$ on $Anxiety_i$ by 0.268 units (0.078 sd).

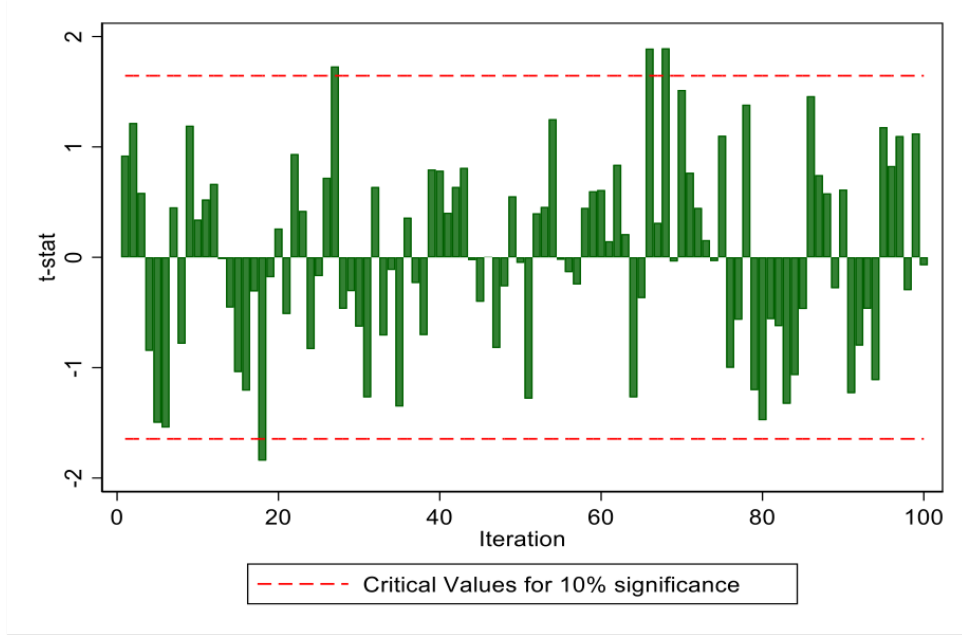
5 Robustness

5.1 Falsification analysis

Our results predominantly point to a negative and statistically significant effect of the woman’s age at marriage on her anxiety levels. We now conduct some additional analysis to support our baseline results. First, we conduct a falsification test and show that results are not obtained if we consider any randomly assigned marriage age in our model. For this exercise, we randomize our main variable of interest, which implies that the relationship between the age at marriage and our IV, her age at menarche is randomized. In other words, we associate a random woman j ’s age at marriage with woman i ’s age at menarche, while holding the outcome, anxiety for woman i , constant. With this test, we provide support for the validity of our results on age at marriage and anxiety levels. We replicate this analysis 100 times and show that 96% of the time, there is no significant impact of a woman’s age at marriage on her anxiety. Thus, we are unable to reject the null that the effect of marriage age is equal to zero only 4 out of 100 times. Figure 9 plots the t-statistics obtained corresponding to the effect of age at marriage on mental health from each of the 100 replications.

This falsification test shows that repeated estimations with random assignments of marriage age do not produce significant results, and underscores the robustness of our baseline results.

Figure 9: Falsification analysis using random age at marriage



Notes: The figure illustrates the t-statistics of the effect of marriage age on anxiety. These test statistics are obtained from 100 iterations of our preferred two-stage least squares estimation but using randomly assigned age at marriage.

5.2 Alternative outcome measures

In our baseline analysis, our outcome variable is on a GAD-7 scale with a range from 0 to 21. Here, we test the sensitivity of our results to alternative measures of the outcome. Table 4 presents the results. First, in column (1), we consider a binary measure of anxiety on the threshold score of 5, which identifies mild anxiety as per [Spitzer et al. \(2006\)](#). We note that a one-year delay in the age at marriage leads to a reduction in mild anxiety by 3.1 percentage points (pp). Second, following [Erten and Keskin \(2018\)](#), we create a z-score for each of the seven types of anxiety using the mean and standard deviation and then construct a continuous outcome variable using the sample averages of these z-scores. We denote this as Average-z-AnxietyScore in column (2). We find a reduction of anxiety by 0.046 SD due to a one-year delay in a woman's age at marriage. Last, we consider an inversely weighted z-score for anxiety as our alternative outcome. By construction, a standard z-score assigns equal weight to each anxiety item regardless of the severity of symptoms depicted by each item. The symptoms, however, may vary considerably across these items. The inversely-Weighted-z-AnxietyScore captures the variability in the symptoms by assigning the inverse of the covariance matrix of the z-scores of these anxiety items. This index assigns a higher (lower) weight to symptoms that are observed less (more) frequently in our analytical sample. Column (3) shows the results. We observe a consistently negative effect on anxiety by 0.048 SD with a year's delay in a woman's marriage timing. Overall, our results with these alternative measures of the outcome variable tell a similar story to that of our baseline analysis.

5.3 Sensitivity Analysis

We conduct an additional sensitivity analysis for our baseline IV results by excluding the top and bottom 1 percentiles of marriage age from our analytical sample and re-estimating the effect of age at marriage on anxiety. Specifically, we exclude women married between 8 and 12 years and 29 and 43 years, while retaining all demographic controls along with region and state fixed effects. Table 5 presents our results. We present the baseline IV result in column (1) for ease of comparison. Column (2) shows the results after removing the outliers. Similar to our baseline result, from column (2), we find a negative and statistically significant effect of the timing of marriage on anxiety. The effect is larger than the baseline effect, noting a reduction of 0.316 units in the anxiety score with a one-year delay in age at marriage. In terms of SD, this translates to a 0.087 SD fall in anxiety with a year's delay in her marriage. The direction and overall conclusions remain robust to this sensitivity.

6 Potential mechanism

The timing of marriage can potentially affect a woman's anxiety levels through either greater psychological maturity leading to a reduction in her anxiety, or through a change in her empowerment on account of more education or labour force participation, the impact of which on anxiety is directionally ambiguous a priori. To understand the channels through which age at marriage affects women's mental health in Nepal, we investigate the role of a woman's marital stress or empowerment as potential mechanisms of our impacts. Table 6 presents the results.

Extant literature consistently shows that early marriage is linked with greater vulnerability to marital stress (Kidman, 2017; Nasrullah et al., 2014b; Coll et al., 2023). Verbal abuse, humiliation, intimidation, and threats from a partner are widely recognized as key determinants of psychological or mental distress (Jewkes, 2010; Beydoun et al., 2012; Qasim and Muzaffar, 2021). We hypothesize that later age at marriage may reduce women's exposure to such emotional abuse, thereby alleviating marital stress and improving their anxiety levels. Specifically, we focus on four outcome variables: 1) humiliated (=1 if a woman reports that her husband has humiliated her in the last twelve months and 0 otherwise), 2) threatened (=1 if a woman reports that her husband has threatened her in the last twelve months and 0 otherwise), 3) insulted (=1 if a woman reports that her husband has insulted her in the last twelve months and 0 otherwise), and faced marital stress (=1 if a woman reports that her husband has humiliated, threatened or insulted her in the last twelve months and 0 otherwise). Table 1 provides the summary statistics of these variables.

To examine this, we first estimate the effect of age at marriage on the probability of a woman being humiliated (column (1)), verbally threatened (column (2)) or insulted (column (3)) as well as an overall measure of marital stress (column (4)), respectively, using our IV approach. Our IV fares well on the specification tests, and our findings reveal a statistically significant negative relationship between the timing of marriage and the different measures of marital stress. Columns (1) - (4) show that women who marry later are less likely to report experiencing humiliation by 2.1 pp, insults by 1.5 pp, verbal threats by 1.8 pp and any of these, captured by marital stress by 2.2 pp, respectively. This is evidence that

women married later are less likely to face such emotional abuse and therefore potentially have lower reports of anxiety. To strengthen our confidence in this channel, following the methodology in [Bose et al. \(2020\)](#), we then generate the predicted marital stress variable and use the predicted marital stress to explain the change in anxiety utilizing an OLS estimation.⁴ Column (7) shows the results. In line with our hypothesis, we find suggestive evidence of a positive relationship between marital stress and anxiety. This indicates that as marital stress lowers, the woman is less likely to report anxiety.

We also consider education and labour force participation as indicators of a woman’s autonomy or empowerment as potential pathways (see columns (5) - (6)). Specifically, education captures the years of education completed by a woman and labour force participation measures her current working status (=1 if yes and 0 otherwise). However, we do not find any evidence of women’s empowerment as the channel through which delayed marriage affects anxiety in the case of Nepal.

7 Conclusion, Discussion and Limitations

Our study extends the literature on the consequences of early marriage by focusing on mental health outcomes, specifically anxiety, in a country with a high prevalence of child marriage and growing mental health concerns. Previous research has extensively documented adverse physical health, educational, and economic outcomes, but the mental health dimension remains less explored. We also contribute by employing an instrumental variable strategy to address the endogeneity inherent in marriage timing decisions, offering more credible causal estimates of the effect of marriage age. Finally, our study goes beyond identifying the main effect by exploring a key potential mechanism: marital stress. We provide evidence suggesting that delayed marriage is associated with lower reported marital stress, which in turn is linked to reduced anxiety.

Our findings reveal a statistically significant and beneficial effect of delaying marriage on women’s mental well-being. The IV estimates indicate that a one-year increase in a woman’s age at marriage leads to a 0.08 sd reduction in her anxiety. This finding is robust to alternative specifications of the anxiety outcome, including a binary measure for mild anxiety and standardized z-scores of anxiety symptoms. Additionally, falsification tests lend additional evidence to the validity of our main results.

A key contribution of this study is the exploration of mechanisms linking marriage age to anxiety. We find strong evidence that marital stress is an important pathway. Specifically, women who marry later report significantly lower instances of marital stress, defined as experiencing humiliation, threats, or insults from their partner; a one-year delay in marriage is associated with a 2.2 percentage point reduction in the likelihood of facing such stress. In turn, higher marital stress is strongly predictive of increased anxiety scores. Interestingly, while often hypothesized, we do not find statistically significant evidence in our sample that delayed marriage operates through increased educational attainment or current employment status of the woman to reduce anxiety, highlighting the centrality of the marital dynamics channel.

These findings have important implications. The mental health benefits of later marriage signify the

⁴We bootstrap the standard errors 50 times.

importance of policies and programs aimed at preventing child and early marriage in Nepal. While legal frameworks exist, their enforcement, coupled with initiatives that empower girls and shift social norms, is crucial. Our results suggest that interventions should not only focus on delaying marriage but also on addressing marital stress within relationships. Programs offering psycho-social support, counselling services for couples, and community-based initiatives to challenge patriarchal norms that may contribute to marital stress could be particularly beneficial. Given the high prevalence of anxiety symptoms reported in the NDHS and the alarming rise in suicide rates in Nepal, addressing these underlying determinants of mental health is of utmost importance.

Future research could build upon these findings in several directions. Investigating other potential mechanisms, such as changes in women’s decision-making autonomy or social support networks resulting from delayed marriage, could provide a more comprehensive understanding. Longitudinal studies tracking women over time would be significant in understanding the long-term mental health trajectories associated with marriage timing. Evaluating the impact of specific interventions designed to delay marriage and reduce marital stress on women’s mental health would also be a crucial next step. A limitation of our study is the small sample size, due to limited observations in NDHS (2022). Over time, as more surveys incorporate a module on mental health in their questionnaire, a more comprehensive understanding of mental health trends and determinants across diverse populations can be obtained to inform evidence-based policies and interventions.

Overall, this study provides compelling evidence from Nepal that delaying marriage yields significant mental health benefits for women by reducing their anxiety levels, largely through a reduction in marital stress. These findings highlight a critical, yet often overlooked, consequence of early marriage and emphasize the need for multi-pronged interventions that not only discourage early marriage but also foster healthier, less stressful marital environments to improve women’s overall well-being.

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Table 1: Summary Statistics

	Mean	SD
<i>Outcome</i>		
Anxiety Score	3.43	3.61
<i>Demographic Characteristics</i>		
Age at Marriage (in years)	18.06	3.41
Age at Menarche (in years)	13.88	1.53
Current Age (in years)	32.44	8.33
Health Status (=1 if good or very good)	0.28	0.45
Media (=1 if reads/listens/watches newspaper/radio/TV)	0.79	0.41
Wealth Status: Poor (=1 if poor or poorest)	0.50	0.50
Social Group: Backward (=1 if yes)	0.52	0.50
Household Size	4.58	1.98
Difficulty in accessing Health Facility (=1 if yes)	0.46	0.50
Place of Residence (=1 if Urban)	0.52	0.50
<i>Region</i>		
Mountain	0.10	0.30
Hill	0.46	0.50
Terai	0.44	0.50
<i>Province</i>		
Koshi	0.15	0.36
Madhesh	0.16	0.36
Bagmati	0.14	0.35
Gandaki	0.12	0.33
Lumbini	0.15	0.36
Karnali	0.14	0.35
Sudurpaschim	0.14	0.34
<i>Mechanism Variables</i>		
Marital stress (=1 if humiliated, threatened, or insulted)	0.09	0.29
Humiliated (=1 if yes)	0.05	0.21
Threatened (=1 if yes)	0.03	0.16
Insulted (=1 if yes)	0.07	0.25
N	4,043	

Table 2: First stage analysis: Estimates of the effect of age at menarche on age at marriage

	Age at Marriage				
	(1)	(2)	(3)	(4)	(5)
Age at Menarche	0.233*** (0.044)	0.212*** (0.044)	0.215*** (0.044)	0.274*** (0.044)	0.261*** (0.044)
Observations	4,043	4,043	4,043	4,043	4,043
Women's age and health	No	Yes	Yes	Yes	Yes
Media	No	No	Yes	Yes	Yes
Socioeconomic Status	No	No	No	Yes	Yes
Region FE	No	No	No	No	Yes
State FE	No	No	No	No	Yes
First Stage F Statistic	27.824	22.861	23.557	39.547	46.060
Kleibergen-Paap rK-LM Statistic	20.196	17.351	17.527	24.590	27.362
R-squared	0.011	0.019	0.027	0.051	0.056

Notes: Estimation via OLS regression analysis. The outcome variable is age at marriage. Column (1) has no controls and no FE. Column (2) controls for women's age and health status (=1 if good or very good). Columns (3) and (4) subsequently includes women's exposure to media (=1 if reads/listens/watches newspaper/radio/TV) and socioeconomic status, respectively. Column (5) further includes region and state fixed effects. Women's socioeconomic status includes indicators for wealth background (=1 if poor), backward social group (=1 if yes), household size, difficulty in accessing health facilities (=1 if yes), and area of residence (=1 if rural). Standard errors (in parentheses) are clustered at the district level. *** p<0.01-significant at 1%, ** p<0.05-significant at 5%, * p<0.1-significant at 10%

Table 3: OLS and IV analysis: Estimates of the effect of age at marriage on Anxiety Score

	OLS			IV-TSLS		
	(1)	(2)	(3)	(4)	(5)	(6)
Age at Marriage	-0.069*** (0.017)	-0.055*** (0.015)	-0.047*** (0.012)	-0.064 (0.167)	-0.254* (0.137)	-0.268** (0.130)
Observations	4,043	4,043	4,043	4,043	4,043	4,043
Demographic Controls	No	Yes	Yes	No	Yes	Yes
Region FE	No	No	Yes	No	No	Yes
State FE	No	No	Yes	No	No	Yes
First Stage F Statistic				27.824	39.604	46.066
Kleibergen-Paap rK-LM Statistic				20.196	24.625	27.372
R-squared	0.004	0.043	0.058	0.004	0.009	0.006

Notes: Estimation via OLS and IV regression analysis. The outcome variable is anxiety score. Column (1) and (4) has no controls and no FE. Column (2) and (5) includes demographic controls. Columns (3) and (6) subsequently includes region and state fixed effects. Demographic controls include women's age, health status (=1 if good or very good), exposure to media (=1 if reads/listens/watches newspaper/radio/TV), indicators for wealth background (=1 if poor), backward social group (=1 if yes), household size, difficulty in accessing health facility (=1 if yes) and area of residence (=1 if urban). Standard errors (in parentheses) are clustered at the district level. *** p<0.01-significant at 1%, ** p<0.05-significant at 5%, * p<0.1-significant at 10%

Table 4: Alternative Outcomes: IV estimates of the effect of age at marriage on anxiety

	IV-TSLS		
	Mild Anxiety	Average z-AnxietyScore	Inversely Weighted z-AnxietyScore
	(1)	(2)	(3)
Age at Marriage	-0.031*	-0.046*	-0.048*
	(0.017)	(0.026)	(0.026)
Observations	4,043	4,043	4,043
Demographic Controls	Yes	Yes	Yes
Region FE	Yes	Yes	Yes
State FE	Yes	Yes	Yes
First Stage F Statistic	46.066	46.066	46.066
Kleibergen-Paap rK-LM Statistic	27.372	27.372	27.372
R-squared	0.005	0.013	0.002

Notes: Estimation via IV-TSLS regression analysis. Column (1) has a binary measure of anxiety. It takes a value 1 if the GAD-7 score is atleast 5 and 0 otherwise. and (4) has no controls and no FE. Column (2) has a sample average of the z-scores of each of the symptoms captured in GAD-7. Column (3) assign inverse probability weights to the z-scores of each of the symptoms captured in GAD-7. All the columns includes demographic controls along with region and state fixed effects. Demographic controls include women's age, health status (=1 if good or very good), exposure to media (=1 if reads/listens/watches newspaper/radio/TV), indicators for wealth background (=1 if poor), backward social group (=1 if yes), household size, difficulty in accessing health facility (=1 if yes) and area of residence (=1 if urban). Standard errors (in parentheses) are clustered at the district level. *** p<0.01-significant at 1%, ** p<0.05-significant at 5%, * p<0.1-significant at 10%

Table 5: Sensitivity Analysis: IV estimates of the effect of age at marriage on anxiety

	IV-TSLS	
	Anxiety Score	
	(1)	(2)
Age at Marriage	-0.268**	-0.316**
	(0.130)	(0.150)
Observations	4,043	3,925
Demographic Controls	Yes	Yes
Region FE	Yes	Yes
State FE	Yes	Yes
First Stage F Statistic	46.066	42.753
Kleibergen-Paap rK-LM Statistic	27.372	27.229
R-squared	0.006	0.001

Notes: Estimation via IV-TSLS regression analysis. Column (1) includes the entire sample, while column (2) excludes the top and bottom 1 percentile values of marriage age. Specifically, it excludes women married between 8 to 12 years and 29 to 43 years. The outcome variable is anxiety score. Both estimates include demographic controls along with region and state fixed effects. Demographic controls include women's age, health status (=1 if good or very good), exposure to media (=1 if reads/listens/watches newspaper/radio/TV), indicators for wealth background (=1 if poor), backward social group (=1 if yes), household size, difficulty in accessing health facility (=1 if yes) and area of residence (=1 if urban). Standard errors (in parentheses) are clustered at the district level. *** p<0.01-significant at 1%, ** p<0.05-significant at 5%, * p<0.1-significant at 10%

Table 6: Mechanism: Estimates

Variables	IV-TSLS						OLS
	Humiliated (1)	Threatened (2)	Insulted (3)	Marital Stress (4)	Education (5)	Current Working Status (6)	Anxiety Score (7)
Age at Marriage	-0.021*** (0.008)	-0.018*** (0.005)	-0.015* (0.008)	-0.022*** (0.008)	-0.115 (0.178)	0.009 (0.016)	
Predicted Marital Stress							2.111*** (0.504)
Observations	4,043	4,043	4,043	4,043	4,043	4,043	4,043
Demographic Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First Stage F Statistic	46.066	46.066	46.066	46.066	46.066	46.066	
Kleibergen-Paap rK-LM Statistic	27.372	27.372	27.372	27.372	27.372	27.372	
R-squared	0.013	0.000	0.147	0.030	0.004	0.398	0.058

Notes: The outcome variables are whether a woman is humiliated (=1 if yes and 0 otherwise), threatened (=1 if yes and 0 otherwise), insulted (=1 if yes and 0 otherwise), and faced marital stress (=1 if humiliated, threatened or insulted and 0 otherwise) in Columns (1), (2), (3) and (4), respectively. The outcome variables in columns (5) and (6) are years of education completed by women and their current working status (=1 if yes and 0 otherwise), respectively. IV regression analysis in columns (1) to (6). Marital Stress is predicted from column (4) and used as a treatment variable in column (7). The outcome variable in column (7) is anxiety score. OLS regression analysis is used in column (7). All the columns include demographic controls, region fixed effects and state fixed effects. Demographic controls include women's age, health status (=1 if good or very good), exposure to media (if reads/listens/watches newspaper/radio/TV), indicators for wealth background (=1 if poor), backward social group (=1 if yes), household size, difficulty in accessing health facility (=1 if yes) and area of residence (=1 if urban). Standard errors (in parentheses) are clustered at the district level. *** p<0.01-significant at 1%, ** p<0.05-significant at 5%, * p<0.1-significant at 10%