Quantifying the association of natal household wealth with women's early marriage in Nepal

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Background. Women's early marriage (<18 years) is a critical global health issue affecting 650 million women worldwide. It is associated with a range of adverse maternal physical and mental health outcomes, including early childbearing, child undernutrition and morbidity. Poverty is widely asserted to be the key risk factor driving early marriage. However, most studies do not measure wealth in the natal household, but instead, use marital household wealth as a proxy for natal wealth. Further research is required to understand the key drivers of early marriage.

Methods. We investigated whether natal household poverty was associated with marrying early, independently of women's lower educational attainment and broader markers of household disadvantage. Data on natal household wealth (material asset score) for 2,432 women aged 18-39 years was used from a cluster-randomized Low Birth Weight South Asia Trial in lowland rural Nepal. Different early marriage definitions (<15, <16, <17 and <18 years) were used because most of our population marries below the conventional 18-year cut-off. Logistic mixed-effects models were fitted to estimate the probabilities, derived from Adjusted Odds Ratios, of (a) marrying at different early ages for the full sample and for the uneducated women, and (b) being uneducated in the first place.

Results. Women married at median age 15 years (interquartile range 3), and only 18% married ≥18 years. Two-thirds of the women were entirely uneducated. We found that, rather than poverty, women's lower education was the primary factor associated with early marriage, regardless of how 'early' is defined. Neither poverty nor other markers of household disadvantage were associated with early marriage at any age in the uneducated women. However, poverty was the key driver of women being uneducated.

Conclusion. When assets are measured in the natal household in this population, there is no support for the conventional hypothesis that household poverty drives families to marry off their daughters early, but it does determine whether they go to school. Improving access to free education would both reduce early marriage and have broader benefits for maternal and child health and gender equality.

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Abstract

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Conclusion. When assets are measured in the natal household in this population, there is no support for the conventional hypothesis that household poverty drives families to marry off their daughters early, but it does determine whether they go to school. Improving access to free education would both reduce early marriage and have broader benefits for maternal and child health and gender equality.

Introduction

Women's early reproduction is detrimental to both maternal and child health (Finlay, Özaltin & Canning, 2011; Fall et al., 2016). However, in many societies, strong cultural norms mean that the vast majority of women marry *before* having children. In such societies, early marriage is therefore the gateway to early childbearing, and as it also has broader implications for women's health, early marriage is a crucial global health issue in its own right (Marphatia, Amable & Reid, 2017).

Globally, 20% of women aged 20-24 years marry or enter into a formal union before 18 years of age (UNICEF, 2021). Among the specific penalties for women associated with early marriage are less education, under-nutrition, lower access to contraception and healthcare, early childbearing, and higher morbidity and mortality during pregnancy and labor (Godha, Hotchkiss & Gage, 2013; Raj & Boehmer, 2013; Ganchimeg et al., 2014; Raj et al., 2014; Delprato et al., 2015; Goli, Rammohan & Singh, 2015; Marphatia et al., 2021). However, these disadvantages are likely to propagate adverse effects to the next generation (Bates, Maselko & Schuler, 2007; Marphatia, Amable & Reid, 2017).

Universally, child or early marriage is defined using a cut-off of <18 years (UN General Assembly, 2014, 2018). However, among the Maithili-speaking Madhesi population in Nepal, where our study is based, most women marry below well before this threshold, around a median age of 16.5 years (MOHP, New ERA & ICF International, 2017). In this population, it would therefore be more informative to investigate the factors associated with marrying at different early marriage ages.

In most studies using the <18 years cut-off to define early marriage, natal household poverty is widely suggested to drive women's early marriage across the global South, including in Nepal (ICRW, 2006; Chaudhuri, 2015; Hodgkinson, 2016). However, most studies measure material assets (as an index of wealth) in the marital household only *after* women have already married, and then use this information as a proxy for the natal household's wealth (Raj et al., 2014; Delprato et al., 2015; Wodon et al., 2017; Scott et al., 2021). This practice therefore relies on an assumption that women are likely to marry into households of similar wealth as their natal homes. Wealth of natal and marital households might indeed be correlated, but a severe shortage of data on natal wealth means that there is little evidence for this assumption.

The wealth of the natal and marital households might therefore also be uncorrelated. For example, some studies find that younger marriages (<15 years) may in part be driven by girls wanting to marry into economically better off marital households as a way of escaping the poverty of their natal home (Human Rights Watch, 2016). However, as wealth was measured neither in the natal or marital household in this qualitative study, it is unclear whether the aims of these families were achieved. Moreover, some poorer families are able to educate their daughters to the secondary level, and this is then leveraged to marry them into more educated and wealthier households (Fafchamps & Shilpi, 2011; Jackson, 2012; Boyden, 2013). We argue, therefore, that using wealth of the marital household, where women end up after marriage, to represent wealth of the natal household, where women came from prior to marriage, is inappropriate when investigating the potential role of poverty in driving early marriage.

Attributing wealth to the correct household is crucial in this context, because it reflects not only the family's socio-economic status but also its spatial niche. Collectively, these characteristics are likely to shape the natal household's intentions around the timing of their daughter's marriage. Misinterpreting the source of the natal household's interests (by using marital household assets) therefore means that we have an inadequate understanding of how both wealth and other related factors may be associated with early marriage.

Using data on natal households from a cluster-randomized trial in lowland rural Nepal, we investigate the independent associations of natal household poverty, as well as other socio-economic factors, with different age groupings of early marriage. We also investigate the contribution of education to early marriage, and whether broader socio-economic factors are associated with women being uneducated in the first place.

What do we know about poverty's association with early marriage?

Most studies which investigate the link between wealth and age at marriage have used marital household assets as a proxy for the natal household's assets (wealth) without appropriate supporting evidence for this assumption. Such studies relating to Nepal vary in whether the poorest (Guragain et al., 2017), or the wealthiest (Aryal, 2007) have the highest risk of marrying early. Other studies find an inconsistent relationship between wealth and marriage age (Raj et al., 2014) or no relationship at all (Pandey, 2017).

Some studies have used household wealth data appropriately, but in two different ways. One group of studies has described the proportion of women married <18 years stratified by marital wealth quintiles without making an assumption that this also represents wealth in the natal household. These studies consistently find that in both impoverished regions of the world, including Nepal and more generally, the poorest marital household quintile have the largest proportion of women married <18 years (ICRW, 2006; UNFPA, 2012; UNICEF & UNFPA, 2017; MacQuarrie & Juan, 2019). Fewer studies have first measured wealth in the natal household itself, and then investigated if this is associated with the likelihood of women marrying early (Muchomba, 2021). For Nepal, we could only find one such study, which produced a less consistent pattern, where it was not the poorest, but the second poorest households whose daughters were married earliest (Bajracharaya and Amin 2012). Collectively, these studies suggest that the relationship between poverty and early marriage is not as strong when wealth is measured in natal households, and that using wealth in the marital household as a proxy for wealth in the natal household may be inappropriate.

Many of the insights on how poverty may push girls into early marriage come from qualitative literature, where household wealth is not measured or quantified. Nevertheless, such work does offer valuable insights on subjective perspectives and decision-making around marriage. Several studies from Nepal have identified a strong economic rationale for the natal household to marry daughters at a young age, related to material poverty: specifically in relation to the costs of caring (food, clothes) for daughters and paying for their education (Verma, Sinha & Khanna, 2013; Chaudhuri, 2015; Human Rights Watch, 2016; Samuels et al., 2017). Dowry (illegal, but typically still paid from the natal to marital household) also tends to increase with age and education level, and may provide an incentive for early marriage (Sah, 2012; Hodgkinson, 2016; Human Rights Watch, 2016; Karim, Greene & Picard, 2016). Hence, in the poorest families,

girls may be perceived as economic burdens and thus the earlier they are married, the better the natal household's economic welfare (Hodgkinson, 2016; Guragain et al., 2017). However, one study from Nepal reporting both attitudinal and quantitative data found the primary drivers of early marriage were family pressure, socio-cultural norms, less education and food insecurity; income poverty was cited as a less important factor (Maharjan et al., 2012).

Other markers of disadvantage and early marriage

Beyond low material assets, other markers of disadvantage may also be associated with early marriage. For example, education is a key factor associated with marriage age, and studies generally find that girls' lower educational attainment (years of schooling completed) increases their risk of marrying early (Raj et al., 2014; Delprato et al., 2015; Sekine & Hodgkin, 2017; Marphatia et al., 2020; Scott et al., 2021). The association between poverty and early marriage may therefore vary by girls' education level, and poverty may also contribute to whether girls are educated in the first place because of the costs associated with schooling (e.g. fees, books, uniforms, etc) (Verma, Sinha & Khanna, 2013; Chaudhuri, 2015; Samuels et al., 2017).

To understand the association between poverty and the timing of women's marriage, we also need to consider other relevant socio-economic factors. In rural contexts, agrarian land-holding is another relevant marker of household wealth (Fisher & Naidoo, 2016). Landlessness may increase the risk of food insecurity, which in turn has been associated with both lower schooling and earlier marriage (Moock & Leslie, 1986; UNICEF, 2014). Caste affiliation is also linked to socio-economic status, with studies generally finding that girls from disadvantaged castes tend to complete less education and also marry <18 years (Stash & Hannum, 2001; Sah, 2018; Devkota, Eklund & Wagle, 2020). There is much less literature on the role of the natal household's geographic location in relation to early marriage, but greater distance to school has been found to be a key constraint to accessing education (Jamison & Lockheed, 1987; Ayral, 2014; Devkota & Upadhyay, 2015). Thus, if schooling is not a viable option, marrying daughters early may alleviate household financial and food pressures (Maharjan et al., 2012; Human Rights Watch, 2016; Samuels et al., 2017).

Socio-cultural norms are also likely to shape both the timing of marriage and the amount of education girls are likely to complete. Bicchiere et al. (2014) define these normative social preferences as 'moral rules' governing decision-making relating to women's life options, whether they refer to marriage, chastity, education, employment, etc. Failing to conform to these norms may adversely affect a girl's marital options and also her natal household's social standing in the community (Caldwell, Reddy & Caldwell, 1983; Maertens, 2011, 2013). However, norms can change over time. Several studies have suggested that secular changes in attitudes and norms, coupled with widespread advocacy on minimum marriage age legislation, improvements in household wealth, and increased girls' educational attainment are collectively likely to explain the overall decrease in early marriage over the past ~15 years across South Asia (Raj, McDougal & Rusch, 2012; Allendorf & Thornton, 2015; MacQuarrie & Juan, 2019; Prakash et al., 2020; Scott et al., 2021).

Study aim and hypotheses

Our study aims to contribute new insights on the economic and social drivers of women's early marriage and lack of education in low-income settings. Using objective data on wealth and broader markers of disadvantage measured in the natal household on 2,432 women aged 18-39

years from lowland rural Nepal, we investigate whether natal household poverty is associated with marrying early. We define 'early marriage' using several different age groupings, because most women in our population marry well below the 18-year threshold (minimum legal age) conventionally used to define early marriage. This is crucial because if we only use the 18-year threshold, we might miss identifying what shapes variability in age at marriage as it is experienced in this population.

Since two-thirds of our sample is entirely uneducated, we also investigate whether poverty is associated with early marriage in uneducated women, and also whether poverty is associated with women being uneducated in the first place. The uneducated women are interesting to examine on their own because for them, education cannot confound the association between wealth and marriage age. Our models adjust for age of women at marriage, to capture potential cohort effects and examine secular changes in social norms over time. To ensure observed associations between poverty and early marriage are not an artefact of related factors, we include women's education level as another key exposure, and also broader markers of socio-economic disadvantage measured in women's natal household: agrarian land-holding, geographic location and caste affiliation.

We investigate four hypotheses:

(1) Natal household poverty is associated with marrying early, using different ages to define this outcome: <15, <16, <17 and <18 years, in each case compared to marrying ≥18 years;
(2) Women's lower educational attainment, independent of natal household poverty and broader markers of socio-economic disadvantage, is associated with early marriage: <15, <16, <17 and <18 years, in each case compared to marrying ≥18 years;
(3) Amongst uneducated women, poverty, independent of broader markers of socio-economic disadvantage, is associated with early marriage at different ages; and
(4) Natal household poverty, independent of broader markers of socio-economic disadvantage, is associated with women being uneducated.

Materials & Methods

Our study is based on data from the Low Birth Weight South Asia Trial (LBWSAT), which assessed the impact of three pregnancy interventions on birth weight and infant growth (Saville et al., 2018). The trial was conducted across 80 geographic clusters in Dhanusha and Mahottari districts in Province 2 of the Terai region bordering Bihar state in India. Married pregnant women were randomized to one of four intervention arms: Participatory Learning and Action (PLA) behavior change intervention in Women's Groups, PLA with unconditional cash transfers, PLA with a fortified blended food supplement, or a control group accessing Government of Nepal health services. Questionnaires were administered orally to 25,090 married pregnant women aged 10-49 years in the home that they were residing in during pregnancy (Saville et al., 2016).

Research ethics approval to conduct the trial was granted by the Nepal Health Research Council (108/2012) and University College London (UCL) Research Ethics Committee (4198/001). Village Development Committee secretaries consented for villages to participate in the trial. Women gave written consent and guardians consented to the participation of married adolescents <18 years of age. Further ethical approval for secondary analyses of LBWSAT data for this

analysis was granted from the Nepal Health Research Council (292/2018), the Research Ethics Committees at UCL (0326/015) and the University of Cambridge (1016).

Marriages in the Maithili-speaking Madhesi population of our study are generally arranged by parents or close relatives, with girls having little say over the timing and choice of spouse (Maharjan & Sah, 2012; Clarke, 2013). In 2016, the Maithili-speaking Madhesi women had the lowest median age at marriage (16.5 years) nationwide (MOHP, New ERA & ICF International, 2017; Pandey, 2017), and were more likely to be uneducated (Marphatia et al., 2020). These factors, and gendered socio-cultural norms restricting women's physical mobility outside of the home, mean that women typically have low levels of agency and decision-making power (Gram et al., 2017; Harris-Fry et al., 2018; Morrison et al., 2018). The main livelihood of this population is subsistence farming (rice, wheat, pulses), with the majority of households purchasing some food items from local markets, or 'bazaars' (Saville, Manandhar & Wells, 2020).

Data

Outcome variables

For our first outcome variable, women's 'early marriage,' we use several different age groupings since the majority of our sample (87%) married below the UN stipulated minimum age of 18 years. In Nepal, the legal minimum age at marriage is 20 years, but marriage at 18 years is possible with parental permission (His Majesty's Government of Nepal, 1963). To ensure comparability across these results, the same reference group, marrying at the minimum age cut-off of ≥18 years, is used irrespective of the age used to define early marriage. We examine the factors associated with marrying <15 years (hence excluding women who married between 15-18 years), <16 years (hence excluding women who married between 16-18 years), <17 years (hence excluding women who married between 17-18 years), and <18 years of age (includes the full sample). In other words, each of the models above the <15 years has the lower group nested within it, but excludes the higher group up to 18 years. **Figure 1** illustrates our approach.

Figure 1 here

Our second outcome variable, women 'being uneducated,' is coded as any formal education (≥1 year) vs no education (0 years). We use this cut-off because two-thirds of our sample have never been to school.

Exposures

Our primary exposure is the score of assets measured in the women's natal household. The natal household asset score is categorized in quintiles, from 1 (poorest) to 5 (richest). This assessment of assets is widely used by national representative surveys, including in our study context (MOHP, New ERA & ICF International, 2017). These assets represent relatively stable markers of wealth, relating to the structure of the home or ownership of consumer goods that require significant financial outlay. They are assumed already to exist before a daughter marries. However, in contrast to the 12-asset score that has been used in previous studies on this population (Saville et al., 2016; MOHP, New ERA & ICF International, 2017; Sah, 2018), we use an 8-asset score. We exclude goods such as color television, motorbike, and computer because they could have been acquired after the daughter had married, especially if there was a

long time-gap between marriage and when the assets were measured. We also exclude agrarian land-holding from the score, because we want to investigate whether the association of land-holding with women's early marriage and lack of education is independent of that of assets.

The score of assets was therefore constructed from eight variables using principal component analysis (Vyas and Kumaranayake 2006). The first principal component had positive factor loadings for all eight variables and accounted for 36.7% of the variability, compared to 13.2% for the second principal component. Thus we used the first score as the marker of natal household wealth. The eight variables contributing the highest factor loadings to the first principal component, listed in order of decreasing size (weight shown in parenthesis), were: wall (0.457), roofing (0.442) and flooring (0.423) materials, toilet facilities (0.412), number of rooms used for sleeping in the house (0.317), access to electricity (0.242), drinking water source (0.227) and non-biomass cooking fuel use (0.188).

Our second key exposure is women's educational attainment. Education is coded according to the Nepalese education system: none, primary (1-5 years), lower-secondary (6-8 years) and secondary or higher (≥9 years) (Ministry of Education Nepal, 2016).

We also include broader markers of household socio-economic disadvantage. Agrarian land-holding is coded as none, 0.01 to 0.5, 0.51 to 0.99 and ≥1 hectare. Geographic location is categorized by accessibility to large markets, known as 'bazaars,' using the normal form of transport, quantified in terms of time (<30 minutes, 30-59 minutes, 60-89 minutes and ≥90 minutes). Large bazaars may be a proxy for access to broader social connections, resources, larger health facilities and schools. Four groups describe caste affiliation: disadvantaged castes are coded into two separate groups: Dalit and Muslim, middle combines Janjati and various Madhesi castes, and advantaged combines Yadav and Brahmin. We do not include religion as the disadvantaged caste variable already examines the Muslim faith separately, and all other groups refer to the Hindu faith.

The women in our sample range from age 18 to age 39 years, and access to education and social norms might have changed in the 20 years between the oldest and youngest growing up. We therefore control for women's age to capture the ways in which secular changes in societal norms may impact marriage age and education patterns.

Statistical methods

We first test for bias in the characteristics of women with assets measured in their natal versus marital households use chi-squared tests (categorical variables) and non-parametric *k*-sample analysis of variance (Kruskal-Wallis test; continuous variables). We also test for differences in individual assets by asset quintile level using chi-squared tests (categorical variables) and ANOVA (reporting the mean and standard deviation, SD). Given the skewed distribution of women's age, we report the median (and interquartile range, IQR) values in completed integer years. A heat table examines the distribution of women by education group and natal household wealth quintiles. We use SPSS 26 to conduct these analyses (IBM Corp., Armonk, NY). Using R library tidyverse and ggplot2, we created boxplots to stratify the association of women's marriage age with their education by natal household asset quintiles (Wickham, 2016; Wickham et al., 2019).

We fit logistic mixed-effects models with a random effect on the intercept accounting for within-cluster variability. Models estimate the probabilities, derived from adjusted Odds Ratios (aORs) with 95% Confidence Interval (CI) of women (a) marrying <15, <16 <17 and <18 years, and (b) being uneducated. Models of the factors associated with being uneducated do not include marriage age because it is not appropriate to use a factor which occurred at time B (marriage age) to predict something earlier, at time A (never starting school). All of the models control for women's age (potential cohort effect), which, when included together with their age at marriage effectively accounts for the time-gap between when they married and their current age (when they were recruited into the trial). Since our interest is in understanding whether poverty (defined relative to the richest quintile) is associated with early marriage, the reference group is set as the highest category across variables, hence: richest asset quintile, secondary education, agrarian land-holding of ≥1 hectare and advantaged caste. Living near to the biggest bazaar (<30 minutes) is set as the reference group because we assume it is a proxy for access to school and other resources.

Models control for random effects (80 geographic clusters of the trial). We evaluate goodness-of-fit using the Nakagawa-Schielzeth marginal R^2 which measures the percentage of variance explained by the model's fixed effects (Nakagawa & Schielzeth, 2013). Models are fitted using the R library lme4 (Bates et al., 2014).

We adjust for trial arms because women from natal households were more likely to enroll in the cash and food interventions. However, since the trial recruited already married and currently pregnant women, interventions could not have influenced marriage age or education (which typically is ended before/once women marry). Moreover, assets were measured before the trial was conducted, so the cash supplementation arm could not have changed their value. As the trial arm was not associated with our outcomes, we do not report the findings, although it is still controlled for in our analyses.

We conduct a sensitivity analysis to examine if the association between poverty and our outcomes change if we apply looser selection criteria, by including all of the women measured in their natal household (n=3,379) regardless of their age. While this introduces the possibility of distortion due to selection bias (as discussed above), it nevertheless allows us to test our hypotheses with a much bigger sample of women.

Results

Sample selection

Married pregnant women were interviewed in the home in which they were residing at the time of recruitment into the trial. Of the 25,090 women recruited into our study, we first exclude 408 women with multiple pregnancies during the trial to ensure they are not double counted in our analysis. Second, of the remaining 24,682 women (raw data in **Data S1** contains this sample), we exclude 3,968 women who had no data on the household in which assets were measured and a further 17,335 women who were interviewed in their marital home. This leaves 3,379 women whose assets and other characteristics were measured in their natal household.

Third, we exclude 947 women aged <18 years because the relationship between wealth, education and marriage age may be distorted due to the selection bias of recruiting only married

pregnant women into our study. Excluding these younger women is important because they would not have had the chance of marrying at older ages, nor adequate time to finish greater levels of education before marrying. For example, a 15 year old married pregnant women never had the chance to have married at any age over 15 years. Our analysis therefore includes 2,432 women aged 18-39 years measured in their natal households, representing 9.7% of the total 25,090 women recruited into the trial.

Table S1 examines whether the characteristics of the women measured in their natal homes are different to those measured in their marital homes. This enables us to identify potential bias in our sample which may result in these two groups of women having a different relationship between wealth and marriage age. A direct comparison between these women is not possible because we do not know the socio-economic background of the natal households of the women who were measured in their marital home.

In comparison to women who were measured in their marital home, those measured in their natal homes were younger, had been married for less time, but at an older age. A greater proportion of women measured in their natal households were from disadvantaged castes, residing further away from big bazaars, and in the trial's cash and food supplementation arms. It is possible that the trial may have incentivised women to return to their natal homes to access these incentives. Women did not differ in their education level, age at first pregnancy, or household asset score. Whilst these results show that women who went to their natal homes during pregnancy were different than those who stayed in their marital homes, they still represent an important sub-group of women with rare data on the socio-economic characteristics of their natal homes.

Description of sample

Table 1 describes our sample of women aged 18-39 years. Women were of median age 21 years (IQR 4) and had been married a median of 5 years (IQR 5). Marriage was typically early among women (median 15 years, IQR 3), and 18% had married ≥18 years. Two-thirds of the women were uneducated, 39% were from natal households without agrarian land and disadvantaged castes respectively, and 29% lived far from large bazaars.

Table 1 here

The heat table shows the overall number of women by their education level and natal household wealth quintiles (**Table 2**). Green shaded areas indicate low numbers and red shaded numbers the highest numbers. Within the whole sample, uneducated women are most likely to come from poorer natal households, and the more educated women are more likely to come from richer households. However, since two-thirds of our sample is uneducated, there is nevertheless variability by wealth.

Figure 2 uses the raw data to stratify the association of women's marriage age with women's education by natal household asset quintiles. Overall, within each wealth group, women with more education marry later. How much education is associated with delayed marriage differs slightly across wealth groups. Interestingly, even in the poorest and poor wealth groups, the median age at marriage was 2 years later among women with ≥6 years of education than among those with no or less education.

Figure 2 here

Hypothesis 1

Table 3 investigates the association of natal household score with the four marriage age groups. Across Models 1-4, there is no evidence of a cohort effect, which may be explained by the relatively narrow age range of our sample. Relative to the richest asset quintile, women from all other asset quintiles have an elevated risk of early marriage, regardless of the age threshold used to define 'early'. However there is little consistent gradient between the coefficients of the poorest four asset groups, indicating that the main difference in marriage age is between the richest and the rest (this is confirmed by analyses using other asset groups as reference (not shown). The variance in marriage age explained by the four models is very low: 5.0%, 3.2%, 2.8% and 2.1%. These results do not support our first hypothesis, that natal household poverty is associated with the likelihood of marrying at different early ages.

Table 3 here

Hypothesis 2

Table 4 investigates the association of broader socio-economic factors with the likelihood of marrying early as defined by the four different age thresholds. With the exception of Model 4, age is not a significant factor associated with early marriage, indicating the absence of a cohort effect. Model 4 shows that older women were less likely to marry <18 years than ≥18 years which is perhaps surprising: we expected that further in the past (older women) prevailing norms might have led to earlier marriage. It is only when education is controlled that this cohort effect shows up, which suggests that this is connected to the difference in the availability of, and attitudes towards, education over time. It is possible that this cohort effect emerges because in the past, high levels of education were rarer, and that they were therefore more tightly associated with delayed marriage then they are in more recent times, whereby education is more widely available to the younger women in our sample.

Across Models 1-4, the asset score is no longer associated with early marriage when women's education is included. The effect of lower wealth appears therefore to be channelled through women's education, which is a better predictor of early marriage in this context. There is a clear education gradient in the likelihood of marrying early, however 'early' is defined. Relative to secondary education, all other education levels have an elevated risk of early marriage, with uneducated women having a substantially greater risk. The magnitude of the effect of education also decreases with each later age at marriage suggesting that education tends to increase with age, but assets don't. Neither land, caste nor geographic location are associated with any of the marriage age models when women's education is controlled.

Compared to **Table 3**, these Models are almost three times better at explaining the variance across the four marriage age groups: 23.5%, 16.4%, 13.1% and 10.6%. These results support our second hypothesis, that women's lower educational attainment, independent of natal household poverty and broader markers of socio-economic disadvantage, is associated with early marriage, whatever the age threshold used to define 'early'.

Table 4 here

Hypothesis 3: only the uneducated women

Hypothesis 3 investigated whether amongst only the uneducated women (*n*=1,610), poverty, independent of broader markers of socio-economic disadvantage, is associated with early marriage at different ages. Results show no cohort effect, nor any association with wealth (**Table 5** Models 1-4), suggesting that the uneducated women who marry early are not systematically more or less wealthy compared to those marrying >18 years. There is also no association between broader socio-economic factors and early marriage, whatever age threshold is used to define early marriage (**Table 6** Models 1-4).

Tables 5 & 6 here

In **Table 5**, Models explain 6.2%, 5.4%, 5.0% and 5.0% of the variance in women marrying <15, <16, <17 years and <18 years respectively. In **Table 6**, Models explain slightly more of the variance in early marriage across the age groups 7.1%, 6.6%, 5.8% and 6.0%. In comparison to Models in **Table 4** with all educational levels, these models of only the uneducated women explain less variance, and the absence of women's education (as we focus on only the uneducated women) in these models is likely to explain this difference. These results do not support our third hypothesis, that for only the uneducated women, poverty, independent of broader markers of socio-economic disadvantage, is associated with early marriage at different ages.

Hypothesis 4

Hypothesis 4 investigated whether poverty, independent of broader socio-economic factors, is associated with women being uneducated. Across the two Models in **Table 7**, older women are more likely to be uneducated, reflecting the increase in the availability and acceptability of education for girls over the twenty year period during which our sample was maturing. Model 1 shows a clear wealth gradient in the likelihood of being uneducated. Relative to the richest quintile, all other asset quintiles have elevated risk of being uneducated, with the poorest quintile having a substantially greater risk. Model 2 finds a similar pattern after inclusion of broader socio-economic factors. In comparison to Model 1, the magnitude of the effect of the first wealth quintile is weaker, that of the mid quintile only slightly weaker, and unchanged in the two richest quintiles. Relative to higher agrarian land-holding, both none and some land-holding are associated with being uneducated. Relative to advantaged caste, the two disadvantaged castes are associated with being uneducated, with the risk substantially greater for the Muslim caste. Relative to living near a big bazaar, living 30-59 minutes away, but not further distances, was marginally associated with being uneducated.

Model 1 explains 21.0% of the variance in women's education, which is lower than Model 2, which explains 36.3% of the variance. These results support our fourth hypothesis, that poverty, independent of broader socio-economic factors, is associated with women being uneducated.

Table 7 here

Supplementary analysis

A potential reason why poverty may not be associated with women's early marriage irrespective of the age group, could be that the individual assets owned by households do not actually differ between the wealth quintiles. **Table S2** shows, however, there is substantial variability across the eight individual assets used to produce our composite asset score using PCA. We also include land-holding in this analysis because it is another marker of wealth in our primarily agrarian population. These individual assets and land ownership matters for daily life and indicates the household's purchasing power. Our results show that asset ownership does indeed differ by wealth levels, nevertheless our analyses described above show that wealth in itself is not associated with women's early marriage in this population.

Given the selection bias in our study of recruiting young, already married and pregnant women, we restricted the analyses described above to women aged ≥18 years only. With the exception of the association of age, our results are nonetheless similar if we include the full sample of women aged 12-39 years (**Tables S3-S7)**. The significance of the age variable in these models is a product of the selection effects (as discussed above), and not a cohort effect.

Discussion

Our results show that if we measure assets in the natal household, then we do not support the conventional hypothesis that household poverty directly drives families to marry off their daughters early. In our population, relative to the richest households, all other asset levels have an elevated risk of marrying early, and the poorest group does not stand out. Moreover, when women's education is also included, it displaces wealth as a predictor of early marriage, whatever age is used in the definition of early marriage. The association of high wealth with reduced risk of early marriage therefore works through education, and more generally it is education level that is directly related to women's marriage age in this population. Additional analysis showed substantial variability in individual assets and land-holding by asset quintiles, but that wealth in itself is not directly associated with women's early marriage in this population.

Relative to secondary education, all other education categories are at risk of marrying early, however there is also a clear gradient, with uneducated women showing the greatest likelihood of early marriage. Even in combination, however, household wealth and women's educational attainment still explain a low proportion of the variance in the likelihood of early marriage models, suggesting that other factors largely drive marriage decisions in this population. Among uneducated women, neither poverty, nor broader markers of household disadvantage are associated with early marriage, however 'early' is defined. Our analyses of uneducated women offer even stronger support for the hypothesis that socio-cultural norms may be the primary driver of early marriage. For example, as they are not in school, their primary role in society may be to be a wife and mother. However, the differences in the age of marriage within uneducated women may also relate to other factors unmeasured by our study.

Where poverty appears to really matter is for the level of education achieved by women, potentially because of the costs associated with schooling. Independently of poverty, both landless and lower agrarian land-holding families are also less likely to send their daughters to school: the lack of land may reflect chronic food insecurity, whereas households with some land may prefer daughters to contribute to family income through working on the farm, rather than attending school.

Like other studies, we also find that disadvantaged castes, especially of the Muslim faith, tend to have lower education (Stash & Hannum, 2001; Sah, 2018; Devkota, Eklund & Wagle, 2020), but this factor was not associated with early marriage. Caste affiliation may be a maker of overall status in society, and therefore act as another marker of access to resources and life opportunities. We find no evidence of geographic location mattering for early marriage, and there was no clear relationship between distance from bazaar and lack of education.

Conclusion

Our study is unique in having objective data on assets and broader markers of disadvantage measured in the natal household. These data enable us to conduct robust and appropriate investigations of the association of natal household wealth with early marriage, using different age thresholds to define 'early'. We also investigate the association of education with the likelihood of early marriage, and whether poverty is the key driver of early marriage in uneducated women who comprise two-thirds of our sample. Finally, we investigate whether poverty is associated with the likelihood of women having no formal education. Whilst we do not find that natal household poverty predicted early marriage in rural lowland Nepal, further research is required in other populations to establish whether this association is apparent more generally.

Our results have implications for research, policy and practice. First, there is an urgent need for better and more appropriate objective data measuring wealth in women's natal households, ideally before they marry, and also in women's marital households, at marriage. This will provide much needed evidence on whether women marry into households of similar wealth levels, and whether natal household poverty is indeed associated with the likelihood of early marriage.

These data-related issues, and in particular the inadequate understanding of the association of wealth and marriage age, may partly explain the inconsistent results of interventions targeting poverty as the main driver of early marriage. A recent systematic review found conditional cash transfers (CCTs) to keep girls in school were more effective in delaying marriage than those directly targeting delayed marriage or poverty (Malhotra & Elnakib, 2021). In Bangladesh, CCTs keeping girls in school for longer delayed marriage, but only for younger girls (aged 12-14 years) living in the poorest district (Amin, 2007). In India, CCTs kept girls in school up to grade 8, but did not delay their marriage (compared to a control group); girls were in fact more likely to marry just after the 18 year cut-off stipulated by the intervention, when parents received cash transfers (Nanda et al., 2015). In both interventions, cash was primarily used to pay the higher cost of dowries demanded by marital households for older, more educated girls (Amin, 2007; Nanda et al., 2015).

Second, we need to better understand the different factors increasing the risk of marrying at different ages, for women of different education levels. Reducing the costs of schooling (e.g. fees, learning materials, offering scholarships) and improving the quality of education may help girls to stay in school for longer and also delay marriage, thereby achieving several of the Sustainable Development Goals (Muchomba, 2021). The question however is whether cash transfers conditional on girls staying in school for longer or the expansion of free state provision of education would have a sustained impact on delaying marriage. However, any school-based

efforts will miss the girls who never went to school in the first place or have already dropped out and married.

Third, there needs to be a collective shift in societal gendered norms and the value attributed to girls and women in society (Maertens, 2013; Bicchieri, Jiang & Lindemans, 2014; Marphatia, Amable & Reid, 2017). Changing norms is difficult and slow, as shown by social interventions that did not succeed in delaying marriage age in India (Prakash et al., 2019; Ramanaik et al., 2020). Moreover, in a population like our study where women marry very early, at the modal age of 15 years, it may initially be more realistic to delay marriage to 16 years. 'Nudging' populations towards a slightly later marriage age for women may therefore lead to more substantial secular changes over time. Whilst this may sit uncomfortably with the human rights constituencies advocating for the 18-year minimum marriage age, ignoring these practiced norms may render us even further from the common goal of delaying marriage overall (Schaffnit, Urassa & Lawson, 2019). Delaying marriage, even by one year, will inevitably delay the age at first child bearing. Early marriage must therefore be seen as a critical concern for public health (Marphatia, Amable & Reid, 2017).

Limitations

Our study has some limitations. With cross-sectional data, we can only investigate associations and not causality. Although we include education in early marriage models, like other studies, we do not know the direction of this association. Our study involved only married pregnant women and we found that women measured in their natal homes during pregnancy differed from those who remain in their marital homes. Our asset score was measured in the natal household after, and not at, marriage. To address this, our asset score excluded items which could have been purchased after marriage. Despite these limitations, the associations between poverty, education and marriage age, and poverty and lack of education identified in our study are likely to be widely applicable, especially to similar Madhesi populations living around the bordering regions of India and Nepal. Our study also benefited from a large sample size and the unique data on several different socio-economic variables as well as women's education.

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Data availability statement

Raw data are available for the purposes of replicating the results in this paper (**Data S1**). Contact Dr Naomi Saville at n.saville@ucl.ac.uk for further information.

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912

Figure 1

Early marriage groups used in analysis

Our first outcome variable, women's 'early marriage,' uses four different age groupings, described as Scenarios A, B, C and D in the Figure. To ensure comparability across these results, the same reference group, marrying at the minimum age cut-off of ≥18 years, is used irrespective of the age used to define early marriage. Each of the scenarios above the <15 years has the lower group nested within it, but excludes the higher group up to 18 years.

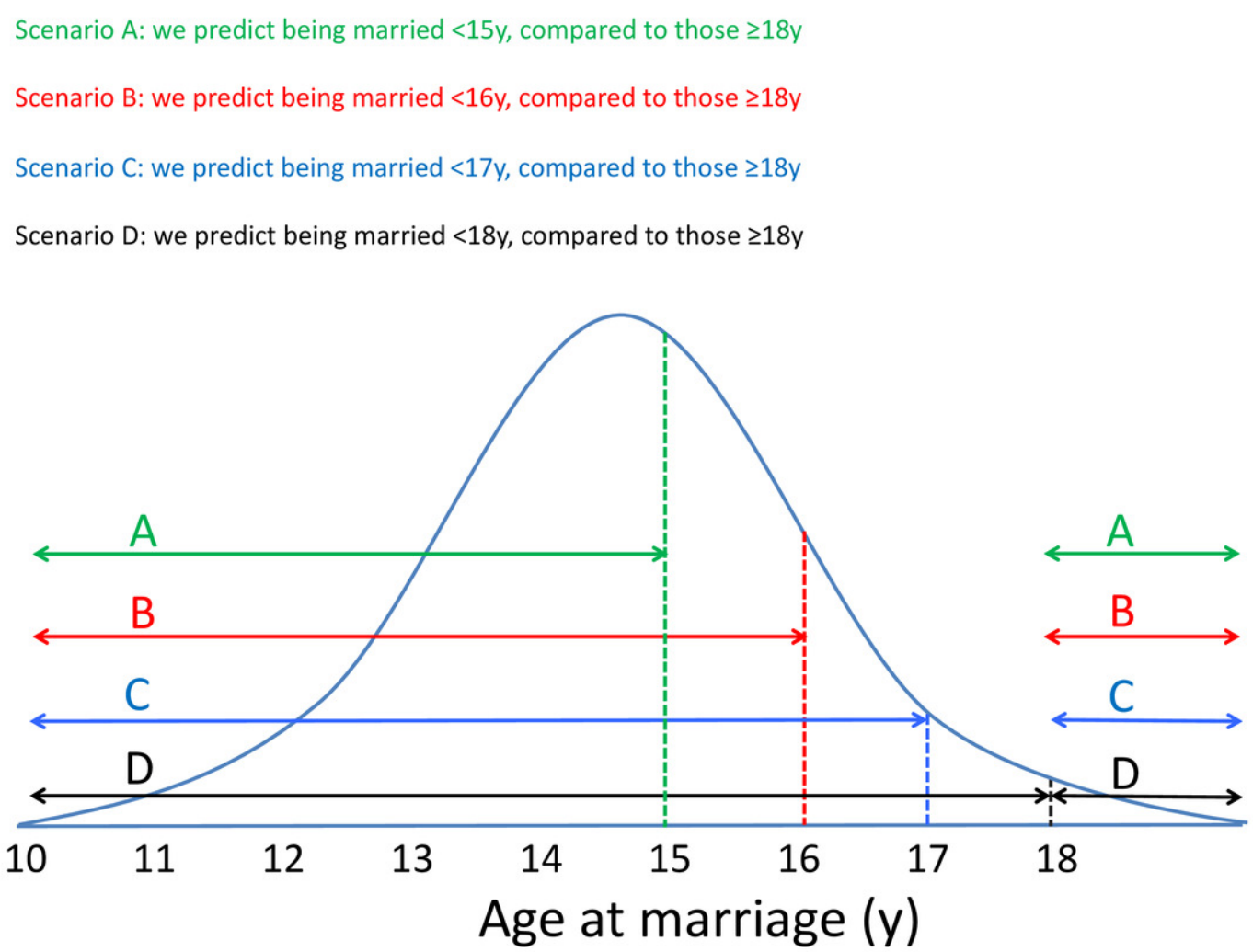

Figure 2

Association of women’s marriage age and their education level stratified by natal household asset score

This figure uses the raw data to stratify the association of women’s marriage age with women’s education by natal household asset quintiles.

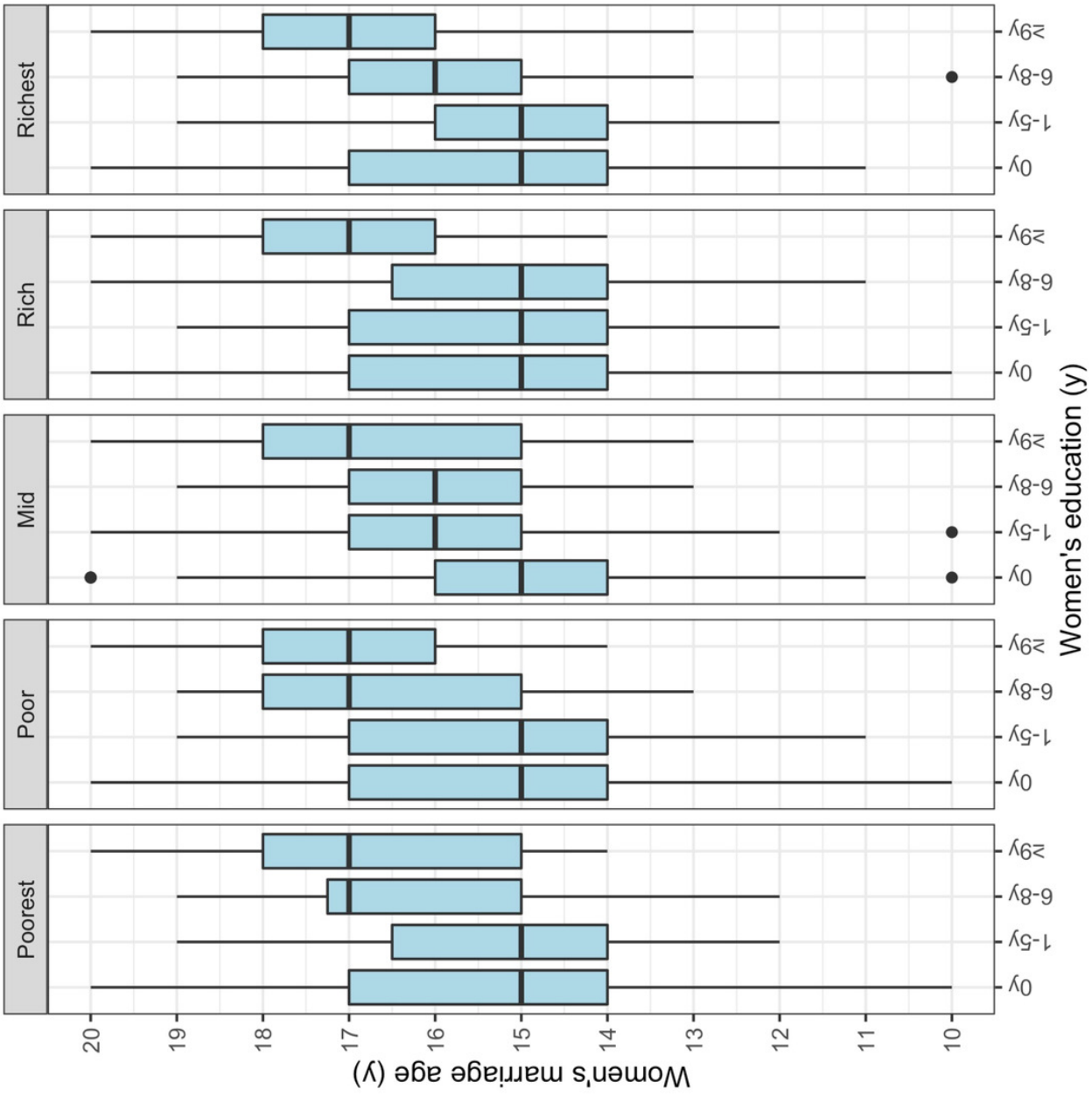
Richest
Rich
Mid
Poor
Poorest
0y
1-5y
6-8y
≥9y
Women's education (y)
20
19
18
17
16
15
14
13
12
11
10
Women's marriage age (y)

Table 1(on next page)

Description of sample

	Traits measured in women's natal household (*n*=2,432)	
	Median	**IQR**
Women's age (y)	21	4
Women's age at marriage (y)	15	3
Time since marriage (y)	5	5
	Frequency	**%**
Trial intervention arm		
Control	429	17.6
Women's Group	446	18.3
Women's Group with cash transfer	793	32.6
Women's Group with food supplement	764	31.4
Women's age at marriage (y)		
<15 years	666	27.4
15 years	574	23.6
16 years	356	14.6
17 years	408	16.8
≥18 years	428	17.6
Women's education level (y)		
None	1610	66.2
Primary (1-5 years)	244	10.0
Lower-secondary (6-8 years)	196	8.1
Secondary or higher (≥9 years)	382	15.7
Natal household asset score (quintiles)		
1: poorest	525	21.6
2: poor	484	19.9
3: middle	528	21.7
4: rich	465	19.1
5: richest	430	17.7
Natal household agrarian land-holding		
None	951	39.1
0.01 to 0.5 hectares	750	30.8
0.51 to 0.99 hectares	344	14.1
≥1 hectare	387	15.9
Natal household access to big bazaar		
<30 minutes	798	32.8
30-59 minutes	934	38.4
60-89 minutes	472	19.4
≥90 minutes	228	9.4
Natal household caste affiliation		
Disadvantaged: Dalit	494	20.3
Disadvantaged: Muslim	468	19.2
Middle: Janjati, Terai castes	927	38.1
Advantaged: Yadav, Brahmin	543	22.3

1 **Table 1.** Description of sample

2 IQR, Interquartile Range.

3

Table 2(on next page)

Heat map of women’s educational attainment by natal household wealth

The heat table shows the overall number of women by their education level and natal household wealth quintiles. Green shaded areas indicate low numbers and red shaded numbers the highest numbers.

Table 2. Heat map of women's educational attainment by natal household wealth

	Natal household asset quintiles					
Women's education (y)	Poorest	2nd Poorest	Mid-level	2nd Richest	Richest	Total row
None	464	351	356	255	184	1,610
Primary (1-5 years)	27	50	61	56	50	244
Lower-secondary (6-8 years)	20	38	41	59	38	196
Secondary/higher (≥9 years)	14	45	70	95	158	382
Total column	525	484	528	465	430	2,432

Table 3(on next page)

Hypothesis 1: Associations of natal household asset score with marrying early

Table 3. Hypothesis 1: Associations of natal household asset score with marrying early

	Model 1: Marrying <15 years *n*=1,094[1] R^2 =0.050		**Model 2: Marrying <16 years** *n*=1,668[2] R^2 = 0.032		**Model 3: Marrying <17 years** *n*=2,024[3] R^2 = 0.028		**Model 4: Marrying <18 years** *n*=2,432[4] R^2 = 0.021	
	aOR (95% CI)	***p*-value**	**aOR (95% CI)**	***p*-value**	**aOR (95% CI)**	***p*-value**	**aOR (95% CI)**	***p*-value**
Women's age (y)	1.02 (0.97, 1.06)	0.485	1.01 (0.97, 1.05)	0.556	0.99 (0.96, 1.03)	0.646	0.98 (0.95, 1.01)	0.178
Asset score								
Poorest	2.98 (1.90, 4.67)	0.001	2.44 (1.67, 3.58)	0.001	2.26 (1.58, 3.24)	0.011	1.93 (1.37 2.72)	0.001
2nd poorest	2.39 (1.53, 3.71)	0.001	1.68 (1.16, 2.44)	0.007	1.57 (1.11, 2.23)	0.002	1.41 (1.01, 1.97)	0.043
Mid	2.12 (1.35, 3.31)	0.001	1.83 (1.26, 2.66)	0.001	1.74 (1.23, 2.47)	0.001	1.52 (1.09, 2.12)	0.013
2nd richest	2.34 (1.49, 3.69)	0.001	1.93 (1.31, 2.83)	0.001	1.90 (1.32, 2.73)	0.001	1.72 (1.22, 2.43)	0.002
Richest (ref)	1.00		1.00		1.00		1.00	
Intercept	0.52	0.286	1.46	0.462	3.11	0.017	6.00	0.001

Models include fixed and random effects estimates for geographic clusters and control for trial arm. As associations of trial arm with early marriage across the age groupings were not statistically significant, they are not reported in Tables. aOR, Adjusted Odds Ratio. CI, 95% Confidence Interval. [1]*n*=428 married ≥18y vs *n*=666 married <15y. [2]*n*=428 married ≥18y vs *n*=1,240 married <16y. [3]*n*=428 married ≥18y vs *n*=1,596 married <17y. [4]*n*=428 married ≥18y vs *n*=2,004 married <18y.

Table 4(on next page)

Hypothesis 2: Broader socio-economic factors associated with women marrying early

Table 4. Hypothesis 2: Broader socio-economic factors associated with women marrying early

	Model 1: Marrying <15 years *n*=1,094[1] R^2 =0.235		**Model 2: Marrying <16 years** *n*=1,668[2] R^2 =0.164		**Model 3: Marrying <17 years** *n*=2,024[3] R^2 =0.131		**Model 4: Marrying <18 years** *n*=2,432[4] R^2 =0.106	
	aOR (95% CI)	***p*-value**	**aOR (95% CI)**	***p*-value**	**aOR (95% CI)**	***p*-value**	**aOR (95% CI)**	***p*-value**
Women's age (y)	0.99 (0.94, 1.04)	0.670	0.98 (0.94, 1.02)	0.401	0.96 (0.93, 1.00)	0.047	0.95 (0.91, 0.98)	0.003
Asset score								
Poorest	1.04 (0.58, 1.85)	0.902	0.90 (0.55, 1.44)	0.651	0.98 (0.63, 1.53)	0.936	0.92 (0.60, 1.39)	0.675
2nd poorest	1.02 (0.59, 1.74)	0.949	0.74 (0.47, 1.15)	0.183	0.82 (0.55, 1.23)	0.340	0.79 (0.54, 1.16)	0.233
Mid	0.95 (0.56, 1.63)	0.863	0.91 (0.59, 1.40)	0.659	1.01 (0.68, 1.50)	0.949	0.94 (0.65, 1.37)	0.763
2nd richest	1.61 (0.94, 2.75)	0.083	1.31 (0.84, 2.02)	0.232	1.47 (1.00, 2.21)	0.050	1.31 (0.90, 1.89)	0.675
Richest (ref)	1.00		1.00		1.00		1.00	
Women's education								
None	18.42 (10.60, 32.03)	0.001	11.51 (7.66, 17.28)	0.001	7.55 (5.58, 11.47)	0.001	5.65 (4.07, 7.55)	0.001
Primary (1-5y)	11.72 (6.06, 22.68)	0.001	7.21 (4.30, 12.09)	0.001	4.83 (3.17, 8.08)	0.001	3.81 (2.46, 5.71)	0.001
Lower-secondary (6-8y)	5.23 (2.56, 10.66)	0.001	4.56 (2.64, 7.88)	0.001	3.80 (2.43, 6.44)	0.001	3.43 (2.18, 5.26)	0.001
Secondary/higher (≥9) (ref)	1.00		1.00		1.00		1.00	
Agrarian land								
None	1.05 (0.61, 1.79)	0.866	1.06 (0.68, 1.65)	0.793	0.96 (0.64, 1.43)	0.823	0.98 (0.67, 1.44)	0.927
0.01 to 0.5 hectares	1.36 (0.81, 2.26)	0.242	1.42 (0.93, 2.15)	0.104	1.25 (0.86, 1.85)	0.244	1.32 (0.92, 1.89)	0.136
0.51 to 0.99 hectares	0.96 (0.55, 1.69)	0.895	1.08 (0.68, 1.70)	0.746	1.09 (0.74, 1.65)	0.683	1.09 (0.74, 1.60)	0.671
≥1 hectare (ref)	1.00		1.00		1.00		1.00	
Access to big bazaar								
<30 min (ref)	1.00		1.00		1.00		1.00	
30-59 minutes	1.09 (0.71, 1.68)	0.682	1.15 (0.81, 2.01)	0.442	0.89 (0.74, 1.44)	0.839	1.09 (0.80, 1.48)	0.605
60-89 minutes	1.11 (0.66, 1.87)	0.702	1.17 (0.76, 1.64)	0.471	1.01 (0.68, 1.51)	0.953	1.01 (0.70, 1.46)	0.967
≥90 minutes	1.32 (0.69, 2.53)	0.409	1.14 (0.65, 1.80)	0.649	1.03 (0.53, 1.52)	0.691	1.03 (0.63, 1.68)	0.913
Caste								
Disadvantaged: Dalit	0.98 (0.56, 1.71)	0.931	1.12 (0.71, 1.78)	0.621	1.18 (0.78, 1.83)	0.425	1.20 (0.80, 1.79)	0.376
Disadvantaged: Muslim	1.01 (0.59, 1.71)	0.984	0.99 (0.63, 1.55)	0.952	1.01 (0.67, 1.55)	0.945	1.03 (0.69, 1.53)	0.883
Middle: Janjati, Terai castes	0.99 (0.63, 1.54)	0.953	1.13 (0.78, 1.62)	0.521	1.12 (0.81, 1.58)	0.466	1.09 (0.80, 1.49)	0.577
Advantaged: Yadav, Brahmin (ref)	1.00		1.00		1.00		1.00	
Intercept	0.14	0.007	0.55	0.316	1.63	0.363	4.01	0.005

Models include fixed and random effects estimates for geographic clusters and control for trial arm. aOR, Adjusted Odds Ratio. CI, 95% Confidence Interval.
[1]*n*=428 married ≥18y vs *n*=666 married <15y. [2]*n*=428 married ≥18y vs *n*=1,240 married <16y. [3]*n*=428 married ≥18y vs *n*=1,596 married <17y. [4]*n*=428 married ≥18y vs *n*=2,004 married <18y.

Table 5(on next page)

Hypothesis 3: Associations of natal household asset score and marrying early in uneducated women

Table 5. Hypothesis 3: Associations of natal household asset score and marrying early in uneducated women

	Model 1: Marrying <15 years *n*=736[1] R^2 =0.062		**Model 2: Marrying <16 years** *n*=1,156[2] R^2 =0.054		**Model 3: Marrying <17 years** *n*=1,376[3] R^2 =0.050		**Model 4: Marrying <18 years** *n*=1,610[4] R^2 =0.050	
	aOR (95% CI)	***p*-value**	**aOR (95% CI)**	***p*-value**	**aOR (95% CI)**	***p*-value**	**aOR (95% CI)**	***p*-value**
Women's age (y)	0.99 (0.94, 1.06)	0.951	1.00 (0.95, 1.05)	0.923	0.98 (0.94, 1.03)	0.473	0.98 (0.93, 1.02)	0.316
Asset score								
Poorest	0.89 (0.46, 1.72)	0.733	0.87 (0.48, 1.57)	0.634	0.91 (0.52, 1.61)	0.757	0.82 (0.48, 1.41)	0.470
2nd poorest	0.83 (0.43, 1.62)	0.590	0.69 (0.37, 1.27)	0.231	0.70 (0.39, 1.25)	0.228	0.67 (0.38, 1.16)	0.155
Mid	0.87 (0.44, 1.71)	0.679	0.83 (0.45, 1.54)	0.560	0.83 (0.46, 1.50)	0.544	0.75 (0.43, 1.32)	0.319
2nd richest	1.71 (0.80, 3.65)	0.168	1.53 (0.76, 3.11)	0.235	1.48 (0.75, 2.93)	0.258	1.48 (0.77, 2.84)	0.241
Richest (ref)	1.00		1.00		1.00		1.00	
Intercept	3.28	0.133	7.14	0.006	12.28	0.001	17.30	0.001

Models include fixed and random effects estimates for geographic clusters and control for trial arm. aOR, Adjusted Odds Ratio. CI, 95% Confidence Interval.
[1]*n*=206 married ≥18y vs *n*=530 married <15y. [2]*n*=206 married ≥18y vs *n*=950 married <16y. [3]*n*=206 married ≥18y vs *n*=1,170 married <17y. [4]*n*=206 married ≥18y vs *n*=1,404 married <18y.

Table 6(on next page)

Hypothesis 3: Broader socio-economic factors associated with women marrying early in uneducated women

Table 6. Hypothesis 3: Broader socio-economic factors associated with women marrying early in uneducated women

	Model 1: Marrying <15 years *n*=736[1] R^2 =0.071		**Model 2: Marrying <16 years** *n*=1,156[2] R^2 =0.066		**Model 3: Marrying <17 years** *n*=1,376[3] R^2 =0.058		**Model 4: Marrying <18 years** *n*=1,610[4] R^2 =0.060	
	aOR (95% CI)	***p*-value**	**aOR (95% CI)**	***p*-value**	**aOR (95% CI)**	***p*-value**	**aOR (95% CI)**	***p*-value**
Women's age (y)	1.00 (0.95, 1.06)	0.959	1.00 (0.95, 1.05)	0.995	0.98 (0.94, 1.03)	0.481	0.98 (0.93, 1.02)	0.338
Asset score								
Poorest	0.75 (0.36, 1.57)	0.449	0.78 (0.40, 1.49)	0.446	0.86 (0.46, 1.61)	0.639	0.78 (0.43, 1.40)	0.400
2nd poorest	0.74 (0.37, 1.50)	0.402	0.63 (0.33, 1.20)	0.163	0.65 (0.35, 1.20)	0.172	0.62 (0.35, 1.12)	0.115
Mid	0.79 (0.39, 1.59)	0.503	0.77 (0.41, 1.46)	0.432	0.79 (0.43, 1.45)	0.440	0.72 (0.40, 1.28)	0.260
2nd richest	1.56 (0.72, 3.38)	0.262	1.45 (0.71, 2.96)	0.311	1.41 (0.71, 2.82)	0.325	1.43 (0.74, 2.77)	0.287
Richest (ref)	1.00		1.00		1.00		1.00	
Agrarian land								
None	1.41 (0.72, 2.78)	0.315	1.24 (0.69, 2.25)	0.476	1.16 (0.66, 2.06)	0.610	1.26 (0.73, 2.18)	0.402
0.01 to 0.5 hectares	1.59 (0.81, 3.11)	0.179	1.48 (0.82, 2.68)	0.196	1.46 (0.82, 2.59)	0.201	1.67 (0.97, 2.89)	0.066
0.51 to 0.99 hectares	1.21 (0.55, 2.67)	0.634	1.18 (0.58, 2.39)	0.646	1.18 (0.60, 2.31)	0.639	1.32 (0.69, 2.53)	0.395
≥1 hectare (ref)	1.00		1.00		1.00		1.00	
Access to big bazaar								
<30 min (ref)	1.00		1.00		1.00		1.00	
30-59 minutes	0.94 (0.56, 1.57)	0.810	0.91 (0.57, 1.44)	0.687	0.89 (0.57, 1.38)	0.597	0.92 (0.61, 1.41)	0.715
60-89 minutes	1.10 (0.58, 2.09)	0.777	1.35 (0.76, 2.43)	0.308	1.19 (0.68, 2.07)	0.536	1.18 (0.70, 2.00)	0.536
≥90 minutes	1.47 (0.67, 3.22)	0.331	1.29 (0.61, 2.70)	0.506	1.09 (0.54, 2.21)	0.803	1.10 (0.56, 2.14)	0.790
Caste								
Disadvantaged: Dalit	1.09 (0.54, 2.20)	0.800	1.03 (0.56, 1.89)	0.933	1.01 (0.56, 1.82)	0.972	1.07 (0.61, 1.88)	0.813
Disadvantaged: Muslim	0.96 (0.50, 1.82)	0.890	0.85 (0.48, 1.51)	0.576	0.87 (0.50, 1.50)	0.610	0.88 (0.52, 1.49)	0.642
Middle: Janjati, Terai castes	0.96 (0.53, 1.74)	0.904	1.00 (0.59, 1.69)	0.996	1.00 (0.60, 1.66)	0.996	0.96 (0.59, 1.56)	0.865
Advantaged: Yadav, Brahmin (ref)	1.00		1.00		1.00		1.00	
Intercept	2.27	0.354	5.62	0.032	10.95	0.002	13.49	0.001

Models include fixed and random effects estimates for geographic clusters and control for trial arm. aOR, Adjusted Odds Ratio. CI, 95% Confidence Interval.
[1]*n*=206 married ≥18y vs *n*=530 married <15y. [2]*n*=206 married ≥18y vs *n*=950 married <16y. [3]*n*=206 married ≥18y vs *n*=1,170 married <17y. [4]*n*=206 married ≥18y vs *n*=1,404 married <18y.

Table 7 (on next page)

Hypothesis 4: Broader socio-economic factors associated with women being uneducated

Table 7. Hypothesis 4: Broader socio-economic factors associated with women being uneducated

	Model 1: Natal household asset score n=2,432[1] R^2 =0.210		**Model 2: Broader socio-economic factors** n=2,432[1] R^2 =0.363	
	OR (95% CI)	***p*-value**	**aOR (95% CI)**	***p*-value**
Women's age (y)	1.16 (1.12, 1.20)	0.001	1.18 (1.14, 1.22)	0.001
Asset score	1.00		1.00	
Poorest	11.84 (8.36, 16.76)	0.001	8.77 (5.96, 12.91)	0.001
2nd poorest	4.01 (2.97, 5.40)	0.001	3.59 (2.58, 4.99)	0.001
Mid	3.18 (2.39, 4.23)	0.001	3.16 (2.30, 4.33)	0.001
2nd richest	1.68 (1.27, 2.22)	0.001	1.67 (1.23, 2.28)	0.001
Richest (ref)			1.00	
Agrarian land				
None			2.99 (2.15, 4.18)	0.001
0.01 to 0.5 hectares			1.79 (1.33, 2.42)	0.001
0.51 to 0.99 hectares			1.17 (0.84, 1.63)	0.350
≥1 hectare (ref)			1.00	
Access to big bazaar				
<30 min (ref)			1.00	
30-59 minutes			1.18 (0.90, 1.55)	0.220
60-89 minutes			1.16 (0.83, 1.61)	0.383
≥90 minutes			1.62 (1.05, 2.52)	0.030
Caste				
Disadvantaged: Dalit			1.67 (1.18, 2.35)	0.004
Disadvantaged: Muslim			7.12 (4.83, 10.49)	0.001
Middle: Janjati, Terai castes			0.99 (0.76, 1.29)	0.923
Advantaged: Yadav, Brahmin (ref)			1.00	
Intercept	0.04	0.001	0.01	0.001

Models include fixed and random effects estimates for geographic clusters and control for trial arm. aOR, Adjusted Odds Ratio. CI, 95% Confidence Interval. [1]n=1822 educated (≥1y schooling) vs n=1,610 uneducated.