Original Research Article

Taller Indian Women are More Successful at the Marriage Market

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Objectives: Whereas being tall has consistently been found a favorable characteristic at the marriage market for men, much less is known about the association between stature and marital success among women. Taller women are healthier than shorter women, give birth more easily and their offspring are healthier. We therefore would expect them to be more successful at the marriage market. However, existing evidence is mixed. We study the association between women's height and the odds of being married, marrying young, experiencing a divorce, and becoming widowed, and the association between women's height and their husbands' educational attainment and occupational status.

Methods: Data come from the Indian National Family Health Survey 2005–2006, a representative study among 124,385 women and 74,369 men in all Indian states. Effects of female height on being married, marrying young, divorce, widowhood, and husband's occupation were estimated using logistic regression models. Effects of female height on husband's education were estimated using OLS regression models. Woman's education and age were always taken into account. Where possible controls for husband's height, husband's education, and age at marriage were included.

Results: Positive effects of women's height on favorable marital outcomes were found. Taller than average women are more likely to marry, get higher educated husbands with better jobs and are less likely to marry at a very young age or to lose their husbands through divorce or premature death.

Conclusions: Taller Indian women seem to be more successful at the marriage market. Am. J. Hum. Biol. 00:000–000, 2012. © 2012 Wiley Periodicals, Inc.

Positively valued traits allow individuals to be more successful and attract better partners at the marriage market. Height is a salient trait that signals strength, health potential, and having experienced a more prosperous childhood (Cavelaars et al., 2000; Marmot et al., 1984; Silvertoinen, 2003; Silvertoinen et al., 1999; Wadsworth et al., 2002). It therefore comes as no surprise that being tall has consistently been found a favorable characteristic at the marriage market for men (Mueller and Mazur, 2001; Nettle 2002a, 2002b; Pawlowski et al., 2000). In contrast, little is known on effects of stature on marital success of women. On average taller women are healthier than shorter women and they have the additional advantages of giving birth more easily and getting healthier offspring (Monden and Smits, 2009; Ozatlin, 2010; Pollet and Nettle, 2008; Sear et al., 2004). We therefore would expect taller women to be more successful at the marriage market. However, the available evidence is mixed and data on actual marriage outcomes are scarce. To contribute to our understanding of the role of female height at the marriage market, we examined the association between female height and mating success in a large dataset with information on marriages concluded between 1970 and 2006 in India. We focus on six marital outcomes: (1) the odds of being married, (2) the odds of marrying at a young age, (3) the educational attainment of the husband, (4) the occupation of the husband, (5) the odds of the (premature) death of the husband, and (6) the odds of experiencing a divorce.

The idea that males would prefer a tall wife might seem at odds with the well-known male-taller norm, which reflects the preference of males and females for the male partner to be taller than the female partner (Gillis and Avis, 1980; Sear, 2010; Shepperd and Strathman, 1989). However, because on average, men are taller than women, the male-taller-norm and a preference among men for relatively tall women do not exclude each other. Indeed there is some evidence that Western men adjust their preferences in relation to their own height and that they prefer taller than-average women, just as women prefer taller mates (Courtiol et al., 2010; Pawlowski, 2003).

Stated preferences, however, may differ from actual mating behavior, and empirical evidence on the role of female height in actual marital outcomes is scarce and mixed. Whereas a recent British study found indications that taller than average women are less likely to be married (Nettle 2002a, 2002b); historical data on 19th century Bavaria indicate that, at that time, taller than average women were more likely to be married than shorter than average women (Baten and Murray, 1998). In recent studies of Gambian agriculturalists and Tanzanian Hadza foragers, female tallness did not play a role at marriage market at all (Sear and Marlowe, 2009; Sear et al., 2004). Given this state of the empirical evidence, there is a need for more information on actual marriage outcomes to shed light on the role of female height in partnership formation.

Ecological factors might condition the value of different traits at the marriage market. Traits signaling health are more likely to play a role in mate selection in poor societies than in affluent societies (Brooks et al., 2011; DeBruine et al., 2010; Monden and Smits, 2009; Pollet and Nettle, 2008). If female tallness is indeed a positive

trait at the marriage market, analyzing data on marriage outcomes in a poor country provides the best opportunity to identify such an effect. We therefore use data for India, a country where the level of living a still relatively low. Despite nodes of economic development in cities like Mumbai, Chennai, and Bangalore, about 75% of the population still lives of <2 dollar a day (Worldbank, 2010). Maternal and child mortality are with 4.5 and 72 per 1,000, respectively very high, compared to 0.1 and 7 per 1,000 in high-income countries (Worldbank, 2010).

METHODS
Data

Data come from the Indian National Family Health Survey 2005–2006, a large representative study encompassing all Indian states. The NFSH consists of a household survey, in which basic information was collected about all members of the household, and separate women's and men's surveys, in which all usual resident women aged 15–49 and half of usual resident men aged 15–54 were interviewed (IIPS, 2007). Data on height was collected in the women's and men's surveys. Information was obtained from 124,385 women and 74,369 men. Response rates were 94.5% (women's survey) and 87.1% (men's survey).

For the analysis of being married, data on 66,992 women aged 26–49 was available. For the analysis of age at marriage, data on 62,985 women aged 26–49 was available. For the analysis of being divorced or separated, data was available on 78,173 women aged 20–49 who were in their first marriage or who had divorced or separated. For the analysis of being widowed data was available on 80,245 women aged 20–49 who were in their first marriage or who had become widowed. The analyses of the effect of women's height on their husband's education and occupation were based on data for married women, aged 20–49, whose husband was interviewed in the male's survey ($N = 32,725$). The sample sizes for the other analyses were larger, because they were based on data from the women's survey only. Women in a second or later marriage and women who married before 1970 were excluded.

Measurement

Height of women and men was measured in centimeters (to one decimal) by the interviewer, using a measuring board. Height was normally distributed in both sexes. The lowest and highest 1% of reported heights were excluded to avoid extreme cases, which are known to have a higher probability to suffer from health problems (Pollet and Nettle, 2008; Silvertoinen et al., 1999). Correlation between wife's and husband's height was $r = 0.23$. Age and age at marriage were self-reported and measured in years. Education was measured as total years of education completed. There is a high correlation between wife's and husband's education, $r = 0.68$. Husband's occupation is coded with a dummy variable indicating whether or not the husband was employed in a professional, managerial, or technical occupation. Husband's education was reported by the wife, and was also reported for ex-husbands and deceased husbands. Husband's height was measured by the interviewer and thus only available if the wife was still married and the husband was included (by a random procedure) in the men's survey. Most individuals have reached their final height and obtained their highest edu-
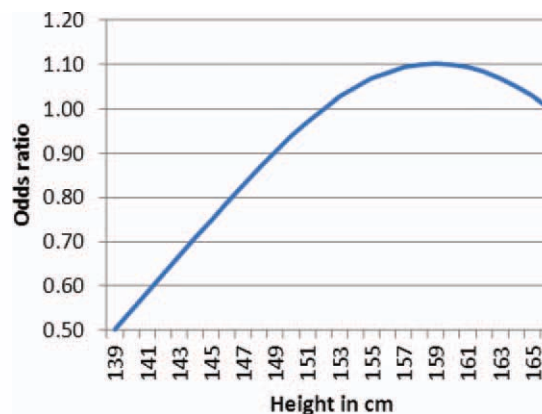

Fig. 1. Association between height and the odds of being married. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]

cational level before they marry (and in virtually all other cases it is at least clear at that time what height or educational level they will eventually reach). Height and education at time of survey give a good indication of the traits of the male and female partners at the time of marriage.

Analyses

Effects of female height on being married, married young, widowed, divorce, and husband's occupation were estimated with binary logit regression models. Effects of female height on husband's education were estimated with an OLS regression model. In the analyses of being married and of age at marriage we adjusted for confounding by woman's education, woman's age, and woman's age squared. In the analyses of husband's education and occupation we adjusted for confounding by husband's height, woman's education, year of marriage, woman's age at marriage and woman's age at marriage square.

It is important to control for husband's height, because we are interested in the association of women's height with the quality of their husbands independent of his height. As a result of the male-taller norm and the tendency to select a partner who does not differ too much in height (height homogamy), taller women tend to be married to taller husbands ($r = 0.23$ in our sample). Because taller men on average have more education and better jobs, a positive association between women's height and husband's education and occupation could partly be the result of this tendency for height homogamy. By controlling for husband's height, our analyses will show whether taller women marry more favorable husbands independent of height homogamy. In the analyses of being divorced or separated and being widowed, we adjusted for confounding by woman's education, husband's education, age at marriage, and woman's age. The height of ex-husbands and deceased husbands is not known.

In all cases, we explored various functional forms of female height (i.e. linear, quadratic, log transformation). We also tested for nonlinear effects of age and added a quadratic term if needed. We present the best fitting models in Figures 1–5. We also reestimated all models using height standardized by sex and state. By using z scores for height by state, we cancel out between-state variations in absolute height; the results show whether being taller
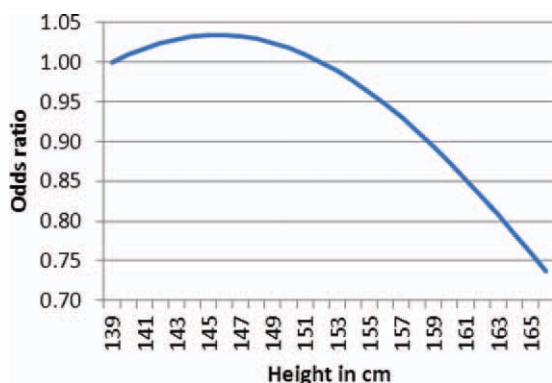
Fig. 2. Association between height and the odds of marrying at a young age. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]
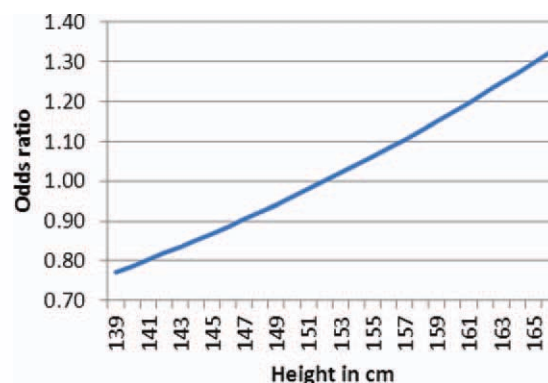

Fig. 4. Association between height and the odds of having a husband with a high occupation. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]
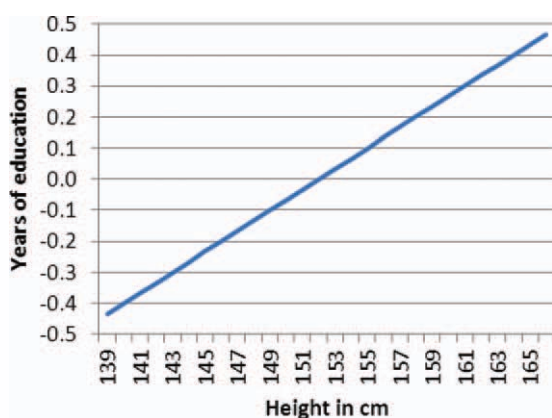

Fig. 3. Association between height and husband's years of education. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]
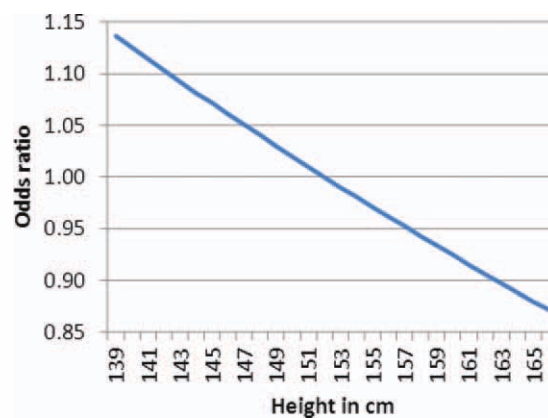

Fig. 5. Association between height and the odds of being widowed. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]

than other women in the state is associated with better marital outcomes. Results from the models with z scores for height confirm the results presented below (see online Supporting Information).

RESULTS

Table 1 presents the descriptive statistics of the variables included in this study. Female height among the Indian women aged 20–49 included in this study ranges from 138 to 164 cm, mean height is 152 cm. The husbands in our sample are on average 12 cm taller; their height ranges from 149 to 180 cm with a mean of 164. The men in our sample completed 2 years of education more than the women. Almost all (96%) of the Indian women aged 25–49 are married and 39% of them married before age 17. Almost 10% of the women were married to a husband with a high occupational level, while 4.3% was widowed and 1.6% reported being divorced or separated.

Table 2 presents the coefficients of the binary logit and linear regression models. Figures 1–6 display the effects of height graphically. In Figure 1 we see that the odds of being married increases nonlinearly with height. Never married women are significantly shorter than ever married women. The odds increase up to 159 cm (the 90th percentile) and thereafter slightly decrease. Compared to

women at the 90th percentile of the height distribution, women at the 10th percentile of the distribution (145 cm) have a 35% lower odds of marriage. Note that remaining unmarried is exceptional in India. Only 4.4% of women aged 25 and over in this sample have never been married.

The odds of marrying at a young age decrease nonlinearly with height (Fig. 2). They first increase slightly with increasing height until 145 cm (the 10th percentile) and from then on decrease. Women at the 90th percentile (159 cm) have a 14% lower odds of marrying before age 17 than women at the 10th percentile.

Taller women are married to "more favorable" husbands in term of educational level. Figure 3 shows a linear association between height of married females and the number of years of education completed by their husbands. On average, the husbands of women at the 10th percentile of the height distribution have completed almost half a year of education less than those of women at the 90th percentile. In a country with an average male educational attainment of 7 years this is a substantial difference. Note that this model includes husband's height as well as the women's own educational level. The higher educational attainment of the husbands of taller women is thus not a byproduct of the women's own educational level or their husband's height.

TABLE 1. *Descriptive statistics of variables included in the analyses*

	Mean	s.d.	Range		N	Age selection
Height women	152.1	5.4	138.7	166.4	81,581	20–49
Height husbands	164.4	6.1	149.2	180.4	32,725	20–49
Years of education women	5.3	5.2			81,581	20–49
Years of education husbands	7.3	5.2			81,581	20–49
Average age of women	32.8	7.9			81,581	20–49
Average age at marriage of women	18.1	3.9			81,581	20–49
% Women who are married	96.4				66,992	25–49
% Women who married young	38.5				62,985	25–49
% Women with high occupation husband	9.5				32,725	20–49
% Women who are widowed	4.3				80,245	20–49
% Women who are divorced or separated	1.6				80,245	20–49

TABLE 2. *Association between women's height and the odds of being (1) married, (2) married at a young age, (4) married to husband with a higher occupation, (5) widowed, (6) divorced, and between women's height and (3) husband's educational level*

	1		2		3		4		5		6	
							H's high					
	Married		Married <17		Husband's education		occupation		Widowed		Divorced	
Height woman	0.620	***	0.236	***	0.033	***	0.020	***	−0.010	**	−0.028	***
	(0.166)		(0.074)		(0.004)		(0.004)		(0.003)		(0.005)	
Height woman squared	−0.002	***	−0.001	***								
	(0.001)		(0.000)									
Height husband					0.046	***	−0.007					
					(0.004)		(0.004)					
Years of education woman	−0.154	***	−0.183	***	0.638	***	0.230	***	−0.045	***	0.006	
	(0.004)		(0.002)		(0.005)		(0.005)		(0.005)		(0.008)	
Years of education husband									−0.028	***	−0.051	***
									(0.005)		(0.007)	
Age woman	0.584	***	0.033	*	0.028	***	0.039	***	0.277	***	0.013	***
	(0.044)		(0.017)		(0.003)		(0.003)		(0.026)		(0.004)	
Age woman squared	−0.007	***	0.0000	*					−0.002	***		
	(0.001)		(0.0000)						(0.000)			
Age at marriage					0.050	***	0.015	**				
					(0.006)		(0.006)					
Constant	−56.541	***	−17.343	***	−10.572	***	−7.575	***	−8.084	***	0.123	
	(12.674)		(5.613)		(0.166)		(0.004)		(0.684)		(0.792)	
Chi-squared	3098.6		10671.8		Adj R^2 = 0.47		4032.3		2686.8		135.7	
Df	5		5		5		5		5		4	
N	66992		62985		32725		32725		80245		78173	

Models 1, 2, and 4–6 are binary logit models, Model 3 is an OLS regression model. Effects are logit coefficients and unstandardized regressions coefficients and their standard errors in parentheses.
*$P < 0.5$; **$P < 0.01$; ***$P < 0.001$.

Also in terms of husband's occupation, being taller is associated with more favorable marital outcomes for Indian women (Fig. 4). Female height is positively associated with the odds of being married to a husband in an upper nonmanual (professional, managerial, technical) occupation (rather than a "lower" occupation). Compared to women at the 10th percentile of the height distribution, women at the 90th percentile of the height distribution have 28% higher odds of having a husband working in such an occupation. When controlling for the husband's education, the effect of woman's height on her husband's occupation decreased, but it remained significant. Hence, the higher occupational level of husbands of taller women is to some extent, but not completely, due to the fact that taller women marry more highly educated husbands.

Taller women in our sample are more successful at retaining their partner once they are married. The odds of divorce decreases significantly with female height (Fig. 5). Note that divorce is a rare event in India, only 1.6% of the women in our sample was divorced. Women at the 90th percentile of the height distribution have 40% lower odds of having experienced a divorce than women at the 10th percentile of the distribution.
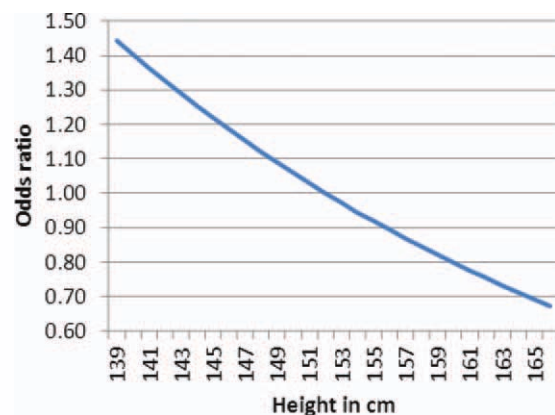

Fig. 6. Association between height and the odds of being divorced or separated. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]

Are taller women also married to healthier husbands? Among ever married women, height is negatively associated with the odds that their first husband has died (Fig. 6). In this sample 4.3% of first husband had died before

the survey date. Compared to women at the 10th percentile of the height distribution, women at the 90th percentile have a 14% lower odds of being widowed.

DISCUSSION

This study aimed to gain insight into the role of female height in mate selection by analyzing data on actual marriages concluded between 1970 and 2006 in India. The results suggest that height is a positive trait for women at the Indian marriage market. Shorter than average women are worse off in terms of their chances of marrying and remaining married. Taller women marry husbands with more education, better labor market positions and their husbands are less likely to die premature or leave through divorce. These findings all point in the same direction and—as they reflect different qualities of the husband—they provide support for the general hypothesis that being taller than average is advantageous for women at the marriage market.

In interpreting the results one has to bear in mind that there are differences in average height among the Indian states. The largest between-state difference for women is 6 cm (comparing Meghalaya with a mean of 149 cm to Rajasthan with a mean of 154 cm). Average levels of education also vary by state, for women it varies from barely 3 years in Rajasthan to 8 or more years in Himachal Pradesh, Goa, and Kerala. At the state level, average female height is not correlated with average female education ($r = 0.08$) but male education is higher in "taller" states ($r = 0.34$). We performed a sensitivity analysis in which we included fixed effects for the states in all our models to control for any confounding. The results showed our findings to be robust. This robustness to state variations in height is also supported by the results obtained after standardizing height by sex and state (see Supporting Information). Using state-specific z scores for height yielded similar results to those presented here for absolute height.

We cannot completely rule out that the associations between female height and positive marriage outcomes are partly due to selection at the marriage market on some family background characteristic rather than selection on height. By controlling for male height and male and female educational attainment we think we have captured most of the relevant variation in family background. Ideally we would like to be able to control for parental wealth or parental socio-economic position, but this kind of information is not available in our sample. Household wealth at the time of survey could pick up some of the parental wealth even after taking the partners' height and education into account. We therefore adjusted our model additionally for household wealth at time of the interview, but this did not affect our conclusions. Nevertheless, we encourage replications of the present models with richer family background information.

The results for divorce should be interpreted with some caution. The divorce rate is extremely low in India (Holden, 2008; Menski, 2001), partly because of the legal difficulties—up to the time of the survey—of getting a no-fault divorce. The legal divorce status therefore does not necessarily reflect the actual living arrangements between the woman and her husband. One implication for our study is that the group of married women in our sample may contain an unknown number of women who are running a household on their own.

Is the positive association between marriage outcomes and female height specific to India? Is this pattern only found in low income countries? So far, most studies on partner choice in high income countries have either focused on height preferences rather than actual choices, or have not included female height. It has been argued that female height is particularly important under stressed circumstances (DeBruine et al., 2010; Monden and Smits, 2009; Pollet and Nettle, 2008). If this holds true, the association between female height and quality of the partner would be weak or absent in high income countries. We await replications for poor as well as rich societies.

We have focused our analyses on the quality of the marriage partner. Our findings may not hold for related but different outcomes, such as reproductive success in terms of the quantity or quality of offspring. We argue that female height plays a positive role primarily because it indicates higher individual health capital. Further studies are needed to test this hypothesis directly.

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