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Regional Disparities in Adult Height, Educational Attainment and Gender Difference in Late- Life Cognition: Findings from the Longitudinal Aging Study in India (LASI)

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Abstract

State policies over time in India may have led to significant differences by sex in population health and cognition. In this paper, we use data from the pilot wave of the Longitudinal Aging Study in India, conducted in Karnataka, Kerala, Punjab, and Rajasthan, to examine state variations in health, educational attainment, and male preference, and how these variations contribute to gender differences in late-life cognition in India. We find men and women born in Punjab are taller than those elsewhere, but do not find any gender differences in height across states with differential male preference. We do find a significant gap in educational attainment that correlates with male preference. We find paternal education benefits both sons and daughters, while maternal education contributes to daughters' educational attainment. Finally, we find that paternal education benefits daughters' late-life cognition, while maternal education benefits sons' late-life cognition, and that children's education has positive association with older adults' cognitive functioning as well.

Keywords

India; late-life cognition; son preference; generational effects; regional disparities

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1. INTRODUCTION[1]

State governments in India have diverged in their policies, rates of economic growth, and investments in education (Ahluwalia, 2000; Alessandrini et al. 2008; Datt and Ravallion, 2011; OECD, 2011). Over time, such cross-state differences have widened (Bhattacharya and Sakthivel, 2004; Purfield, 2006; Sen and Himanshu, 2004) and may have led to significant variations in population health and cognition. In this paper, we examine cross-state variations in adult height and educational attainment and their separate influence on later-life cognition. Adult height is considered to be a good measure of levels of nutrition during early childhood and the prenatal period (Deaton, 2008; Smith et al., 2010; Steckel, 1979).

Ever since Sen (1990) found evidence of "missing women" in imbalanced sex ratios, discrimination against women has been recognized as a critical issue in India. The case of 'missing women' has deep historical roots, dating at least to the mid-nineteenth century, when British censuses also indicated a problem of 'missing women' in northern regions such as Punjab (Chakraborty and Kim, 2008). The overall sex imbalance at birth in India actually increased between 1901 and 2011 (Ja et al., 2011), and cross-state variations in sex imbalance remain substantial. Discrimination against women is also more pronounced in ruling castes and among Hindus than among lower castes and other religious groups (Borooah et al., 2009; Chakraborty and Kim, 2008). A substantial literature has informed and continues to improve upon what we know about inequitable human capital investment (Mishra et al., 2004). Building on this literature, we further investigate gender differences in cognition in India.

Specifically, we examine state variations in adult height, educational attainment, and male preference and how these variations contribute to gender differences in late-life cognition in India. We do so by using recently available data from the Longitudinal Aging Study in India (LASI). The pilot wave of LASI collected rich survey data as well as direct anthropometric and cognitive-functioning measures for a representative sample of respondents aged 45 and older from four states: Karnataka, Kerala, Punjab, and Rajasthan. These states were chosen for their geographic dispersion and cultural diversity. Using LASI data, we also explore the effect of education for respondents as well as their parents and adult children on late-life cognition.

2. DATA

LASI is designed to be a panel survey representing persons at least 45 years of age in India and their spouses regardless of age. The pilot LASI survey was fielded from October to December 2010. These four states were chosen to capture regional variations as well as socioeconomic and cultural differences across India (Arokiasamy et al., 2012). Primary sampling units (PSUs) were stratified across urban and rural districts within each of the four states. LASI randomly sampled 1,546 households from these stratified PSUs (N=63). Among them, 950 households with a member at least 45 years old were interviewed

[1]Abbreviations used in this article include LASI (Longitudinal Aging Study in India), OBC (other backward class), OLS (ordinary least squares), PSU (primary sampling unit), SC (scheduled caste), SES (socioeconomic status), and ST (scheduled tribe).

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(response rate of 88.5%). From these households, 1,486 age-qualifying individuals and 197 non-age eligible spouses participated in individual interviews (response rate of 90.9%).

The multidisciplinary survey consisted of two main sections: the household interview and the individual interview. The household module asks about physical environment and household finances, including income, expenditure, consumption, and assets, and could be completed by any knowledgeable household member at least 18 years old. The individual module asks about demographics, family, social activities, health and health behaviors, cognition, work and pension, and includes biomarker collection. The individual interview was only for age-eligible household members and their spouses, and could be completed by a proxy respondent if necessary. Survey questions were translated into languages common in these states (e.g., Hindi, Malayalam), and interviews were done in the language of respondent's choice.

From the survey, we draw data on adult height, parents' socioeconomic status (SES), and SES in adulthood as well as on cognitive ability. LASI interviewers measured height in centimeters, and we use natural log of height in our equations. For education, LASI collected data on years of schooling, highest degree earned, and literacy of respondents and their parents.

Caste is an important indicator of SES in India. We include a categorical variable based on respondents' self-report: scheduled caste, scheduled tribe, other backward class (OBC), and all "other" caste or affiliations, including "no caste" affiliation. The scheduled castes (SCs) and scheduled tribes (STs) are two groups of historically-disadvantaged people recognized in the Constitution of India. They have often been excluded from education, public spaces (e.g., temples, wells for drinking water), and most other aspects of civil life in India (Subramanian et al., 2008). The primary criteria for delimiting ST includes traditional occupation, definitive geographical area, and cultural characteristics reflecting a range of tribal modes of life such as language, customs, traditions, and religious benefits. While less marginalized and stigmatized than scheduled castes or tribes, members of OBC are also recognized by the Indian government as being of relatively lower social status and having barriers to economic and educational opportunities.

For cognitive ability, LASI administered tests for word recall (both immediate and delayed), a modified version of the Min-Mental State Exam, and serial 7s (see Lee et al., 2011, for a comprehensive description). We create a summary index for these cognitive tests, ranging from 0 to 32. Cronbach's alpha for this summary measure is 0.91 (0.90 for men and 0.91 for women), indicating high internal consistency. We examine gender differences in each individual cognitive test as well as in the summary index.

Below, we review prior literature and our data and results for findings on adult height, education, and gender differences and their effects on late-life cognition in India.

3. ADULT HEIGHT

The positive association between height and economic condition was noted as far back as 1829 when Louise Villermé recognized that height is taller and men grow faster in wealthier

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countries (Komlos and Meermann, 2007). Height had been widely recognized as an indicator for malnutrition by physicians and nutritionists in the 1950s and by economists two decades later (Heller and Drake, 1979; Steckel, 1979). More recently, substantial empirical research using increasingly available micro-data has investigated the relationship between height and economic development in developing countries (Steckel, 1995, 2009).

Within India, one of the largest developing nations in the world, Deaton (2008), using height as measured directly in the 2005 – 2006 National Family Health Survey and state-level household expenditure data from the 1983 National Sample Survey,[2] found that Indian men born between 1956 and 1990 were getting taller at more than three times the rate Indian women were. Using data from LASI, we examine height of Indian men and women born between 1907 and 1965. Deaton (2007) attributed the gender difference in height growth to gender discrimination giving men more access to food and health care than women had. He also found the differential trend in adult heights to be consistent with the trend in the ratio of females to males, a widely-accepted measure of gender discrimination.

We examine cross-state variations in adult height and per capita consumption. Among the four states where the LASI sample was drawn, Punjab had the highest level of per capita consumption in 1960–61 (the earliest available data on state-specific per capita consumption), as shown in Table 1. Possibly reflecting cross-state variations in economic development, mean heights for both men and women are highest in Punjab. Punjab is also where male-preference is the most pronounced, as indicated by an unbalanced child sex ratio. According to the 2001 Census, for every 1,000 boys aged 0 to 6, only 798 girls lived in Punjab. In contrast, Kerala had 960 girls for every 1,000 boys.

We do not find any significant height difference between men and women across states. This result is puzzling. Such difference might be due to mortality bias, but we do not find significant cross-state height differences between men and women less than 70 years of age. Male preference may also be manifest primarily through abortion and to a lesser degree, influence intra-household allocation of nutrition. Genetics may also be a cause of this result, with taller tribes living in northern India. Unfortunately, we cannot test these hypotheses with our data but only call for future research on them.

To further examine gender difference in height, we estimated the model

$$Height_i = c_1 + \beta_1 Age_i + \beta_2 Dad\text{'s} education_i + \beta_3 Mom\text{'s} education_i + X\rho + \varepsilon_{1i} \quad (1)$$

where $Height_i$ is individual i's adult height; Age_i captures economic conditions when individual *i* was born; and *Dad's education*$_i$ and *Mom's education*$_i$ capture both years of schooling and literacy of father and mother. *X* is a vector of control variables, including caste, state and urban/rural residence at birth, and ε_i is the error term, that reflects, among other things, the influence of genetics and other idiosyncratic childhood diseases.

[2]While Deaton (2008) acknowledged potential endogeneity in that a taller person may decide to reside in richer state, he was unable to control for it given that birth-year-and-place specific economic data were unavailable.

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We estimate the above equation for men and women separately using Ordinary Least Squares (OLS). As men are biologically taller than women, even equal effects of economic development on height could show larger effects for men than for women. To avoid such a mechanical effect, we estimate the above model using log height by taking natural logarithm of individual i's adult height. We first estimate the base model, controlling for only state and urban/rural area of residence, caste, and age, and then estimate the full model, introducing father's and mother's education.

Tables 2a and 2b present OLS results for height and log height. Qualitatively, the results are quite consistent. We therefore discuss only the findings on height for ease of interpretation. The reference groups are non-scheduled men and women born in urban areas of Karnataka, where estimated height for men is 1.71 meters and that for women 1.59 meters. For both men and women, age is significantly and negatively associated with height, reflecting an increase in height with economic development over time. Given the age group of the LASI study, these age coefficients could also reflect shrinkage with age (Lei et al., 2012). We do not find any statistically significant difference in age effects between men and women.

Reflecting cross-state differences in economic development, we also find that men and women born in Punjab are more than 3 centimeters taller than those born in Karnataka. Rajasthan women are taller than Karnataka women, but we do not find any statistically significant gender difference in state variations in height.

We do find statistically significant gender difference in coefficients for scheduled castes and scheduled tribes. Men in higher castes (reference group) are 2.9 centimeters taller than men in scheduled castes and 6.7 centimeters taller than men in scheduled tribes. Women in higher castes are only 1.5 centimeters taller than women in scheduled caste and 2.9 centimeters taller than women in scheduled tribes. Because male preference or discrimination against women is stronger among higher castes than lower castes, we expect height difference between higher and lower castes would be greater for men than women. Our results support this expectation.

Regarding parents' education, we find only father's literacy to be significantly associated with women's height, although coefficients of father's literacy on both men and women are similar. We do not find any significant differences in literacy for respondents' mothers.

4. EDUCATION

The Indian government has long had a policy goal of free and compulsory education for all children, but until recently progress toward this goal has been elusive (Sankar, 2007). Not until April 2010 did the Indian Parliament make free and compulsory education a right of every child 6 to 14 years of age (GoI, 2012). In the absence of free and compulsory education, children's education has been largely determined by parental investment.

Driven by a tradition of son preference and attitudes towards women, parental investments in education have been unequal between sons and daughters. This has caused a substantial gender gap in educational attainment. Table 3 shows the gender gap in educational attainment among persons 15 years and older in India since 1950–51, the earliest year such

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statistics are available. The proportion of the Indian population with no schooling decreased from 75 percent in 1950–51 to 43 percent in 2000–01. While educational attainment increased for all, disparities between men and women persisted and may have even grown. In 1950–51, men reported a mean 1.5 years of schooling, while women reported 0.4 years. In 2000–01, men reported a mean 5.3 years of schooling, while women reported a mean 3.0 years.

Similarly, gender gaps persisted in primary, secondary, and tertiary school enrollments in India. In 1950–51, girls were only 28 percent of primary, 13 percent of secondary, and 10 percent of tertiary enrollment. By 2000–01, girls had increased to 44 percent of primary, 39 percent of secondary, and 37 percent of tertiary enrollment.

Beyond these national statistics, we note that, historically, state governments have had almost complete responsibility for producing and delivering public education (Govinda and Bandyopadhyay, 2008). As a result, the quality and availability of state-sponsored education is highly heterogeneous across the country. Consequently, there has been substantial geographic variation in educational attainment. This may contribute to variation in later-life cognitive functioning across states.

Table 1 shows cross-state variations in educational attainments of three generations: LASI respondents, their parents, and their children. We note several interesting patterns, particularly significant cross-state variations in education. Not surprisingly, residents of Kerala are the most educated in all three generations. The gender gap in educational attainment is more pronounced for LASI respondents than for their parents or their children. Yet Kerala had the smallest gender gap in education among LASI respondents; in fact, among children of Kerala respondents, there is no gender difference in years of schooling and literacy rate.

We examine the effect of parents' education on educational attainment and late-life cognition. In doing so, we pay particular attention to how maternal and paternal education may affect parental investment in sons' and daughters' education. Weir (1993) recognized the role of parental decisions in distributing economic resources. Indian parents tend to invest more in sons than daughters. For example, boys tend to be favored in the intra-household distribution of nutrients, immunization, and other health investment (Das Gupta, 1987; Mishra, Roy, and Retherford, 2004; Oster, 2009; Pande, 2003).[3]

We acknowledge and investigate potential differences in the effects of father's and mother's education for sons and daughters. Specifically, we estimate the following model of years of schooling:

$$Educyrs_i = c_2 + \gamma_1 Age_i + \gamma_2 Dad\text{'}seducation_i + \gamma_3 Mom\text{'}seducation_i + \gamma_4 R\_height_i + X\rho + \varepsilon_{2i} \quad (2)$$

[3]Mishra, Roy, and Retherford (2004) find the extent of gender discrimination depends on birth order and the sex composition of older living siblings.

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where $Educyrs_i$ refers to years of schooling. R_height is equal to (height – gender-specific age-adjusted mean height). We estimate an OLS model for years of schooling separately for men and women and then formally test gender differences in coefficients.

Table 4 presents separate estimation of education models (equation 2) for men and women. We first estimate the base model, controlling for only state, caste, age, and urban/rural residence and then the full model, further introducing parents' education and relative height. As with the height model, the reference groups are non-scheduled men and women respondents born in urban Karnataka; as shown in constant terms, such men have 3.3 more years of schooling than women. As shown in both base and full models, age is negatively associated with years of schooling for both men and women, reflecting the increase in access to education with economic development over time. Yet the rate of increase is modest: only half a year increase over a decade. This is much smaller than what is observed over the same period of time in the same age cohorts in China (Lei et al, 2012).

Reflecting cross-state variations in education, years of schooling completed is associated with the state of birth. Comparing the results from base and full models, we find that the magnitude and significance of state coefficients are reduced in the full model once we control for parents' education, as their educational attainment is also associated with the respondent's birth state. Both men and women born in Rajasthan are less educated, whereas both men and women born in Kerala are more educated than those born in Karnataka, reflecting cross-state variations in educational investment. We also find significant gender difference in being born in the state of Kerala. Through state-government financing, Kerala increased access to education, pulling up both men and women's schooling to roughly equal levels, whereas a significant gender gap in education exists in other states.

Being of scheduled castes or scheduled tribes is negatively associated with educational attainment. Similarly, those born in rural areas have less schooling than those born in urban areas, and such disadvantage has a greater effect on men than women. It is interesting to note that height has a significant positive association with years of schooling for men, but no significant association for women.

We also find that father's years of schooling and literacy increases years of schooling for both men and women, and that such positive effects of father's education do not differ between sons and daughters. Having a more educated mother matters for women's years of schooling, but not for men's, although this gender difference is not statistically significant.

5. COGNITION

The gender gap in education has implications for Indian women throughout their lives. Many studies of older individuals in the community in both North America and Europe have found that lower educational attainment predicts poorer global cognitive functioning (Evans et al., 1997; Lei et al, 2012: Stern, 2007; Wilson et al., 2009; Zahodne et al., 2011). Primarily, education may contribute to cognitive reserve which allows cognitive function to be maintained into later life. Higher levels of cognitive reserve may protect against cognitive decline and risk for dementia by allowing individuals to maintain cognitive function in the face of aging-related insults to the brain such as inflammation (e.g., Alzheimer's disease)

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and cerebrovascular disease (e.g., strokes) (Fratiglioni and Wang, 2007; Katzman, 1993; Satz, 1993; Stern et al., 1994).

The current literature on late-life cognition in India is limited and ambiguous about the extent of female disadvantage in cognitive functioning and the risks that may contribute to gender disparity. One study found that women 55 and older living in India's northern state of Haryana did worse than men (after adjusting for age) on a Hindi version of the Mini Mental State Exam (H-MMSE) (Ganguli et al., 1995). The authors attributed this female disadvantage to differences in educational attainment but were not able to formally test this hypothesis. Mathuranath et al. (2007) found no gender differences in the unadjusted score of verbal fluency among a sample of 153 South Indian men and women, but the generalizability of this study, relying on samples from single-city populations may be limited. We hypothesize that differential human-capital investment (i.e., education) by gender contributes to cognitive disadvantages for women and that this disparity is greater in states where gender discrimination is more pronounced (Sen, 1990; Chakraborty & Kim, 2008).

Specifically, we estimate the following equation separately for men and women,

$$\begin{aligned} Cognition_i = {} & c_3 + \alpha_1 Age_i + \alpha_2 Dad\text{'}seducation_i \\ & + \alpha_3 Mom\text{'}seducation_i \\ & + \alpha_4 R\text{'}sown\ education_{i+} \alpha_5 son\text{'}seducation_i \\ & + \alpha_6 daughter\text{'}seducation_i + X\rho + \varepsilon_{3i} \end{aligned} \qquad (3)$$

Because we expect parents' education to influence cognitive development, we introduce parents' educational attainments to the above equation (3). We also introduce education of adult children, who may provide intellectual stimuli, helping to preserve cognitive reserve. We first estimate the above model without introducing respondent's own education and children's education and then the full model to fully understand the role of parental education on cognition.

As shown in Table 5, older women in India perform worse than older men in all cognitive tests (one exception is delayed recall in Kerala where no gender difference is noted). Gender gap in cognitive functioning test is the smallest in Kerala in all tests excepting serial 7s.

OLS estimates of equation (3) using the cognitive summary index are listed in Table 6. We estimate three models: model 1 (base model), which controls for only state, caste, age, and urban/rural residence; model 2, controlling for parents' education variables, and model 3 (full model), controlling for respondents' log height and education and their children's education. As we introduce mean years of education for all sons and daughters at age 15 and older, we also control for not having any son or daughter at age 15 or older.

The reference groups are again non-casted men and women born in urban areas of Karnataka. As shown in constant terms in Models 1 and 2, men's cognitive score is about 2 point higher than women's. But, in the full model, this gender gap in cognitive score disappears.

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It is interesting to note that cross-state variations remain even after controlling for educational attainment of parents, respondents, and their children. Both men and women born in Punjab have higher cognitive summary scores, while those born in Kerala have lower scores than men and women born in Karnataka.

While caste is significantly associated with cognitive score in models 1 and 2, it is not so associated in the full model controlling for educational attainment. Being born in a rural area is negatively associated with cognitive score for both men and women in models 1 and 2, but only for women in model 3, and with a gender difference that is not statistically significant.

What are most interesting are the intergenerational effects of literacy on late-life cognition. Once we control for respondent's own and their children's education, we find parents' literacy is significantly associated with late-life cognition, while we do not find statistically significant findings on parents' years of schooling. We find that father's literacy has positive effects on only women, although the gender difference is not statistically significant. Mother's literacy has a positive effect on cognitive score for men but not for women in model 3, with the difference between men and women also being statistically significant. Considering that mother's literacy is significant after controlling for respondent's education, it appears that the positive effects of mother's literacy go beyond those for making investment in education, suggesting mothers may spend more time and attention on sons than daughters, helping cognitive development of their sons.

Respondents' own education is also significantly associated with the cognitive score for both men and women. Years of schooling are more closely associated with women's cognitive score than men's, whereas literacy matters for men's cognitive score but not women's.

Finally, we find that son's years of schooling is positively associated with men's late-life cognitive functioning score, whereas daughter's years of schooling is positively associated with women's cognitive score. Such gender difference is not statistically significant for son's years of schooling but is statistically significant for daughter's years of schooling. This finding might be explained by adult sons interacting more with their fathers and adult daughters interacting more with their mothers, creating positive cognitive stimuli.

CONCLUSIONS

Reflecting cross-state variations in economic development, we find that men and women born in the richer state of Punjab are taller than those born in other states. We also find height gains over time.

Male preference or discrimination against women vary by both states and castes. Prior literature suggests that male preference is stronger in northern states than southern states and among higher castes than lower castes. For the LASI cohorts, born 1965 or earlier, we do not find any gender differences in height across states with differential male preference. This lack of gender differences in height is puzzling, calling for further research. We, on the other

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hand, find supporting evidence that height difference between men and women is greater among higher castes than lower castes.

We further examine cross-state variations in education and find substantial cross-state differences in both years of schooling and literacy rate. In educational attainment, we find significant gender gap, and that such gender gap also varies greatly cross states and correlates with male preference.

Parents' education should benefit both sons and daughters, but parents may make unequal investment between sons and daughters. We find that father's education benefits both sons and daughters and do not find evidence of unequal parental investment. Maternal education, however, significantly contributed to women's educational attainment among LASI respondents, but not to men's educational attainment.

Parents' education, particularly their literacy, not only influences educational attainment of their children, but also late-life cognitive functioning even after control for educational attainment. Interestingly, father's literacy positively influences daughter's cognition, while mother's literacy positively influences son's cognition.

We also find that children's schooling has positive effects on older adults' cognitive functioning, and such effects may be gender-specific. We find evidence that son's years of schooling is positively associated with male respondents' cognition, whereas daughter's schooling is positively associated with cognitive outcomes of female respondents.

From our findings, we observe the long-lasting benefits of education to human capital. Recognizing the full effects of education on human capital is important in evaluating the benefit-cost analyses of education policies and programs. Investment in educating girls should be a particularly important policy goal given that in many of the states, girls' educational attainment is much lower than boy's educational attainment where the funding is left to parents' investment without societal investment in the form of free education.

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Table 1

State-level variations in Adult Height and Education

			Punjab	Rajasthan	Karnataka	Kerala	F-stat[4]	ALL
Height		Men	167.9	164.4	163.8	163.7		164.5
(all ages)		Women	155.1	153.1	151.1	150.5		152.0
		(men - women)	12.8[a]	11.5[a]	12.7[a]	13.2[a]	1.29	12.5
Log height		(men – women)	0.2	0.1	0.1	0.1	1.56	0.1
1960–61 Per capita consumption (2004–05 Rs/month)[1]		Urban	83.7	66.6	72.1	53.6		NA
		Rural	82.1	55.7	59.2	46.6		NA
Child sex ratio (girls per 1,000 boys aged 0–6)[2]			798	909	946	960		927
Caste		scheduled caste	33.5	9.7	16.5	7.4		14.5
		scheduled tribe	0.0	35.2	8.9	0.0		13.8
		other backwards caste	11.6	28.5	59.2	42.9		39.5
		non/other caste	54.9	26.6	15.5	49.7		32.2
Parents' education	years of schooling	Father	0.4	0.5	1.4	3.4		1.4
		Mother	0.0	0.1	0.5	2.6		0.7
		(father - mother)	0.4[a]	0.4[a,b]	1.0[c]	0.8[b,c]	4.40**	0.7
	literacy	Father	6.0	7.7	21.1	67.5		25.9
		Mother	1.9	2.6	10.2	54.1		16.8
		(father – mother)	4.1[a]	4.8[a]	11.7[b]	13.7[b]	5.81***	9.1
		(father/mother)	3.2	2.8	2.1	1.3		1.5
Education	years of schooling	Men	4.2	2.8	5.6	8.4		5.1
		Women	2.1	1.0	3.0	7.6		3.4
		(men - women)	2.1[a]	1.7[a,b]	2.9[a]	0.9[b]	6.11**	1.7
	literacy rate	Men	50.8	28.7	62.4	96.7		57.3
		Women	27.5	12.6	36.8	83.2		40.8
		(men – women)	22.7[a,b]	15.9[a,b]	25.9[a]	14.6[b]	1.94	16.5

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			Punjab	Rajasthan	Karnataka	Kerala	F-stat[4]	ALL
		(men/women)	1.8	2.3	1.7	1.2		1.4
Children's education (among age 15+)	years of schooling	Son	8.2	5.1	8.7	11.9		9.2
		Daughter	7.8	3.5	7.7	12.6		8.7
		(son - daughter)	0.4[a]	1.6[b]	1.0[b]	−0.7[c]	10.57***	0.5
	literacy rate	Son	83.3	52.0	77.6	98.8		75.0
		Daughter	81.6	35.7	77.2	98.9		72.5
		(son – daughter)	1.7[a]	16.3[b]	0.4[a,c]	−0.1[c]	10.43***	2.5
		(son/daughter)	1.0	1.5	1.0	1.0	9.79***	1.0

[1] Source: Datt (1998)

[2] Source: The 2001 Census of India

[3] All other data are age-adjusted estimates from 2010 LASI

[4] F-stat tests whether gender difference in cognition varies across the states

[5] The different alphabets (a, b, c) indicate statistically difference in pair-wise test of gender difference across the states.

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Table 2

a.OLS results of Height model

height	model 1						model 2					
	men		women		B(m)=B(w)		men		women		B(m)=B(w)	
	coef		coef		F		coef		coef		F	
state												
punjab	**3.200**	*	**3.381**	***	0.02		**3.366**	*	**3.687**	***	0.05	
rajasthan	1.684		**1.840**	*	0.01		1.806	†	**2.175**	**	0.09	
kerala	−1.436		−1.081		0.08		**−2.770**	*	**−2.092**	*	0.19	
(karnataka)												
state												
Scheduled caste	**−2.904**	**	−1.478	†	1.74		**−2.863**	**	−0.902		**3.28**	†
Scheduled tribes	**−6.703**	***	**−2.946**	**	**8.88**	**	**−6.670**	***	**−2.669**	*	**8.74**	**
Other Backward Group	−1.494		−0.960		0.25		−1.449		−0.693		0.46	
(no/other)												
years of school												
father							−0.257		−0.186		0.06	
mother							0.468		−0.013		1.42	
literacy												
father							2.272		**2.271**	*	0.00	
mother							−0.531		1.596		0.74	
age	**−0.099**	**	**−0.113**	***	0.16		**−0.082**	*	**−0.107**	***	0.45	
rural	0.825		−0.079		0.65		1.335		−0.013		1.34	
_cons	171.013	***	158.685	***			**169.455**	*	**157.720**	***		
N	657		867				598		780			
F-stat	7.13	***	9.71	***			8.560	***	6.24	***		
R-sq	0.1175		0.1059				0.1262		0.1118			

b. OLS results of Log Height model

log height	**model 1**						**model 2**					
	men		**women**		**B(m)=B(w)**		**men**		**women**		**B(m)=B(w)**	
	coef		**coef**		**F**		**coef**		**coef**		**F**	
state												
punjab	**0.019**	*	**0.022**	***	0.12		**0.020**	*	**0.024**	***	0.23	
rajasthan	0.010		**0.012**	*	0.06		0.011		**0.015**	**	0.22	
kerala	−0.008		−0.007		0.04		**−0.017**		**−0.013**	†	0.11	
(karnataka)												
Caste												
Scheduled caste	**−0.017**	**	−0.01		1.27		**−0.017**	**	−0.006		**2.82**	†
Scheduled tribes	**−0.041**	***	**−0.019**	*	**7.78**	**	**−0.041**	***	**−0.017**	*	**7.94**	**
Other Backward Group	−0.009		−0.006		0.15		−0.009		−0.005		0.36	
(no/other)												
years of school												
father							−0.002		−0.001		0.80	
mother							0.003		0.000		1.54	
literacy												
father							0.014		**0.015**	*	0.01	
mother							−0.003		0.011		0.80	
age	**−0.001**	**	**−0.001**	***	0.46		**−0.001**		**0.001**	***	0.86	
rural	0.005		−0.000		0.53		0.008		0.000		1.10	
_cons	5.142	***	5.067	***			5.132					
N	657		867				598		780			
F-stat	6.97	***	9.71	***			8.45	***	6.25	***		
R-sq	0.1165		0.1040				0.1256		0.1100			

* p<.05,

** p<.0 1,

*** p<.0 01

† p<.10

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Table 3

Gender Gap in Educational Attainment

	Highest level attained among age 15+ population [1]				Mean years of schooling[1]		% of girls enrollment to total enrollment[2]		
Year	**no schooling**	**primary**	**secondary**	**Tertiary**	**male**	**female**	**Primary**	**Secondary**	**Tertiary**
1950 – 51	74.7	22.6	2.1	0.6	1.54	0.40	28.1	13.3	10.0
1955 – 56	73.6	23.6	2.2	0.6	1.58	0.44	30.5	15.4	14.6
1960 – 61	72.1	24.8	2.5	0.6	1.68	0.50	32.6	20.5	16.0
1965 – 66	70.9	24.0	4.1	0.9	1.90	0.64	36.2	22.0	20.4
1970 – 71	66.2	27.1	5.6	1.1	2.26	0.83	37.4	25.0	20.0
1975 – 76	65.9	20.6	11.7	1.8	2.78	1.10	38.1	26.9	23.2
1980 – 81	66.3	12.6	18.7	2.3	3.25	1.37	38.6	29.6	26.7
1985 – 86	58.5	16.5	21.8	3.2	3.93	1.78	40.3	30.3	33.0
1990 – 91	51.6	18.7	25.6	4.0	4.56	2.25	41.5	32.9	33.3
1995 – 96	47.4	19.4	29.1	4.1	4.92	2.61	43.1	36.1	37.2
2000 – 01	43.0	19.7	32.9	4.5	5.31	3.03	43.7	38.6	36.9

[1] Source: 1. Barro & Lee (2012)

[2] GoI (2008)

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Table 4

OLS results of years of schooling

years of school	Base Model						Full Model					
	men		women		B(m)=B(w)		men		women		B(m)=B(w)	
coef		coef		F		coef		coef		F		
Punjab	−1.447		−1.164		0.23		−0.986		−0.264		1.12	
Rajasthan	**−1.948**	*	**−1.740**	***	0.13		**−2.094**	**	**−1.153**	*	2.78	
Kerala	**2.085**	**	**4.313**	***	**20.8**	***	0.324		**2.718**	***	**14.15**	***
SC	**−3.746**	***	**−2.786**	***	**4.85**	*	**−3.010**	***	**−1.908**	***	**3.98**	†
ST	**−4.118**	***	**−2.219**	***	**9.78**	**	**−2.921**	***	**−1.307**	**	**6.02**	*
OBC	**−1.225**	*	**−1.272**	**	0.01		−0.693		−0.665	†	0.00	
age	**−0.069**	***	**−0.079**	***	0.47		**−0.053**	***	**−0.050**	***	0.05	
rural	**−2.831**	***	**−1.527**	**	**7.83**	**	**−2.205**	***	**−1.125**	*	**6.93**	*
Years of school												
father							**0.460**	***	**0.275**	**	2.37	
mother							0.130		**0.333**	***	2.45	
Literacy												
father							**1.253**	*	**1.382**	*	0.03	
mother							−1.308		0.329		3.95	†
R_height							**0.053**	**	0.015		**3.32**	†
_cons	13.16	***	9.85	***			10.821	***	6.358	***		
N	733		945				598		779			
F-stat	56.6	***		59.84	***		51.46	***	67.46	***		
R-sq	0.356		0.421				0.4249		0.5557			

* p<.05,

** p<. 01,

*** p <.001

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† $p<.10$

Note. R_height = height – age/gender -specific mean height

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Table 5

Gender difference in late-life cognition by state

		Punjab	Rajasthan	Karnataka	Kerala	F-stat	ALL
immediate recall (a)	men	5.9	5.3	5.2	5.0		5.2
	women	5.3	4.4	4.4	4.7		4.6
	(men - women)	0.6[a,b]	0.7[a]	0.8[a,b]	0.3b	1.82	0.6
delayed recall (b)	men	5.3	3.0	4.7	3.2		3.9
	women	4.4	2.5	4.0	3.1		3.4
	(men - women)	0.9[a]	0.5[b,c]	0.7[a,b]	0.1[c]	4.33**	0.5
episodic memory (a+b)/2	men	5.6	4.2	4.9	4.1		4.6
	women	4.8	3.5	4.2	3.9		4.0
	(men - women)	0.8[a]	0.7[a,b]	0.7[a]	0.2[c]	2.90*	0.6
date naming (c)	men	3.1	2.6	2.8	3.5		2.9
	women	2.7	1.6	2.0	3.2		2.3
	(men - women)	0.4[a,b]	1.0[b,c]	0.8[b]	0.3[a]	10.30***	0.6
naming prime minister (d)	men	0.7	0.3	0.5	0.8		0.5
	women	0.4	0.1	0.2	0.6		0.3
	(men - women)	0.3[a]	0.2[a,b]	0.3[b]	0.2[a,b]	2.12	0.2
backward count from 20 (e)	men	1.2	0.7	1.2	1.8		1.1
	women	0.8	0.3	0.8	1.6		0.8
	(men - women)	0.4[a]	0.4[a]	0.4[a]	0.2[a]	0.90	0.3
serial 7s (f)	men	2.0	1.4	1.8	2.9		1.9
	women	0.9	0.4	1.4	2.0		1.2
	(men - women)	1.1[a]	1.0[a,b]	0.4[b]	0.9[a,b]	2.36†	0.7
cognition summary index (a+b+c+d+e+f)	men	18.1	13.2	16.3	17.3		15.6
	women	14.4	9.4	12.8	15.4		12.6
	(men - women)	3.7[a]	3.8[a]	3.3[a,b]	1.9[b]	2.42†	3.0

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Note. All data are age-adjusted estimates from 2010 LASI

F-stat tests whether gender difference in cognition varies across the states

The different alphabets (a, b, c) indicate statistically difference in pair-wise test of gender difference across the states.

* $p<.05$,

** $p<.01$,

*** $p<.001$,

† $p<.10$

Table 6

OLS results of cognition

	model 1			model 2			model 3		
	men	women	B(m)=B(w)	men	women	B(m)=B(w)	men	women	B(m)=B(w)
	coef	coef	F	coef	coef	F	coef	coef	F
punjab	2.315 *	0.838	2.56	**2.873** **	**2.178** **	0.61	**3.250** ***	**2.07** ***	1.99
rajasthan	−1.577	3.132 ***	3.18	−1.467	**−2.300** ***	0.93	0.609	**−0.961**	**3.44** †
kerala	0.682	1.908 *	2.34	−1.586	−0.501	1.03	**−2.435** **	**−2.929** ***	0.29
SC	−4.232 ***	3.134 ***	1.64	−3.59 ***	−2.167 ***	2.36	−1.085	−0.509	0.43
ST	−5.040 ***	3.818 ***	1.16	−4.174 ***	−2.718 ***	1.55	−1.343	−1.423	0.00
OBC	−1.075	1.211 *	0.04	−0.574	−0.454	0.03	−0.020	0.246	0.15
age	−0.136 ***	0.160 ***	1.36	**−0.12** ***	**−0.141** ***	0.73	**−0.076** ***	**−0.089** ***	0.25
rural	−2.499 ***	2.657 ***	0.07	**−2.058** ***	**−2.185** ***	0.05	−0.496	**−1.216** **	2.33
father's yrs of schooling				0.206 †	0.107	0.36	−0.152	−0.121	0.04
mother's yrs of schooling				0.074	**0.446** **	1.96	−0.083	0.149	1.09
father's literacy				1.375	**3.398** ***	3.41 †	0.297	**2.196** **	2.57
mother's literacy				0.933	−0.615	0.56	**3.061** **	−0.716	**7.15** *
R_height							0.032	0.012	0.27
yrs of schooling							**0.498** ***	**0.703** ***	**3.80** †
literacy							**2.397** **	0.111	**3.95** †
son's yrs of schooling							**0.263** †	0.155	0.43
daughter's yrs of schooling							−0.249	**0.358** *	**7.86** **
son's literacy							0.170	−0.540	0.50
daughter's literacy							1.530	−0.791	2.41
no son at age 15+							−0.393	−0.561	0.08
no daughter at age 15+							−0.147	0.245	0.51
_cons	27.078 ***	25.49 ***		24.813 ***	22.105 ***		15.101 ***	15.367 ***	
N	686	884		625	799		572	742	

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	model 1					model 2					model 3				
	men		women		B(m)=B(w)	men		women		B(m)=B(w)	men		women		B(m)=B(w)
	coef		coef		F	coef		coef		F	coef		coef		F
F-stat	22.69	***	30.12	***		30.51	***	21.41	***		38.18	***	30.100	***	
R-sq	0.272		0.3126			0.3113		0.4133			0.5328		0.5564		

[*] p<.05,

[**] p<.01,

[***] p<.001,

[†] p<.10

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