Is the Effect of Neighborhood Sanitation on Child Height in India Overstated? Evidence from National Family Health Survey-4

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Extended Abstract

The paper engages with an important finding emerging from the empirical studies on child height in India: the role of neighborhood sanitation. The paper examines whether the effect of increase in the neighborhood sanitation on child height remains invariable irrespective of the level of neighborhood sanitation. We examine this issue by analyzing the unit-level data of the National Family Health Survey (NFHS-4), 2015-16. The analysis, employing linear regression models and generalized additive models, suggests that the marginal effect of neighborhood sanitation on child height decreases with an increase in the level of neighborhood sanitation.

Keywords: Externalities; Nutrition; Sanitation; India

Neighborhood Sanitation and Child height

Stunting, an indication of long-term nutritional deprivation, has emerged as the preferred indicator of child undernutrition, as it is associated with sub-optimal brain development leading to poor school performance and reduced intellectual capacity (WHO 2010). With 38.4 per cent of children under five years being stunted in 2015-16, India continues to belong to the league of countries with higher level of stunting across the globe. This higher level of stunting, despite India's impressive performance in economic growth, appears as a puzzle, often referred to as 'Indian enigma'.

What can possibly explain this Indian enigma? A growing body of empirical evidence claims that higher prevalence of open defecation in India almost entirely explains the higher stunting prevalence in India. A recent paper argues that 'open defecation can statistically account for *much or all* of the average height-for-age difference between India and Africa' (Spears, 2018:1, emphasis added). Importantly, the paper, by identifying the pathways through which open defecation adversely influences child height, emphasizes the role of 'open defecation density': higher level of open defecation combined with population density in India. This implies that 'children in India are harmed by their *neighbors' open defecation* in addition to their own households' (Spears, 2018: 12, emphasis added; see also Geruso and Spears, 2018).

In this context, yet another 'development puzzle' specific to India merits a mention: Muslim advantage in child survival in India. It has been found that 'despite being, on average, less educated and poorer, Indian Muslims exhibit a substantial advantage in child survival over high-caste Hindus' (Bhalotra, Valente and van Soest, 2010:191). A recent empirical examination of the Muslim advantage in child survival identifies the influence of neighborhood sanitation as the primary cause (Geruso and Spears, 2018). Thus, neighborhood sanitation appears to provide Muslims an apparent advantage in child survival. However, the advantage of Muslims in child infant mortality has followed a declining trend, while the difference in the sanitation practices of Muslims and Hindus still appears to be quite large and significant (18%

percentage points). What is more, the advantage is also dwindling when compared with Scheduled Castes and Scheduled Tribes Hindus who are disadvantaged in socio-economic status and have the worst sanitation practices among all socio-religious groups.

The above discussion brings out the significant positive influence of 'neighborhood sanitation' both on child height and child survival in India. Against this context, our paper assumes significance and relevance. Specifically, we examine whether the marginal effect of neighborhood sanitation on child height remains constant irrespective of the varying level of neighborhood sanitation across socio-religious groups in India? To put differently, we seek to identify whether increase in neighborhood sanitation has any nonlinear association with child height in India.

Methodology

We estimate the relationship between sanitation coverage in the neighborhood and child height using different specifications employing the following linear regression model:

$$Y_{ij} = \alpha_0 + \alpha_1 HS_{ij} + \alpha_2 S_j + \beta \boldsymbol{X}_{ij} + u_{ij}$$

Where Y_{ij} represents height (height-for-age Z-scores) of child i in neighborhood j, HS_{ij} refers to child's household access to improved sanitation facility and S_j is the fraction of households that have access to improved sanitation in *jth* neighborhood. $\mathbf{X}_{ij}$ is a vector of control factors representing the child's individual and household characteristics. They include number of children in the household, interaction term between birth order of child and sex of the child, age of child, place of residence (rural or urban), wealth index score excluding household sanitation (having toilet at home), mother's education in single years, mother's nutrition (measured through BMI), risky birth interval, household having access to clean water, whether mother is anemic (in terms of iron deficiency), whether child was breastfed within one hour of birth, whether vitamin-A supplementation was given to the child in the last 6 months, whether child was given vaccination, safe disposal of stool, household using iodized salt and whether households owns livestock.

Further, to confirm the existence of non-linear relationship between neighborhood sanitation and child height we use Generalized Additive Models (GAMs). The Generalized Additive Models (GAMs) have the advantage of fitting nonparametric curve to the data without assuming any particular parametric form to describe the nonlinearity between the variables. We use the following generalized additive model specification (see Wood 2017):

$$g(E(Y_{ij}|z_{ij}, X_{ij})) = \alpha_1 + s(SH_{ij}) + \beta_{ij} \boldsymbol{X}_{ij}$$

where, g(.) refers to a link function, $\boldsymbol{X}_{ij}$ are a vector of other control variables with linear effect, SH_{ij} is neighborhood sanitation with a nonlinear effect captured by a smooth function which is unknown.

Data and Measures

Our analysis makes use of the unit-level data of the NFHS-4 (2015-16). The data includes height for age z-scores for children under age five calculated as per new WHO guidelines (2004). We use this variable to calculate neghaz (negative of Z scores) which is our main dependent variable. Increasing neghaz represents decreasing child height. The survey also collected information about different household assets that we use to calculate a wealth measure. The wealth measure we employ does not include variables relating to sanitation and water facilities as they have been separately included in the regression models. Sanitation variable in our analysis has been coded as per WHO recommendation: 'a facility is considered to be improved if it can hygienically separate human excreta from human contact. Unimproved sanitation facilities include pit latrines, hanging latrines, bucket latrines and open defecation in fields, forests etc.' Household sanitation is treated as a dichotomous variable, which assumes the value of 1 if households have access to improved sanitation, otherwise 0.

The survey has a two-stage sampling structure that we use to identify neighbourhoods as primary sampling units (PSUs). These PSU frames may be entire villages for rural areas. In urban areas, they are census enumeration blocks. Using PSU identifiers, we calculate neighbourhood level variables. These variables can describe the characteristics of small localities. For each PSU, we calculate the fraction of Muslims, Scheduled Caste, Scheduled Tribe and Upper Caste Hindus. We also calculate 'mean sanitation in the neighbourhood' which we refer to as 'neighbourhood sanitation', henceforth. We only perform the analysis for Hindus and Muslims.

Our pooled sample has 207,908 valid observations. After adjusting for missing variables, the data sample reduces to 195,547. However, the total sample had valid anthropometric measurements for 236,176 observations. All descriptive statistics presented above use appropriate weights. We report the regression results without using weights.

Results and Findings

Existing studies find that an increase in Muslim fraction is positively correlated with neighborhood sanitation [Figure 1]. In other words, it implies that higher the Muslim fraction in the neighborhood, higher the positive externality (Geruso and Spears, 2018). Contrary to the above, our analysis reveals that the impact of fraction of Muslims or upper caste Hindus in the neighborhood on child height appears to be insignificant [Table 1]. This is indeed surprising, as Muslims and upper caste Hindus in general practice better sanitation when compared to other Hindus as well as sanitation is significantly associated with child height in India.

Given this evidence, we extend the analysis by replacing neighborhood fraction of Muslims and upper caste Hindus with fraction of sanitation coverage in the neighborhood sanitation [Table 2, Panel A]. First, we examine whether an increase in neighborhood sanitation has any positive externality on both households which have access to improved sanitation as well as households which do not have access to improved sanitation. We find that, for our entire sample, neighborhood sanitation and individual household sanitation are significant even after controlling for other factors [Column 7 and 8]. On an average, households having improved sanitation facility have better Z-scores (height-for age) than households not having the same by 0.03 standard deviations. Further, a 10 per cent increase in the neighborhood sanitation will improve the Z-scores by 0.0170 standard deviations. Our analysis points out that the positive

externality of neighborhood sanitation benefits both the households which have access to and those who lack access to improved sanitation facility. However, the magnitude of positive externality differs with households not having access to improved sanitation facility getting benefitted more [Column 4 and 10]. Further, this difference in externality decreases as neighborhood sanitation increases.

Second, we examine whether there exists any non-linear relationship between neighborhood sanitation and child height. To do so, we include a squared term of neighborhood sanitation to capture its non-linear effect on child height in our model. The squared term becomes significant after including extended controls [Column 5 and 11]. This indicates that increasing neighborhood sanitation may not have the same impact on child height across the distribution of neighborhood sanitation coverage. In other words, increase in neighborhood sanitation may have more impact at the lower end i.e., for neighborhoods having low sanitation coverage than for those that lie at the higher end of the distribution of neighborhood sanitation [Figure 2A]. To verify the robustness of the above results of non-linear impact of increase in neighborhood sanitation on child heights, we repeat the same analysis using generalized additive models [Figure 2B]. The results from generalized additive models clearly reinforce the findings from regression models.

To further examine the robustness of our finding, we carry out the analysis by disaggregating the sample into various socio-religious groups (Muslims, upper caste Hindus, Hindu OBCs, Hindu SCs and Hindu STs). This is done mainly because there are huge differences between these groups in sanitation access. Additionally, it is likely that the groups that have higher sanitation access might reside in the neighborhoods which have higher sanitation coverage as well. For example, Muslims largely reside in Muslims dominated neighborhoods which also have higher sanitation coverage when compared average neighborhood sanitation. When we repeat the above analysis only for Muslims sample [Table 2, Panel C], we find that the effects of both household sanitation and neighborhood sanitation on child height emerge statistically insignificant [Column 7 and 8]. However, we observe that the interaction term and squared term remain significant [Column 10 and 11]. The significance of squared term implies that the influence of increase in sanitation in Muslim neighborhood on child height either declines or does not produce the intended positive effect. Doing the analysis with only the Muslim sample also allows us to get rid of the estimation errors that would have occurred because of the lack of usage of sanitation facilities even when they are available. This particularly holds true in case of Hindus as noted by Sangita Vyas and Dean Spears, 2018. It, thus, appears that increasing neighborhood sanitation may have diminishing returns.

We repeat the same analysis for Hindu upper caste sample, as they have household sanitation access equivalent to that of Muslims [Table 2, Panel B]. Interestingly, the results of Hindu upper caste reinforce the results found from Muslim sample. This clearly suggests that irrespective of religious or social group differences, the positive externality of increasing neighborhood sanitation on child height might be ineffective beyond a threshold of neighborhood sanitation coverage. These findings are further substantiated by GAMs [Figure 2C and 2D respectively].

The separate analysis among samples of SCs, STs and OBCs also emphasizes the distribution sensitive influence of neighborhood sanitation on child height [Table 2, Panel D, E and F respectively]. The results indicate the positive and significant impact of neighborhood sanitation on child height among these social groups. This implies that the positive impact of further improvement in neighborhood sanitation will be more effective among social groups or

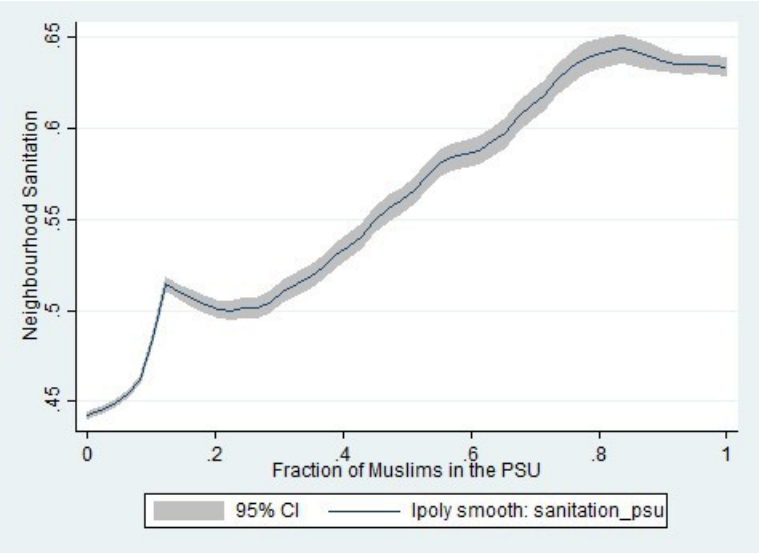
neighborhoods where sanitation coverage is lower compared to Muslims and Hindus upper caste.

Key Findings

In conclusion, the improvements in neighborhood sanitation will have desired positive effects on child heights when the average neighborhood sanitation level is low to begin with. Further and continuous improvement in neighborhood sanitation beyond a threshold may not yield the expected results on child height. This, to our understanding, goes against the singular emphasis accorded to total sanitation coverage as the primary means to reduce child stunting or for increasing child height in India. Evidence from other South Asian countries, such as Bangladesh having stunting level close to that of India despite its almost absence of open defecation, clearly validates our findings (we repeated the same analysis using the latest round of Bangladesh's DHS. The results were similar to the ones reported above. Our findings are also in consonance with similar findings from Peru (Alderman et al, 2003).

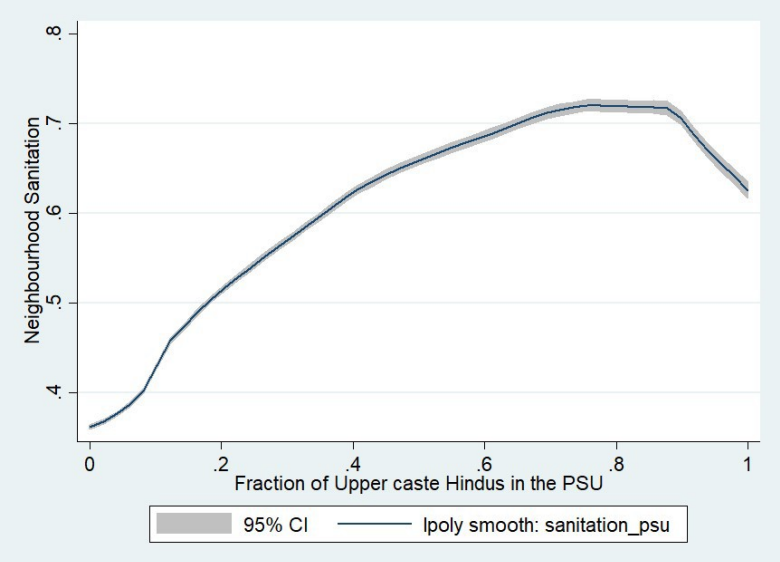
Figures

Figure 1A: Neighborhood sanitation Vs Fraction of Muslims in the PSU



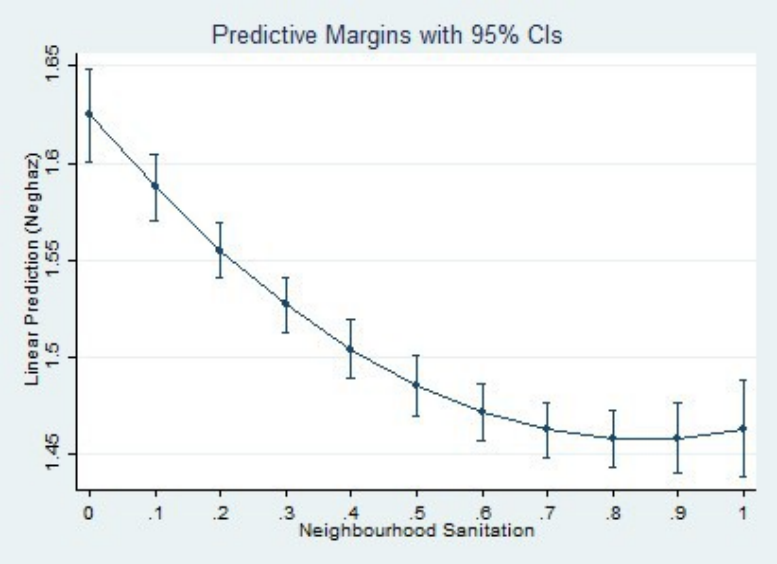
Source: Authors calculations from NFHS 4.

Figure 1B: Neighborhood sanitation Vs Fraction of upper caste Hindus in the PSU



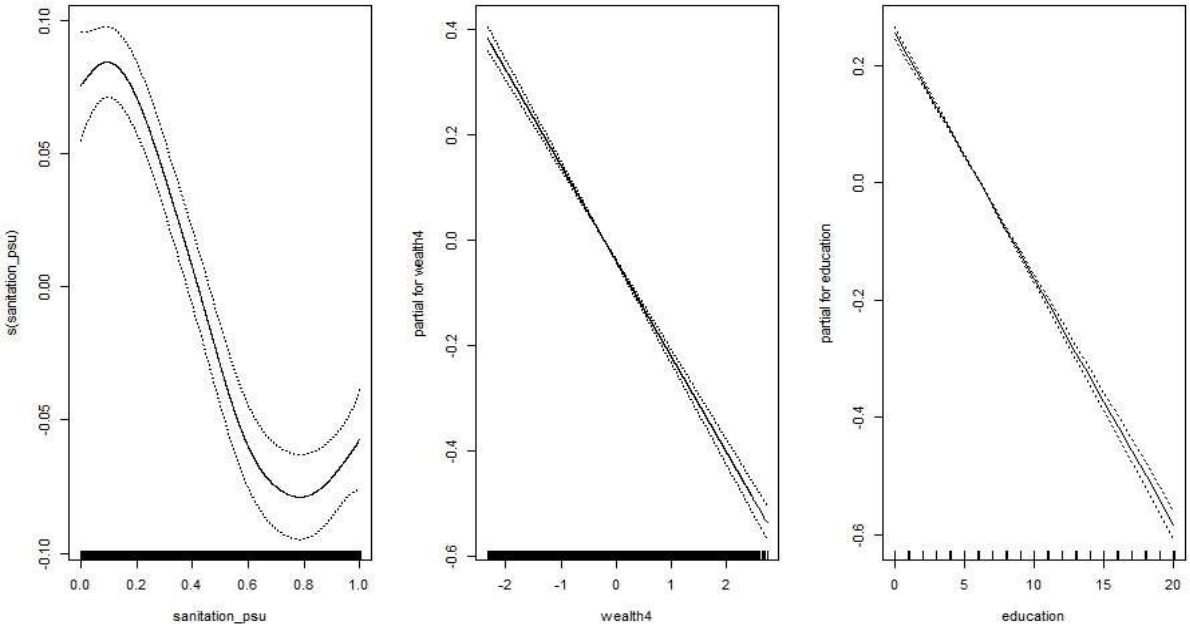
Source: Authors calculations from NFHS 4.

Figure 2A: Linear prediction (neghaz) Vs Neighborhood sanitation.



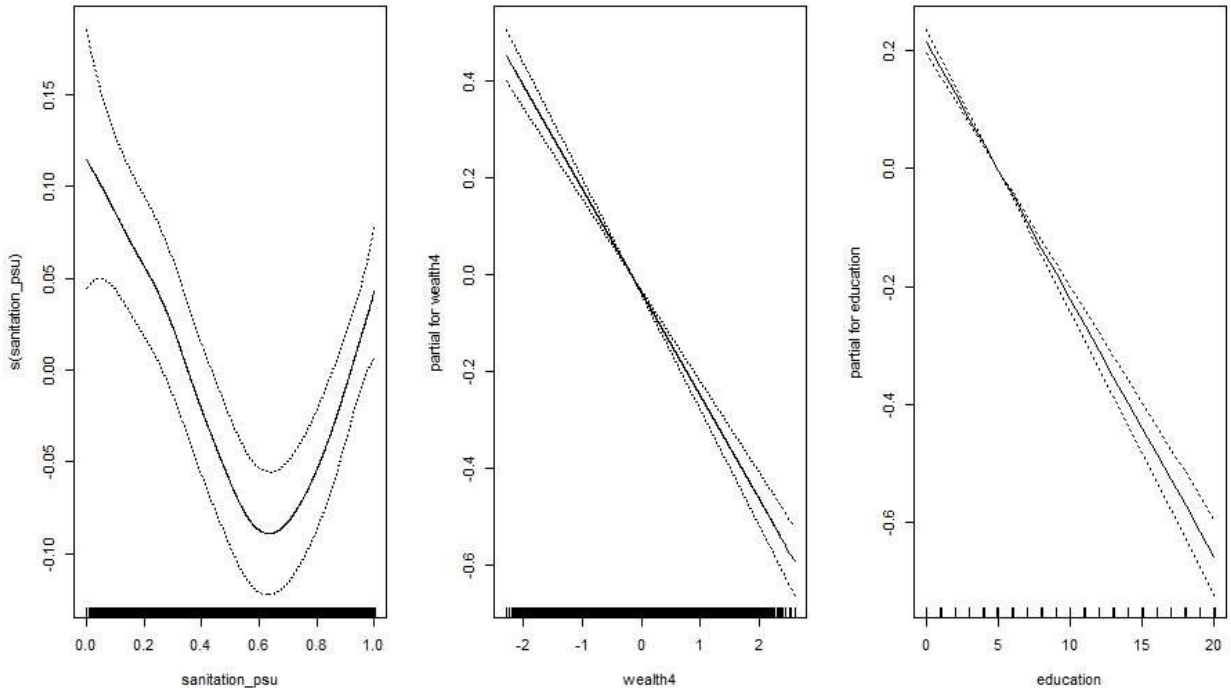
Source: Authors calculations from NFHS 4.

Figure 2B: Generalized additive models; For all Hindus and Muslims.



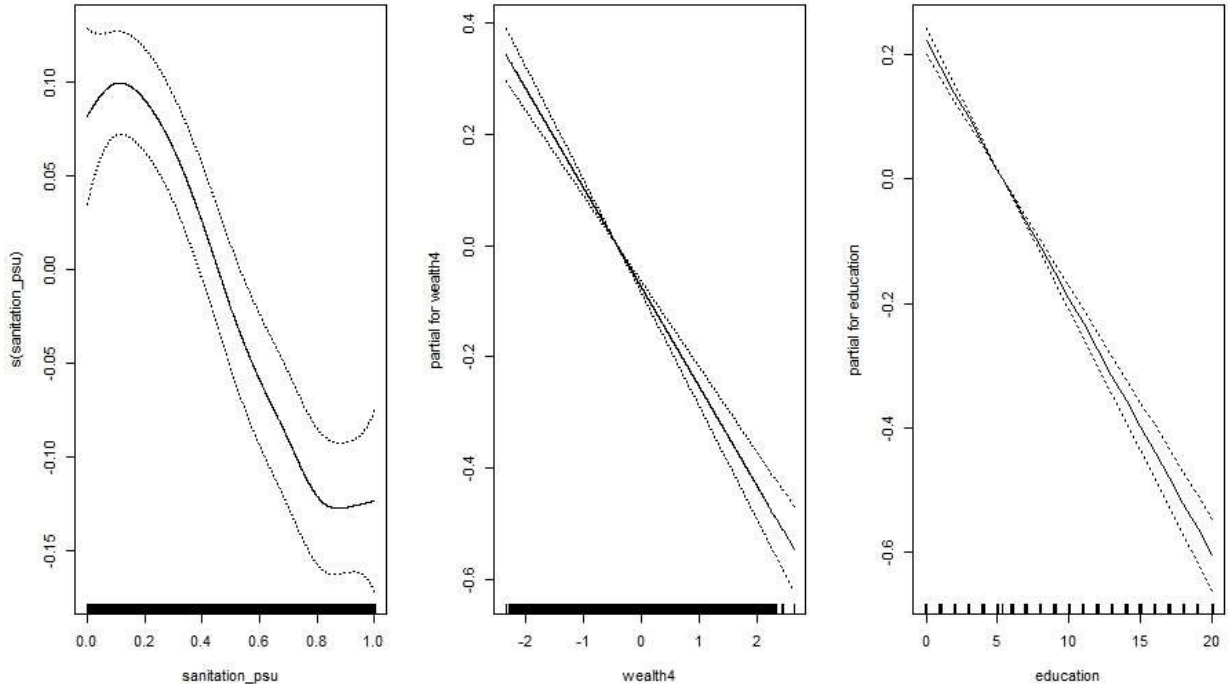
\ Source: Authors calculations from NFHS 4. Note: We have also used GAMs with household wealth and mother's education as they have shown strong association with child health outcomes in this work and other empirical studies.

Figure 2C: Generalized additive models; For all Muslims.



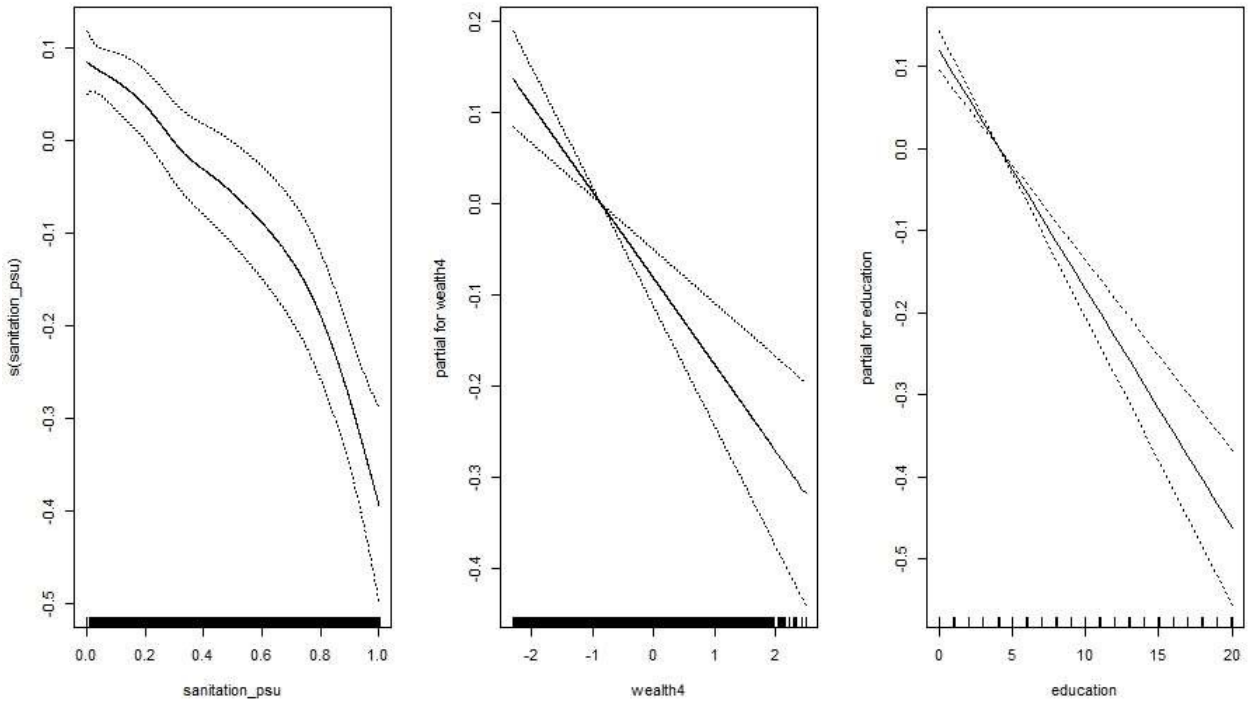
Source: Same as above.

Figure 2D: Generalized additive models; For all Hindus SCs.



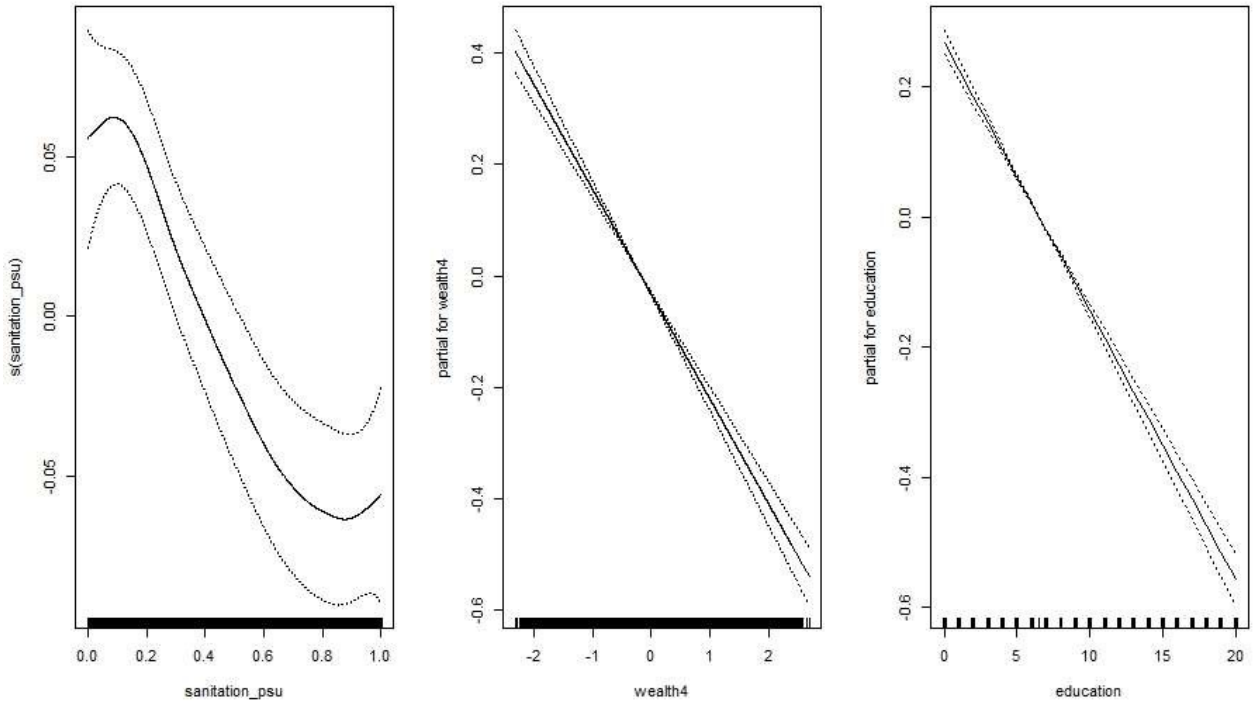
Source: Same as above.

Figure 2E: Generalized additive models; For all Hindus STs.



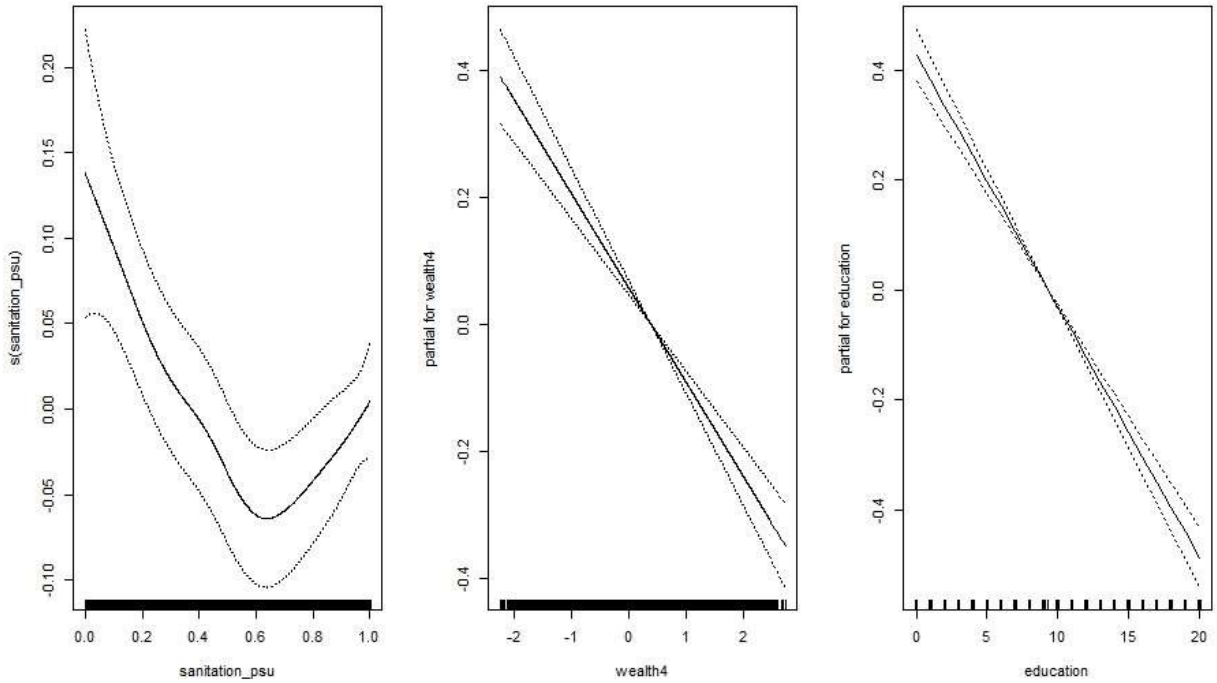
Source: Same as above.

Figure 2F: Generalized additive models; For all Hindus OBCs.



Source: Same as above.

Figure 2G: Generalized additive models; For all Hindus upper caste.



Source: Same as above.

Table 1: Neighbourhood Effect

Variables	Muslims to Hindus (Pooled)	Muslims to Hindus (Pooled); with controls	Muslims to SC Hindus	Muslims to SC Hindus; with controls	Muslims to ST Hindus	Muslims to ST Hindus; with controls	Upper Caste Hindus to SC and ST Hindus (Pooled)	Upper Caste Hindus to SC and ST Hindus (Pooled); with controls	Upper Caste Hindus to SC Hindus	Upper Caste Hindus to SC Hindus; with controls	Upper Caste Hindus to ST Hindus	Upper Caste Hindus to ST Hindus; with controls
Muslim Fraction in the PSU	0.00378	-0.00658	0.193**	0.115	-0.250	-0.0174						
	(0.21)	(-0.40)	(2.81)	(1.78)	(-1.81)	(-0.13)						
Upper Fraction in the PSU							-0.306***	0.0121	-0.272***	-0.0448	-0.496***	-0.110
							(-6.57)	(0.26)	(-5.14)	(-0.89)	(-4.83)	(-1.01)
Constant	1.511***	1.352***	1.669***	1.379***	1.694***	1.683***	1.719***	1.426***	1.722***	1.387***	1.719***	1.694***
	(256.21)	(32.15)	(149.68)	(14.64)	(111.58)	(12.52)	(160.81)	(18.54)	(127.88)	(14.69)	(102.69)	(12.60)
N	207908	195547	40808	38362	25031	23385	65839	61747	40808	38362	25031	23385

Table 2 : Regression Results

Variables	(1)	(2)	(3)	(4)	(5)	(6)
Improved Sanitation Facility in Household	-0.505***		-0.328***	-0.328***	-0.328***	
	(-56.74)		(-30.30)	(-30.30)	(-30.34)	
Neighbourhood Sanitation		-0.699***	-0.368***		-0.440***	-0.746***
		(-48.69)	(-20.35)		(-7.29)	(-12.56)
Neighbourhood Sanitation (Centered)				-0.417***		
				(-15.47)		
Interaction of household sanitation facility and neighbourhood sanitation				0.0932*		
				(2.57)		
Interaction of neighbourhood sanitation and neighbourhood sanitation (squared term)					0.0713	0.0461
					(1.28)	(0.83)
Constant	1.750***	1.849***	1.844***	1.655***	1.854***	1.856***
	(261.84)	(211.16)	(210.64)	(198.72)	(153.76)	(153.93)
N	207908	207908	207908	207908	207908	207908
			With Extended Controls			
Variables	(7)	(8)	(9)	(10)	(11)	(12)
Improved Sanitation Facility in Household	-0.0797***		-0.0343**	-0.0336**	-0.0342**	
	(-7.41)		(-2.94)	(-2.88)	(-2.93)	
Neighbourhood Sanitation		-0.170***	-0.145***		-0.371***	-0.396***
		(-9.24)	(-7.18)		(-6.39)	(-6.92)
Neighbourhood Sanitation (Centered)				-0.223***		
				(-8.22)		
Interaction of household sanitation facility and neighbourhood sanitation				0.163***		
				(4.60)		

Interaction of neighbourhood sanitation and neighbourhood sanitation (squared term)					0.234***	0.234***
					(4.28)	(4.29)
Constant	1.451***	1.481***	1.481***	1.398***	1.516***	1.515***
	(34.21)	(34.75)	(34.76)	(32.56)	(35.01)	(35.00)
N	195547	195547	195547	195547	195547	195547

ALL HINDUS (PANEL B)

Variables	(1)	(2)	(3)	(4)	(5)	(6)
Improved Sanitation Facility in Household	-0.536***		-0.346***	-0.346***	-0.346***	
	(-55.25)		(-28.71)	(-28.65)	(-28.71)	
Neighbourhood Sanitation		-0.743***	-0.392***		-0.385***	-0.694***
		(-48.34)	(-19.98)		(-6.04)	(-11.04)
Neighbourhood Sanitation (Centered)				-0.424***		
				(-14.49)		
Interaction of household sanitation facility and neighbourhood sanitation				0.0614		
				(1.56)		
Interaction of neighbourhood sanitation and neighbourhood sanitation (squared term)					-0.00691	-0.0482
					(-0.12)	(-0.81)
Constant	1.748***	1.851***	1.843***	1.646***	1.842***	1.845***
	(246.61)	(201.60)	(200.92)	(180.18)	(146.91)	(147.04)
N	170277	170277	170277	170277	170277	170277

With Extended Controls

Variables	(7)	(8)	(9)	(10)	(11)	(12)
Improved Sanitation Facility in Household	-0.0925***		-0.0436***	-0.0418**	-0.0439***	
	(-7.66)		(-3.33)	(-3.19)	(-3.35)	
Neighbourhood Sanitation		-0.189***	-0.158***		-0.306***	-0.336***

		(-9.38)	(-7.18)		(-4.93)	(-5.48)
Neighbourhood Sanitation (Centered)				-0.424***		
				(-14.49)		
Interaction of household sanitation facility and neighbourhood sanitation				0.137***		
				(3.52)		
Interaction of neighbourhood sanitation and neighbourhood sanitation (squared term)					0.156**	0.155**
					(2.63)	(2.61)
Constant	1.461***	1.492***	1.492***	1.405***	1.515***	1.515***
	(31.28)	(31.84)	(31.83)	(29.67)	(31.91)	(31.91)
N	160237	160237	160237	160237	160237	160237

ALL MUSLIMS (PANEL C)

Variables	(1)	(2)	(3)	(4)	(5)	(6)
Improved Sanitation Facility in Household	-0.409***		-0.264***	-0.270***	-0.262***	
	(-19.15)		(-10.58)	(-10.73)	(-10.51)	
Neighbourhood Sanitation		-0.594***	-0.335***		-0.794***	-1.072***
		(-16.27)	(-7.63)		(-4.82)	(-6.62)
Neighbourhood Sanitation (Centered)				-0.445***		
				(-6.59)		
Interaction of household sanitation facility and neighbourhood sanitation				0.187*		
				(2.17)		
Interaction of neighbourhood sanitation and neighbourhood sanitation (squared term)					0.415**	0.435**
					(2.93)	(3.07)
Constant	1.761***	1.869***	1.874***	1.696***	1.955***	1.953***
	(97.80)	(73.74)	(74.01)	(87.49)	(51.73)	(51.66)

N	37631	37631	37631	37631	37631	37631
			With Extended Controls			
Variables	(7)	(8)	(9)	(10)	(11)	(12)
Improved Sanitation Facility in Household	-0.0390		-0.0116	-0.0189	-0.00657	
	(-1.61)		(-0.44)	(-0.71)	(-0.25)	
Neighbourhood Sanitation		-0.103*	-0.0941		-0.677***	-0.683***
		(-2.33)	(-1.94)		(-4.40)	(-4.51)
Neighbourhood Sanitation (Centered)				-0.226***		
				(-3.36)		
Interaction of household sanitation facility and neighbourhood sanitation				0.244**		
				(2.93)		
Interaction of neighbourhood sanitation and neighbourhood sanitation (squared term)					0.551***	0.553***
					(4.09)	(4.10)
Constant	1.337***	1.367***	1.368***	1.310***	1.473***	1.472***
	(13.12)	(13.23)	(13.23)	(12.79)	(13.65)	(13.65)
N	35310	35310	35310	35310	35310	35310

ALL HINDU SCs (PANEL D)

Variables	(1)	(2)	(3)	(4)	(5)	(6)
Improved Sanitation Facility in Household	-0.480***		-0.267***	-0.271***	-0.266***	
	(-25.37)		(-10.70)	(-10.63)	(-10.56)	
Neighbourhood Sanitation		-0.722***	-0.453***		-0.430***	-0.529***
		(-24.73)	(-11.65)		(-3.64)	(-4.47)
Neighbourhood Sanitation (Centered)				-0.476***		
				(-9.28)		
Interaction of household sanitation facility and neighbourhood sanitation				0.0557		

				(0.72)		
Interaction of neighbourhood sanitation and neighbourhood sanitation (squared term)					-0.0238	-0.193
					(-0.21)	(-1.72)
Constant	1.857***	2.005***	1.983***	1.759***	1.979***	1.978***
	(149.81)	(117.72)	(115.46)	(113.56)	(83.27)	(83.18)
N	40808	40808	40808	40808	40808	40808
			With Extended Controls			
Variables	(7)	(8)	(9)	(10)	(11)	(12)
Improved Sanitation Facility in Household	-0.0861***		-0.00151	-0.00514	-0.00234	
	(-3.53)		(-0.06)	(-0.19)	(-0.09)	
Neighbourhood Sanitation		-0.264***	-0.262***		-0.288*	-0.289*
		(-6.91)	(-6.19)		(-2.49)	(-2.50)
Neighbourhood Sanitation (Centered)				-0.284***		
				(-5.36)		
Interaction of household sanitation facility and neighbourhood sanitation				0.0574		
				(0.75)		
Interaction of neighbourhood sanitation and neighbourhood sanitation (squared term)					0.0277	0.0266
					(0.25)	(0.24)
Constant	1.365***	1.431***	1.430***	1.301***	1.435***	1.435***
	(14.40)	(14.98)	(14.98)	(13.63)	(14.80)	(14.81)
N	38362	38362	38362	38362	38362	38362

ALL HINDU STs (PANEL E)

Variables	(1)	(2)	(3)	(4)	(5)	(6)
Improved Sanitation Facility in Household	-0.424***		-0.202***	-0.207***	-0.195***	
	(-13.66)		(-5.45)	(-5.60)	(-5.23)	

Neighbourhood Sanitation		-0.658***	-0.469***		-0.276	-0.382*
		(-13.90)	(-8.07)		(-1.72)	(-2.40)
Neighbourhood Sanitation (Centered)				-0.389***		
				(-5.32)		
Interaction of household sanitation facility and neighbourhood sanitation				-0.222		
				(-1.80)		
Interaction of neighbourhood sanitation and neighbourhood sanitation (squared term)					-0.238	-0.327
					(-1.35)	(-1.87)
Constant	1.778***	1.858***	1.853***	1.652***	1.837***	1.837***
	(109.74)	(91.94)	(91.33)	(65.43)	(74.29)	(74.27)
N	25031	25031	25031	25031	25031	25031
			With Extended Controls			
Variables	(7)	(8)	(9)	(10)	(11)	(12)
Improved Sanitation Facility in Household	-0.141***		-0.0336	-0.0373	-0.0304	
	(-3.81)		(-0.84)	(-0.93)	(-0.76)	
Neighbourhood Sanitation		-0.339***	-0.314***		-0.215	-0.228
		(-5.63)	(-4.77)		(-1.33)	(-1.42)
Neighbourhood Sanitation (Centered)				-0.269***		
				(-3.51)		
Interaction of household sanitation facility and neighbourhood sanitation				-0.130		
				(-1.03)		
Interaction of neighbourhood sanitation and neighbourhood sanitation (squared term)					-0.124	-0.136
					(-0.68)	(-0.74)
Constant	1.814***	1.854***	1.851***	1.708***	1.839***	1.841***
	(13.20)	(13.55)	(13.51)	(12.05)	(13.47)	(13.49)

N	23385	23385	23385	23385	23385	23385
			ALL HINDU OBCs (PANEL F)			
Variables	(1)	(2)	(3)	(4)	(5)	(6)
Improved Sanitation Facility in Household	-0.496***		-0.343***	-0.341***	-0.343***	
	(-35.34)		(-19.34)	(-19.10)	(-19.34)	
Neighbourhood Sanitation		-0.682***	-0.332***		-0.326***	-0.681***
		(-30.52)	(-11.62)		(-3.55)	(-7.55)
Neighbourhood Sanitation (Centered)				-0.369***		
				(-8.39)		
Interaction of household sanitation facility and neighbourhood sanitation				0.0668		
				(1.15)		
Interaction of neighbourhood sanitation and neighbourhood sanitation (squared term)					-0.00595	-0.000625
					(-0.07)	(-0.01)
Constant	1.735***	1.820***	1.816***	1.647***	1.815***	1.820***
	(172.65)	(140.79)	(140.89)	(120.51)	(100.51)	(100.65)
N	73218	73218	73218	73218	73218	73218
			With Extended Controls			
Variables	(7)	(8)	(9)	(10)	(11)	(12)
Improved Sanitation Facility in Household	-0.0776***		-0.0422*	-0.0366	-0.0410*	
	(-4.39)		(-2.18)	(-1.88)	(-2.11)	
Neighbourhood Sanitation		-0.154***	-0.124***		-0.291**	-0.325***
		(-5.23)	(-3.83)		(-3.27)	(-3.71)
Neighbourhood Sanitation (Centered)				-0.198***		
				(-4.46)		
Interaction of household sanitation facility and neighbourhood sanitation				0.146*		

				(2.56)		
Interaction of neighbourhood sanitation and neighbourhood sanitation (squared term)					0.175*	0.180*
					(2.06)	(2.12)
Constant	1.340***	1.364***	1.363***	1.291***	1.390***	1.391***
	(19.11)	(19.39)	(19.38)	(18.19)	(19.47)	(19.48)
N	69056	69056	69056	69056	69056	69056

ALL HINDU Upper Caste (PANEL G)

Variables	(1)	(2)	(3)	(4)	(5)	(6)
Improved Sanitation Facility in Household	-0.424***		-0.300***	-0.294***	-0.298***	
	(-17.09)		(-9.97)	(-9.68)	(-9.84)	
Neighbourhood Sanitation		-0.535***	-0.271***		-0.367*	-0.781***
		(-15.17)	(-6.32)		(-2.16)	(-4.74)
Neighbourhood Sanitation (Centered)				-0.356***		
				(-4.19)		
Interaction of household sanitation facility and neighbourhood sanitation				0.118		
				(1.21)		
Interaction of neighbourhood sanitation and neighbourhood sanitation (squared term)					0.0838	0.217
					(0.59)	(1.54)
Constant	1.438***	1.479***	1.522***	1.377***	1.539***	1.524***
	(66.11)	(56.91)	(57.42)	(54.72)	(38.76)	(38.33)
N	28206	28206	28206	28206	28206	28206
			With Extended Controls			
Variables	(7)	(8)	(9)	(10)	(11)	(12)
Improved Sanitation Facility in Household	-0.0378		-0.0305	-0.0182	-0.0168	
	(-1.31)		(-0.97)	(-0.57)	(-0.53)	

Neighbourhood Sanitation		-0.0446	-0.0242		-0.514**	-0.535***
		(-1.02)	(-0.51)		(-3.10)	(-3.35)
Neighbourhood Sanitation (Centered)				-0.203*		
				(-2.45)		
Interaction of household sanitation facility and neighbourhood sanitation				0.265**		
				(2.79)		
Interaction of neighbourhood sanitation and neighbourhood sanitation (squared term)					0.449**	0.458**
					(3.14)	(3.24)
Constant	1.555***	1.557***	1.561***	1.520***	1.644***	1.643***
	(13.97)	(13.91)	(13.94)	(13.55)	(14.27)	(14.26)
N	26637	26637	26637	26637	26637	26637

Notes

The coefficient of Neighbourhood Sanitation is the mean change if the PSU moves from 0 to 100% sanitation.

t statistics in parentheses

* p<0.05; ** p<0.01; *** p<0.001