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Sanitation, Ek Prem Katha: The Impact of Sanitation on Education in Indian Government Schools

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by

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Abstract

The Total Sanitation Campaign is an initiative launched by the Government of India in 1999 to accelerate sanitation coverage throughout the country. This thesis measures the impact of the Total Sanitation Campaign on education in Indian government schools. I assess whether access to toilets, access to water or access to both toilets and water impact the following parameters of education: literacy, current enrollment in school or completed years of education. Data is sourced from the Indian Human Development Survey (IHDS) 2005, sorted for the nineteen major states in India and aggregated at a district level for each state. The analysis employs two separate probit regression models to assess sanitation facilities' impact on literacy and current enrollment in school, and a robust linear model to assess sanitation facilities' impact on completed years of education. The models control for age, sex, caste, religion, household location, household size and household income. The results indicate that sanitation facilities positively impact education based on the age, sex and caste of the sample population. These findings present implications for future policymaking in order to improve access to and participation in education.

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Introduction

Inadequate sanitation has been increasingly recognised as an issue that governments in developing countries need to address, given the major health and economic costs (Tyagi et al., 2010). India fares poorly in its sanitation coverage, as it is the home to one-third of the world's population without access to improved sanitation (WHO; UNICEF, 2012). As of 2011, 69 percent of rural households in India did not have toilet infrastructure, and constituted 58 percent of the world population that practiced open defecation (ASER Centre, 2011). This is important since safe water supply systems and functional sanitation infrastructure are closely linked to issues of health. Open defecation increases the prevalence of communicable and non-communicable diseases - the World Bank estimates that 21 percent of communicable diseases are associated with unsafe water and sanitation (WHO, 2002). In addition, UNICEF child mortality data shows that India accounts for 24 percent of daily deaths of children under the age of five due to diarrhoeal diseases (UNICEF, 2013). Therefore, improvements in water and sanitation can reduce child mortality rates.

One of the means by which sanitation may decrease child mortality rates is by promoting sanitation facilities in schools and households. In India, there is a pressing concern regarding the lack of adequate sanitation facilities in rural schools. From a survey conducted by the ASER[1] centre, 45.6 percent of the sampled Anganwadis[2] and 50 percent of the sampled schools had bacterial contamination in their water (ASER, 2011).

[1] The ASER Centre is an autonomous assessment, survey, evaluation and research unit established in 2008 under Pratham, an Indian charitable trust.

[2] Anganwadis are rural childcare centres as part of a national government scheme implemented in 1975 as part of the Integrated Child Development Services program. In various regional languages, *Anganwadi* translates to "courtyard shelter".

According to the ASER centre, only 51 percent of schools had functional toilets (ASER, 2010), and functional girls' toilets were found in 37 percent of schools. As a result, politicians have largely been promoting sanitation schemes as part of election campaigns, along with other initiatives intended to promote development and growth. India's most recent example is current Prime Minister, Narendra Modi. Modi declared his commitment to providing sanitation and adequate drinking water facilities to all households and schools in India prior to the national elections in 2014 by launching a "Swachh Bharat: Swachh Vidyalaya" (Clean India: Clean Schools) campaign. Following his election, Modi publicised his intention of making India free of open-defecation and ensuring that all schools have functional toilets and drinking water facilities by 2019. Modi is not the first of Indian political leaders who have attempted to improve sanitation in India, as the turning point for such an initiative was in 1999, under the governance of Atal Bihari Vajpayee.

The first policy framework that grew out of concern surrounding the lack of safe water and sanitation facilities in schools in India was the Total Sanitation Campaign (TSC) in 1999. The campaign was based on the re-evaluation of an existing scheme, the Central Rural Sanitation Programme, which had little impact on its targeted rural areas (Centre for Public Impact, 2017). The campaign was intended to be demand-driven, community-led and incentive-based (Peal et al., 2010) and stipulated that "toilets in all types of government schools i.e. primary, upper primary, secondary and higher secondary and Anganwadis should be constructed" (Planning Commission, Government of India, 2013). The Total Sanitation Campaign worked in conjunction with the School Sanitation and Hygiene Education (SSHE) programme to emphasise school sanitation and hygiene.

The aim was to cultivate "behavioural changes for relevant sanitation and hygiene practices from a young age" (Ministry of Drinking Water and Sanitation, 2012). The question arises: are there implications for improving access to and participation in education by exposing children to clean water and sanitation? Should policymakers highlight sanitation facilities in infrastructure when constructing schools? This paper uses the Total Sanitation Campaign as a framework to assess the impact of sanitation on education in Indian government schools, using data from the first round of the Indian Human Development Survey in 2004-2005.

The existing research on improving educational outcomes in Indian government schools has predominantly been focused on creating incentives (Kingdon, 2007) for students, parents and teachers. Furthermore, this is directed toward combatting teacher negligence (Kremer et al., 2005). In addition, government initiatives and various non-profit organisations that prioritise improving quality of education conduct interventions through randomised control trials (Kingdon, 2007). Impact evaluations of the District Primary Education Project, that focused on sustainable primary education development, find that positive impacts were stronger for low-caste children and girls (Schmid, 2006). Likewise, a large number of NGOs that have carried out education-related interventions, have been assisted by private and corporate funding. These field experiments test particular interventions and have, broadly speaking, found positive impacts on education in India (Kingdon, 2007). The activities conducted by these NGOs include, but are not limited to, organising learning camps for girls to promote gender parity and bridge courses that prepare drop-out children to re-enrol in school, and introducing attendance-contingent bonuses in schools in Rajasthan (Kingdon, 2007). Much of the available

literature has not analysed the impact of sanitation facilities on education. I seek to fill this gap by studying the impact of access to toilets, access to water and access to both toilets and drinking water on education in Indian government schools.

The following section outlines the background of the Total Sanitation Campaign and reviews the existing literature on sanitation, health and education. Section III describes the obtained data and models used for the purpose of this quantitative analysis. I use probit regression models to measure effects on literacy and current enrollment in school and a linear regression model to assess impacts on completed years of education. In Section IV, I present my results and limitations to the study. Finally, in Section V, I conclude that the results indicate that sanitation facilities impact education.

Literature Review

Total Sanitation Campaign: Background

The Total Sanitation Campaign, launched in 1999, presented what seemed to be a cutting-edge innovation to address India's sanitation needs (Hueso and Bell, 2013), as the government strived to achieve universal rural sanitation. The responsibility of programme deliverance fell upon local rural governments. State and central governments were meant to act as facilitators in framing policies, providing support and monitoring progress (Water and Sanitation Project, 2010). The campaign rolled out its projects at a district level, with an emphasis on rural areas, and implementation in 606 districts of 30 states/union territories (Water and Sanitation Project, 2010). The campaign achieved growth in rural sanitation coverage from 18% in 2000 to 38% in 2006 (Department of Drinking Water Supply, Government of India, 2010) at a national level.

Total Sanitation Campaign: Inefficiencies

While the campaign accomplished an increased sanitation coverage between 2000 and 2006, some issues are found in the implementation and evaluation of the campaign. The first problem that arises is flawed reporting and monitoring – since the data is typically self-reported, there are potential discrepancies which can cause the analysis of the campaign to be less reliable. Secondly, the campaign required identification of below poverty-line households, which can generate exclusion. This is explained by inaccurate poverty classifications, whereby households who do not have BPL cards due to their caste are largely excluded from government programmes such as the Total Sanitation Campaign (Kingdon, 2007). Next, there is a gap between theory and practice, whereby factors such as corruption, and lack of motivation and accountability result in sanitation

facilities not being installed (Kingdon, 2007). Furthermore, open defecation in India is strongly connected with social practices and lack of awareness about the health hazards of water-borne diseases (Patwa and Pandit, 2018; Panda et al., 2017). This implies that despite improvements in sanitation provisions, individuals may actually not be using these facilities (Biswas, 2014).

India could turn to its neighbour, Bangladesh, to understand how to better implement sanitation policies by focusing on attitudes and behaviours along with infrastructure and technology. Bangladesh's National Sanitation Campaign, launched in 2003, has been comparatively more successful than India's Total Sanitation Campaign. In Bangladesh, open defecation reduced from 34 percent in 1990 to 3 percent in 2012 (World Bank). The National Sanitation Campaign circulated slogans amongst the rural population that spread the message about how open defecation would result in people eating each other's faeces – creating incentive for people to reduce open defecation (Hanchett et al., 2010). The success of sanitation coverage in Bangladesh can be widely attributed to human efforts involving communication and persuasion, resulting in behavioural changes that supplemented technology and infrastructure (Hanchett et al., 2010).

A prominent platform for behavioural changes to occur is schools, which is the motivation behind assessing the impact of the Total Sanitation Campaign in India on education. This could direct future research towards education as a means for students to spread information regarding sanitation practices amongst their households.

The Effects of Sanitation on Health

A closer look at the impact sanitation facilities may have on education is by assessing the effects of sanitation on health. A study conducted by Hammer and Spears (2016) indicates that an initial implementation of the Total Sanitation Campaign in rural Maharashtra, India, caused a modest improvement in sanitation and an increase in child height. Villages in the treatment group built more latrines, resulting in these children being taller than children from the control group. The installation of latrines and hand-wash facilities is hypothesised to remove faeces from the living environment (Patil et al., 2014). This would reduce faecal contamination of source water, and subsequently, drinking water (Patil et al., 2014; Andres et al., 2014). As a result, this would reduce diarrhoea, enteropathy or other parasite infections, then causing a reduction in anaemia, and finally, an improvement in the average height-for-age or weight-to-age for children (Patil et al., 2014; Dickinson et al., 2015). In Patil et al.'s study (2014); 15.98 percent of the intervention households reported correct disposal of child faeces, 41.11 percent did not have observed faeces in the living areas around households, and 95.93 percent households' drinking water was contaminated with *E. coli*. This is in comparison with the following results from the control group: 13.39 percent reported correct disposal of child faeces, 38.11 percent did not have observed faeces in living areas around households and 97.70 percent of households' drinking water was contaminated with *E. coli*. These results are indicative of the positive impact sanitation facilities have on health.

The Effects of Health on Education

Poor health may reduce learning for reasons such as lower daily attendance, less efficient learning per day spent in school and fewer years enrolled in school (Fentiman et

al., 1999; Glewwe and Miguel, 2008; Burde and Linden, 2013). In addition, there is increasing evidence that stunting, often linked to poor nutrition, is correlated with lower educational and labour market attainments (Augsburg and Rodríguez-Lesmes, 2015). As a result, recent studies using cross-sectional data, panel data, or data from randomised evaluations have found sizeable and statistically significant positive impacts of child health on primary school participation and increases in years of school enrollment (Glewwe and Miguel, 2008). Infrastructural investments in water and sanitation can be expected to increase attendance by reducing the spread of sickness and making the school environment more pleasant for students (Gupta, Dubey and Simonsen, 2018). One such implementation of a childhood programme studied a Kenyan project in which a mass treatment with deworming drugs was randomly phased into schools. The project showed a reduction of student absenteeism in treatment schools by one quarter (Miguel and Kremer, 2004), and interestingly, positively impacted participation in non-treatment neighbouring schools. It is likely that this was due to reduced disease transmission; a result of an epidemiological externality (Glewwe and Miguel, 2008).

The Relationship between Sanitation and Education

Observing the relationship between sanitation and education through the channel of health has led to an increasing policy emphasis on school sanitation in India. This has manifested in Modi's campaign of "toilets before temples" and the Swachh Bharat: Swachh Vidyalaya initiative to provide universal access to sex-specific latrines in all government schools. Inadequate school sanitation facilities have been cited as a factor that can impact school attendance and completion by 'pushing' children out of school (Birdthistle et al., 2011). Thus, when access to school sanitation increases, student

enrollment increases and dropout rates decrease (Adukia, 2016). The estimated impacts of latrine construction have highly statistically significant results on increases in primary school and upper primary school enrollment, however, the estimated impacts on primary school enrollment are larger than impacts on upper-primary school enrollment (Adukia, 2016).

Policy initiatives focused on sanitation may have a stronger positive impact on gender parity in educational participation. Studies focus on the effects of sanitation facilities on girls' health and education, as the absence of latrine facilities may delay girls' enrollment in lower primary schools (Adukia, 2016) and expose pubescent-age girls to threats of verbal and physical harassment and absenteeism due to menstruation (Nekatibeb, 2002; Snel, 2003; Mathes and Ramela, 2006; Kirk and Sommer, 2006; Adukia, 2016). Additionally, there is a strong focus on menstruation as a factor holding girls back from school when there are inadequate sanitation facilities. Girls who lack adequate sanitary materials may miss school each month during the days of their menstrual cycle. This is a phenomenon seen around the world, whereby UNICEF (2005) estimates that 1 in 10 school-age African girls don't attend school during menstruation, or drop out at puberty because of the lack of clean and private sanitation facilities in schools. Regular absence from school for several days a month can negatively impact a girl's learning, and consequently, her overall academic performance in school (Kirk and Sommer, 2006; Adukia, 2016).

The provision of water and sanitation facilities in schools is widely considered to contribute to increased enrollment and retention of girls (Fentiman et al. 1999; Kirk and Sommer, 2006; Birdthistle et al. 2011). Kazianga et al.'s case study (2013) is indicative

of this, as seen two and a half years after the conception of "girl-friendly" schools under the BRIGHT[3] school construction programme in Burkina Faso. The programme placed relatively well-resourced schools with a number of amenities directed at encouraging the enrollment of girls in 132 villages. The prototype school included separate latrines for boys and girls and a borehole equipped with a natural pump that served as a source of clean water. (Kazianga et al., 2013) Kazianga et al. (2013) find that infrastructure is a significant determinant in families' decisions to enrol their children in school, as girl-friendly schools increased overall enrollment by 19 percent and improved the test scores by 0.41 standard deviations. In India, the reforms introduced in the late-1990s through the Total Sanitation Campaign increased the school attendance rate for both rural low-income girls and boys, but the effects were twice as strong for girls. This is predominantly driven by primary school attending girls between the ages of 6-11, and among treated girls from lower castes (Gupta, Dubey and Simonsen, 2018).

Economic Implications

Diseases are shown to have direct associations with the short and long-term effects on human capital (Bleakley, 2010). Many of these cases are believed to be due to the contamination of the environment, linked to unsafe water, inadequate sanitation or insufficient hygiene (Augsburg and Rodríguez, 2015; Agoramoorthy et al., 2009). Therefore, from a public health perspective, reductions in diarrhoea and resulting improvements in nutritional status are the main driving factors for investing in sanitation benefits. This leads to a conclusion that improved health outcomes in early childhood are an indicator of long-term human capital attainment, whereby improved sanitation

[3] The BRIGHT programme is the Burkinabé Response to Improve Girls' Chances to Succeed programme, implemented in Burkina Faso in 2005.

facilities are suggested to have a positive effect on health outcomes. Therefore, controlling sanitation-related diseases is crucial for achieving development goals since health improvements influence economic productivity by increasing returns to labour (Agoramoorthy et al., 2009).

Improvements in health - which is in turn positively impacted by sanitation - benefits school participation (Glewwe and Miguel, 2008). This leads to greater access to education, which subsequently improves earning opportunities and more productive work within the household. Health has a significant positive impact on economic development via a direct labour productivity effect and an indirect incentive effect (Finlay, 2007). The former asserts that individuals who are healthier will be more productive and thus, have a higher return on labour. The latter is theoretical in nature and asserts that healthier individuals will have greater incentive to invest in education as it extends the time period for which returns can be earned (Finlay, 2007).

This builds the case for my argument, in which I assess how sanitation facilities impact education: I hypothesise that improved hygiene practices improves education, which has implications for spreading sanitation coverage through awareness promoted by students. Accordingly, better sanitation facilities would contribute to improving health outcomes - increasing human capital attainment, labour productivity and finally, driving economic growth.

Data and Model

This paper uses cross-sectional data from the Indian Human Development Survey for 2004-2005 (IHDS-I). The IHDS-I is a nationally representative, multi-topic survey of 41,554 households in 1503 villages and 971 urban neighbourhoods across India. Data is collected through two one-hour interviews in each household, in which individuals are surveyed for a variety of topics such as health, education, employment, gender relations, economic status and marriage[4]. From this survey, I include nineteen of the major states in India[5]. I aggregate the data about school facilities at a district level and then combine it with household and individual-level data. My analysis does not include data from certain states and union territories[6], due to economic and political characteristics[7] that differ from the major states in India. This is intentional in order to avoid potential outliers or observations that may be affected by factors not controlled for in my regression, which could therefore skew the results. Since the Total Sanitation Campaign was implemented in 1999 and the survey was carried out in 2004-2005, I restrict the data to exclude individuals over the age of 24. This follows under the assumption that individuals over the age of 24 in 2004-2005 would not have been enrolled in school in 1999. Therefore,

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[4] The Indian Human Development Survey, available at https://ihds.umd.edu/

[5] In alphabetical order: Andhra Pradesh, Assam, Bihar, Chhattisgarh, Gujarat, Haryana, Himachal Pradesh, Jharkand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttaranchal, Uttar Pradesh and West Bengal.

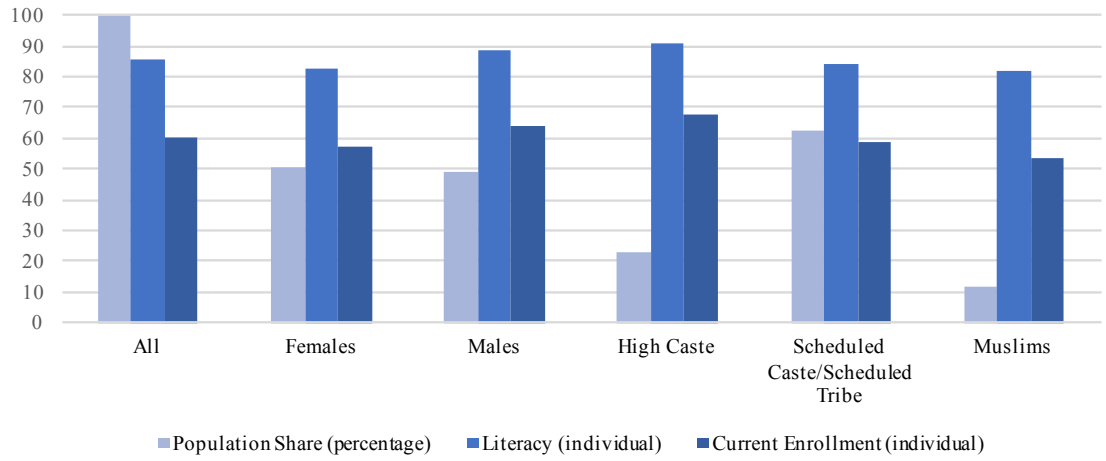
[6] In alphabetical order, the excluded states are: Arunachal Pradesh, Goa, Jammu and Kashmir, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura. The excluded union territories are: Andaman and Nicobar Islands, Chandigarh, Dadra and Nagar Haveli, Daman and Diu, Delhi, Lakshadweep and Puducherry.

[7] Due to hostile border disputes and political tensions, the Northeastern states (officially known as the North East Region, NER) are highly militarized in order to maintain political order. Jammu and Kashmir has been a region of contention between India, Pakistan and China since 1947, with frequent border skirmishes and several armed conflicts. The Armed Forces Special Power Act which was implemented for "disturbed areas" encompasses the Northeastern states and Jammu and Kashmir, and continues to be enforced by the Indian military. Union territories, unlike states, do not have their own governments as they are federal territories mandated by the central government. In accordance with Article 239, Part VIII of the Indian constitution, union territories are under the administrative jurisdiction of the President of India.

the oldest an individual enrolled in school would be at the time the campaign was launched is 18 years old. At the time of the survey, five years later, they would be 24 years old but may still have been exposed to sanitation facilities in their school.

From the sample of individuals aged 5-24, 50.71 percent were females, 49.23 percent were males, 22.84 percent were of higher caste[8], 62.18 percent were Other Backward Caste/Scheduled Caste/Scheduled Tribe[9] (hereafter written as OBC/SC/ST) and 11.95 percent were Muslims. Figure 1.1 shows the sample who reported to be literate or currently enrolled in school and how the proportion changes based on sex, caste and religion.

Figure 1.1: Literacy and Current Enrollment Based On Social Characteristics



[8] Here, higher caste includes individuals self-reporting as Brahmin or another high caste that is not specified or defined by the Indian Human Development Survey.

[9] Other Backward Caste/Scheduled Caste/Scheduled Tribe are hereby used as a collective term to encompass individuals self-reporting as being from an Other Backward Caste, a Scheduled Caste, or a Scheduled Tribe. These are official classifications as mandated in the Indian Constitution, which describes OBCs as "socially and educationally backward classes". Scheduled Castes/Scheduled Tribes are designated groups of "historically disadvantaged" people in India. According to the 2011 census, SC/STs comprise approximately 16.6% and 8.6% of India's population respectively. Reservations in India were introduced for individuals of OBC/SC/ST to provide political representation (Articles 243, 330, 334, Constitution of India 1949) and civil employment (Article 335, Constitution of India 1949).

From Table 1.1, which reports descriptive statistics for the sample, males are approximately 6.8 percent more likely to be literate than females, and individuals of higher caste are more likely to be literate than OBC/SC/STs or Muslims. The mean completed years of education is highest, 6.459 years, for those of a higher caste and lowest for Muslims at 4.957 years. The overall mean seems to be higher than one would expect given that the sample is restricted for individuals aged 5-24, however, completed years of education is specified by the IHDS to range from 0-15 years. This implies that on average, individuals have completed at least five years of education which corresponds to completing 5th standard, or primary school. Primary school completion is expected, as the highest proportion of all individuals reported as literate in India were those who had primary education, at 26.2 percent (Census of India 2001).

The IHDS classifies the highest level of education at a household level for adults aged over 21, which suggests how access to and participation in education may vary across households based on socioeconomic characteristics. The mean is lowest for Muslims – 8.273, which is just over 8th standard – and highest for high-caste individuals – 10.544, corresponding to completing a matriculation examination[10]. These statistics support the results observed for the mean completed years of education, highlighting the educational advantages received by individuals of higher caste contrary to those received by Muslims.

On average, household size does not vary greatly based on social characteristics, and overall fluctuates between six and seven people per household. The mean income per

[10] In India, matriculation examinations are commonly used to reference passing tenth grade in completion of tenth-grade state board exams.

household is lowest, INR48,486.68 per annum[11], for OBC/SC/STs and highest, INR81,235.49[12] per annum, for high-caste individuals. This is indicative of the disadvantages faced by OBC/SC/STs in employment prospects, which can be further attributed to their lack of education.

Table 1.1: Descriptive Statistics, Individuals Aged 5-24

	All	Females	Males	High Caste	Scheduled Caste/Scheduled Tribe	Muslims
Population Share (percentage)	100	50.706	49.293	22.842	62.175	11.95
Literacy (individual)	85.516	82.554	88.394	90.744	83.913	81.777
Current Enrollment (individual)	60.594	57.039	64.049	67.758	58.83	53.795
Mean Completed Years of Education (individual)	5.612	5.368	5.850	6.459	5.365	4.957
Mean Highest Level of Education (household, adults aged 21+)	9.133	9.144	9.123	10.544	8.706	8.273
Mean Household Size	6.842	6.942	6.745	6.637	6.832	7.411
Mean Income (household)	58700.44	58355.64	59035.63	81235.49	48486.68	55101
Number of Observations	58318	28747	29571	13321	36259	6969

Source: Indian Human Development Survey 2005.

Notes: All descriptive statistics are restricted for individuals between the ages of 5 and 24 at the time of the survey. Population share, literacy (ability to read and write a sentence) and current enrollment in school are reported as proportional percentages of the sample. Completed years of education, highest level of adult education in the household, household size and income are reported as means. Literacy, current enrollment in school and mean completed years of education are reported at the individual level. The highest level of education is observed at the household level, for adults aged over 21.

The variation in literacy, current enrollment and completed years of education raises the question of whether these parameters of education are impacted by an individual's access to sanitation facilities in their schools. In my assessment of the variation in these parameters of education, I control for personal and social characteristics

[11] INR48,485.68 is estimated to be USD1,077.48 for an approximated 2005 foreign exchange rate of 1USD=45INR.
[12] Similarly, INR81,235.49 is estimated to be USD1,805.23 for an approximated 2005 foreign exchange rate of 1USD=45INR.

including the age of the individual, sex of the individual, caste of the individual, religion they self-identify with, their household size, where their household is located and their household income.

I build my regression model as follows:

$$\Pr(Y_i = 1|X_i) = \phi(\beta_0 + \beta_1 sanitation_i + \beta_2 age_i + \beta_3 sex_i + \beta_4 highcaste_i + \beta_5 muslim_i + \beta_6 hhsize_i + \beta_7 rural_i + \beta_8 INCOME_i + \varepsilon_i)$$

The probit model is fitted for the binary variables literacy and current enrollment[13], and predicts the probability of a positive outcome for the dependent variable given the independent variables. The probit model automatically corrects for potential heteroskedasticity by reporting robust standard errors.

To analyse the impact an individual's access to sanitation facilities has on their completed years of education, I model an Ordinary Least Squares regression as follows:

$$Y_i = \beta_0 + \beta_1 sanitation_{i1} + \beta_2 age_{i2} + \beta_3 sex_{i3} + \beta_4 highcaste_{i4} + \beta_5 muslim_{i5} + \beta_6 hhsize_{i6} + \beta_7 rural_{i7} + \beta_8 INCOME_{i8} + \varepsilon_i$$

For this study, the variable *sanitation* is further defined for three variables within each regression model as either *toilet* (access to toilets), *water* (access to water), or *both* (access to both toilets and water)[14]. This is to understand whether access to one form of sanitation, and if so, which, has a significant impact on the dependent variable of interest compared to access to both forms of sanitation. Since my emphasis is on the impact of sanitation facilities, the coefficients on *toilet, water* or *both* are the focus of all of the analyses. My independent variables of interest are self-reported personal and social

[13] The Indian Human Development Survey defines literacy as the ability to read and write a sentence. In this study, literacy takes on the absolute value 1 if the individual responded 'yes' in the survey and not-literate takes on the absolute value 0 if the individual responded 'no' in the survey.

[14] The variables are coded as follows: *toilet* = 1 if the individual has access to toilets, and if not, *toilet* = 0. Access to water is coded as *water* = 1, and if there is no access, *water* = 0. Access to both toilets and water is generated as *both* = 1 and no access to both is *both* = 0.

characteristics gathered from the Indian Human Development Survey at an individual or household level.

In the models, *age* is restricted for individuals between 5 and 24 years old, based on my assumption that individuals over the age of 24 in 2004-2005 would not have been enrolled in school in 1999, and individuals under the age of 5 would be too young to be educated. This assumption is supported by summary statistics on education for individuals under the age of 5 years old[15]. An individual's age is included in the model to measure its impact on education – if younger or older students are more or less likely to be educated. Subsequently, I disaggregate the sample based on primary school-aged and secondary school-aged students.

The following independent variables are binary in nature: *sex,* where female = 1 and male = 0, *highcaste* (high caste); where Brahmin or another self-reported high caste = 1 and OBC/SC/ST = 0; and *muslim* (Muslim), where identifying as a Muslim = 1 and non-Muslim = 0. These variables are of interest to understand, firstly, whether the social characteristic of an individual impacts education and secondly, to analyse whether the impact of sanitation changes when the sample is disaggregated and regressions are conditional on these social characteristics. This is further motivated by the variation in average education attainment for individuals who identify as female or male, high caste or OBC/SC/ST, or Muslim when compared to the overall sample population - as seen in Table 1.1.

[15] The data collected by the IHDS reports that on average, approximately 4.7% of children under the age of 5 are literate and 9% are currently enrolled in school. In addition, the average completed years of school is 0.017.

The independent variable for household size (*hhsize)* is restricted to include households with less than or equal to 15 people. This is in order to observe whether the size of a household has an impact on education – it can be hypothesised that a smaller household has a positive impact on education for multiple reasons. This may be explained because if there are more children in the household, they may have less access to health and education due to the higher amount of investment required.

The variable on whether a household is rural or not (*rural)* is a binary variable reported at the individual level, where living in a rural area = 1 and living in a non-rural area = 0. This is included in the model because of the impact an individual's residence may have on their education. Since the study assesses sanitation facilities in government schools and is restricted as such, it can be hypothesised that rural households have a positive impact on education. This is because schools in rural areas are more likely to be government schools and have been included as treatment schools in the Total Sanitation Campaign, which focused predominantly on spreading sanitation to rural areas.

Individual income is controlled for under the variable *INCOME,* which is restricted to be greater than or equal to INR6,000[16] and less than or equal to INR175,000[17]. These values correspond with the 5th and 95th percentiles of the reported income for individuals less than 24 years old. This is representative of the income disparity in the sample, as the standard deviation is INR90,654.12[18].

[16] INR6,000 is estimated to be USD133.33 for an approximated 2005 foreign exchange rate of 1USD=45INR.
[17] INR175,000 is estimated to be USD3,888.88 for an approximated 2005 foreign exchange rate of 1USD=45INR.
[18] INR90,654.12 is estimated to be USD2,014.54 for an approximated 2005 foreign exchange rate of 1USD=45INR.

In addition, I control for the two independent variables school features (*schoolfeatures*) and the number of full-time teachers at the school (*ftteachers*), as specifications in my models. Here, school features *(schoolfeatures)* is binary in nature, where the school having certain features = 1 and not-having certain features = 0. The features, as reported in the school facilities dataset, include one or more of the following: access to electricity, classrooms, chairs and desks, meal provision for students, free books, free uniforms, scholarships. This is in order to hold fixed the impact additional school facilities aside from sanitation facilities may have on education. I hypothesise that school features (*schoolfeatures*) have a positive impact on education, as it creates incentive for students to go to school when they are receiving private benefits in the form of nutrition, financial aid or academic resources.

The number of full-time teachers employed at the school (*ftteachers*) is collected from the school facilities dataset. I hypothesise that this variable has a positive relationship with education, because a larger number of teachers indicates the increased likelihood that more students will be in classes with a present teacher. I introduce both variables to the model sequentially, to assess whether the coefficients on the sanitation variables change when additional school infrastructure are provided or there are full-time teachers. Tables 1.1-2.3 indicate if school infrastructure or the number of full-time teachers has been specified in the model or not, and accordingly, whether the coefficients of the included independent variables change.

Results

The results of my assessment of the impact of sanitation on education in Indian government schools are reported in Tables 1.1-2.3. In addition, results are provided for regressions that are restricted based on the following characteristics: females, males, high caste and OBC/SC/ST. This is to observe whether the introduction of sanitation facilities affects these demographics. In the results, the first column (1) denotes the results without the variables full-time teachers (*ftteachers*) or school facilities (*schoolfacilities*) as fixed effects. The second column (2) includes school facilities (*schoolfacilities*) and the third (3) includes the former and full-time teachers *(ftteachers)*. Finally, all of the estimates are weighted for using the IHDS weights.

For individuals between the age of 5-24, Tables 1.1-1.3 present the results on literacy, Tables 1.4-1.6 present the results on current enrollment and Tables 1.7-1.9 present the results on completed years of education. Tables 1.1-1.5 show that while there is a positive relationship between sanitation and literacy and current enrollment, they are not of statistical significance. In Table 1.6, column (3), however, access to both toilets and drinking water is estimated to increase the probability that an individual is currently enrolled in school by 0.062 at a 10 percent level of significance. Table 1.7 shows that a unit increase in access to toilets increases educational attainment by 0.2 years at a 1 percent level of significance. This effect continues when individuals have both, however, the level of significance decreases to 5 percent. Table 1.8 shows that water does not have as significant of an impact on educational attainment except in column (3) under the new specifications, whereby a unit increase in access to water is estimated to increase an individual's completed years of education by 0.08 years at a 10 percent level of

significance. Furthermore, this positive impact is seen when an individual has a unit increase in access to both toilets and drinking water, as they are predicted to complete 0.12 more years of education at a 5 percent level of significance. These results support the case that access to sanitation improves education through the channel of health, which in turn increases learning abilities and performance.

Tables 1.1-1.9 indicate that the variables that control for age, sex, high caste, Muslim, household size and income consistently report significant coefficients. This indicates that as children attend school from a younger age and thereby are in school for a longer duration of time, they are more likely to be literate. Children who are of high caste and have higher income are predicted to be more literate as well. This can be explained by the social discrimination between high-caste and lower-caste individuals in education and employment. Individuals of a higher caste are more likely to access education, be employed in the professional sector (Desai and Kulkarni, 2008), earn greater income and therefore be able to send their children to school.

On the other hand, the variables Muslim and household size indicate a negative relationship with literacy. This is explained by the educational inequalities attributed to religion as well, where Muslims have been disadvantaged in access to formal sector employment and education as well (Desai and Kulkarni, 2008). The negative, significant coefficient on household size supports the argument that an additional child in the family reduces the probability of being educated, especially for rural households, due to the additional incurred financial costs (Kugler and Kumar 2015). The same relationships are seen for older students too, however, Tables 1.1-1.3 and 1.7-1.9 report negative coefficients on *sex* at a 1% level of significance. This is indicative of the gender

disparities not only between males and females through the declining enrollment faced by girls in secondary education (Adukia, 2016), which I argue is due to inadequate sanitation facilities.

Literacy

Table 2.1a reports the results of the probit regression model for the impact of sanitation on literacy for individuals aged 5-13 and Table 2.1b reports the same for individuals aged 13-18. I disaggregate the samples by age for all of the regressions to understand further if there is an impact on primary school students compared to secondary school students.

While there is a positive relationship between access to toilets, access to water, or access to both toilets and water on the likelihood of being literate, the reported coefficients are not statistically significant. However, Table 2.1a shows that for primary OBC/SC/STs aged 5-13, access to toilets corresponds with a coefficient of 0.18 on literacy. To understand this impact further, I conduct an average marginal effects test, which shows that a unit-increase in access to toilets corresponds in a 0.035 increase in the probability of being literate. This suggests that schools that have toilet infrastructure are likely to have either invested in it themselves or as the result of a policy initiative in order to increase access to and participation in education. Such an initiative is a motivating factor to send OBC/SC/STs to school as it would attempt to improve their health through sanitation facilities, where they may otherwise be disadvantaged in health due to sociocultural factors.

Looking at the impact of drinking water on literacy shows that it has a positive relationship with literacy for both age categories, however, it is not of statistical

significance. Table 2.1a and Table 2.1b reports the coefficient to be 0.1 times at a 10 percent level of significance and 5 percent level of significance respectively. For boys aged 5-13, a unit-increase corresponds with a 0.02 increase in the probability that they will be literate, indicating a marginal impact of drinking water on literacy. For the boys who are 13-18 years old, the marginal effect is lower, at 0.014. This shows that the marginal effect is stronger for younger boys. This lends weight to the importance of sanitation as a means by which health outcomes can be improved, which indicates a stronger effect on literacy due to improved learning outcomes. Moreover, access to both toilets and drinking water has a positive relationship with literacy, specifically for boys aged 5-13. Table 2.1a reports a coefficient of 0.13 for primary school-aged boys when they have access to both. Further, the marginal effect of access to both sanitation facilities on a younger boy's literacy is 0.025, which is higher than the marginal effect of access to water. This result may be dominated by the impact drinking water has on younger boys, but is indicative that access to both sanitation facilities has a greater positive impact on literacy due to the increased benefits received by both rather than solely toilets or drinking water.

On the other hand, access to water indicates a negative relationship for girls, but the coefficients are statistically insignificant. It is surprising as to why there is a negative relationship between girls' literacy and access to drinking water but there are two possible explanations for this. The first is that access to water could imply that a school is less financially accessible for poorer girls, and the second is that if a school does have water but its source is outside the land of the school, then girls may be collecting the

water and thus reducing their time spent in school (Nauges and Strand, 2011; Sekhri, 2013).

The contrasting results based on the sex variable indicates that while boys may nonetheless have a higher likelihood of being literate (Bhagavatheeswaran, 2016), access to sanitation is indicative of improvements on health outcomes from a younger age (thus explaining the significance for boys aged 5-13), which in turn increases their learning potential (Augsburg and Rodríguez 2015; Agramoorthy et al. 2009). This consequently increases the likelihood of them being literate due to greater learning abilities afforded by better health.

Furthermore, it is notable that the marginal effect of sanitation on literacy is highest for SC/ST individuals. This can be explained by the fact that this social group includes for SC/ST girls as well, which perhaps shows that despite the insignificant result for the restriction on all girls (as seen in Table 2.1), SC/ST girls are benefiting from the scheme. In addition, this indicates that SC/ST youth benefited from the Total Sanitation Campaign as they were able to participate in education, whereas they would have otherwise been excluded from school due to social discrimination based on caste (Jamdade et al., 2017). In turn, this improved their probability of being literate.

Current Enrollment

Access to sanitation facilities are hypothesised to positively impact current enrollment in a school, and the results support this – however, they are only statistically significant for older girls who are assumed to attend secondary school. Table 2.2b shows that the coefficient for girls aged 13-18 is 0.2 when they have access to toilets at a 10 percent level of significance; with a unit-increase in access to toilets having a marginal

effect of 0.036 on the probability of being currently enrolled. The coefficient on access to water is 0.17 at 1 percent level of significance, with a marginal effect of 0.051 on the probability of being currently enrolled. Finally, the coefficient on access to both is 0.22 at a 1 percent level of significance, with a marginal effect of 0.067 on the probability of being currently enrolled. The marginal effect on the probability of being currently enrolled in school is higher when girls aged 13-18 have access to both sanitation facilities rather than just one, which can be explained by how sanitation facilities "pull" (Birdthistle et al., 2011) girls into school. Moreover, having access to water may be important for older girls because it maintains hygienic hand-washing practices when they are menstruating. This strongly aligns with the argument that the lack of sanitation infrastructure impedes girls' schooling when they are menstruating (Fentiman et al. 1999; Kirk and Sommer, 2006; Adukia, 2017).

Providing sanitation facilities means that older girls would not be compelled into dropping out of school upon reaching puberty due to menstruation, but also due to safety reasons (Adukia, 2017). Privacy and sexual safety may be important channels driving the impacts of school latrines in upper primary schools (Adukia, 2016). With sanitation facilities in place, especially toilets, older girls may feel safer attending school and similarly, their parents may be more willing to enrol them in school with this knowledge. This has further implications for shaping future policy in order to reduce gender disparities in education and create incentive for girls to remain enrolled in school, thereby increasing their human capital.

Completed Years of Education

The results of the linear regression model show that sanitation facilities impact completed years of education more significantly than they impacted the probability of being literate or currently enrolled in school. Table 2.3a shows that access to toilets positively impact all primary aged individuals, and more specifically OBC/SC/STs and girls.

The results show that a one-unit increase in access to toilets corresponds to OBC/SC/STs completing 0.16 more years of education at a 5 percent level of significance and similarly, girls completing 0.18 more years of education at a 10 percent level of significance. This is supplemented by the results for both girls and OBC/SC/STs in the category of 13-18 year olds. Table 2.3b shows that a one-unit increase in access to toilets predicts that girls aged 13-18 complete 0.5 more years of education at a 10 percent level of significance and likewise, OBC/SC/STs complete 0.47 more years of education at a 5 percent level of significance. This indicates that completing additional more years of education translates into the ability of upward mobility in the education system by completing high school, rather than just primary school. While access to both has a positive relationship with SC/STs, it is not of statistical significance. However, access to both sanitation facilities has a statistically significant impact on girls aged 5 to 13 years.

A one-unit increase in access to both sanitation facilities estimates that girls complete 0.1 more years of education at a 10 percent level of significance, as seen in Table 2.3a. This suggests that access to both sanitation facilities increases primary-school aged females' completed years of education because it improves their health, and consequently, their ability to stay in school longer and attain more education. However,

access to a toilet is more statistically significant for females as compared to access to drinking water. This suggests that toilets may have a more significant impact on improving health by actively reducing the amount of urea or faecal bacteria in the surrounding area. Thus a larger number of students are retained in school and are able to complete more years of education. In addition, this result can explain how sanitation facilities' effects on improved health outcomes positively impact learning abilities and performance, which thus allows girls to attain more years of education.

On the other hand, while access to drinking water has a positive relationship with completed years of education, it is less statistically significant. Table 2.3b indicates that high caste individuals aged between 13-18 complete 0.2 more years of education when their access to drinking water increases by one unit at a 5 percent level of significance. Access to both sanitation facilities has a positive impact for high-caste individuals aged 13-18 as well, with a one-unit increase in access to both facilities predicting an increase by 0.284 years at a 10 percent level of significance. Due to the social advantages that high caste individuals have in education, this is not a surprising result. This does imply, however, that access to drinking water promotes hygienic practices in schools which keeps this community healthier and thus, allow them to complete more years of education.

Finally, boys aged 13-18 are predicted to complete 0.271 more years of education at a 5 percent level of significance when there is a unit increase in their access to both. This result is interesting given that neither access to toilets nor access to drinking water reported statistically significant coefficients, despite indicating a positive relationship with completed years of education. This highlights the significance of access to both

sanitation facilities and further indicates that mobility in education attainment increases as their access to sanitation facilities increases. Moreover, this supports my argument that access to both sanitation facilities – drinking water and latrine use - work in conjunction with each other to affect education attainment for students by improving their awareness about hygiene and improving their learning outcomes.

Higher completion of schooling is indicative of not only the ability to stay in school longer, but moreover, the ability to pursue higher degrees (such as a matriculation examination or even completion of 12^{th} grade). This is important because it would allow them to seek opportunities outside of their village or district as they would be viewed as more employable if they are more educated. Moreover, the statistically significant results for girls and SC/STs is indicative of increased educational attainment for individuals historically held back from education due to social discrimination through caste-based exclusion (Hartmann et al., 2015; Bhagavatheeswaran, 2016).

Limitations

Some of the results that arose from my regressions were surprising, especially those that reported negative coefficients on sanitation. It is unclear as to how sanitation facilities could negatively impact education, however, this may be an issue with possible discrepancies in the data, or my choice of model. I anticipate the need to address endogeneity concerns and ensure that I am assessing the causal impact of the sanitation programme on education.

Since the campaign was launched in 1999 and the data is obtained in 2004-2005, the duration of time between data collection and the campaign implementation could mitigate any lags that could impact the effectiveness of the campaign. However, there is the possibility that the data is affected by extraneous factors that may have impacted sanitation aside from the Total Sanitation Campaign, that are not accounted for in the model.

Future research would study changes in the impact of sanitation by using more recent data from the second round of the IHDS in 2011-2012, as this would allow for a more in-depth analysis. It would be interesting to examine how changes in governance – for instance, the current political administration is geared towards promoting sanitation facilities in schools across India compared to past administrations – affect education outcomes.

Conclusion

Overall, sanitation facilities are shown to positively impact education in Indian government schools. Notably, the impact itself is stronger based on which education parameter is measured and on certain social characteristics - as seen from the results, the variation is predominantly based on age, sex and caste. Access to sanitation facilities has a less significant impact on the probability of being literate. This can be explained by the impact of supplementary factors such as teachers, quality of education and students' attendance at school.

The probability of being currently enrolled has a more statistically significant positive relationship with access to sanitation facilities. This is specifically seen for females aged 13-18, since this would be when dropout rates are highest for girls due to menstruation. This aligns with the existing literature that measures the impact of toilets on female attendance rates at school, and can be attributed to the theory that access to sanitation affects girls' ability to participate in school during menstruation. It is possible that if a school has neither a toilet facility nor access to drinking water, parents are more unwilling to send their female child to school, or the female student herself is unable to maintain enrollment in school.

Across all three education parameters, even though they are not as statistically significant, the most relevant finding is that access to both toilets and water have a stronger impact than just toilets or water. This lends weight to the potential improvements in education driven by greater investments in in sanitation infrastructure across schools in India. In addition, it suggests that a stronger emphasis be placed on spreading the

importance of sanitation and hygiene in order to effect behavioural changes that would promote sanitation use.

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Table 1.1: Literacy and Toilets, Individuals Aged 5-24

	(1)	(2)	(3)
Toilet	0.058	0.057	0.0489
	(0.055)	(0.056)	(0.057)
Age	0.043***	0.043***	0.043***
	(0.002)	(0.002)	(0.002)
Sex	-0.325***	-0.325***	-0.325***
	(0.02)	(0.02)	(0.02)
High Caste	0.255***	0.255***	0.254***
	(0.026)	(0.026)	(0.026)
Muslim	-0.194***	-0.194***	-0.194***
	(0.031)	(0.031)	(0.031)
Household Size	-0.038***	-0.038***	-0.038***
	(0.004)	(0.004)	(0.004)
Rural	-0.089***	-0.089***	-0.085***
	(0.024)	(0.024)	(0.024)
Income	4.33e-06***	4.33e-06***	4.33e-06***
	(3.43e-07)	(3.43e-07)	(3.44e-07)
School Features	No	Yes	Yes
Full-Time Teachers	No	No	Yes
N	51821	51821	51821
R^2	0.098	0.098	0.098

Notes:

***: p<0.01, **: p<0.05, *: p<0.10

Robust Standard Errors are reported in parentheses.

Table 1.2: Literacy and Water, Individuals Aged 5-24

	(1)	(2)	(3)
Water	0.019	0.019	1.019
	(0.027)	(0.027)	(0.027)
Age	0.043***	0.043***	0.043***
	(0.002)	(0.002)	(0.002)
Sex	-0.326***	-0.326***	-0.326***
	(0.020)	(0.020)	(0.020)
High Caste	0.257***	0.256***	0.256***
	(0.026)	(0.026)	(0.026)
Muslim	-0.194***	-0.194***	-0.194***
	(0.031)	(0.031)	(0.031)
Household Size	-0.038***	-0.038***	-0.038***
	(0.004)	(0.004)	(0.004)
Rural	-0.098***	-0.098***	-0.09***
	(0.022)	(0.022)	(0.023)
Income	4.35e-06***	4.35e-06***	4.34e-06***
	(3.42e-07)	(3.42e-07)	(3.43e-07)
School Features	No	Yes	Yes
Full-Time Teachers	No	No	Yes
N	51821	51821	51821
R^2	0.098	0.098	0.098

Notes:

***: p<0.01, **: p<0.05, *: p<0.10

Robust Standard Errors are reported in parentheses.

Table 1.3: Literacy and Both, Individuals Aged 5-24

	(1)	(2)	(3)
Both	0.025	0.025	0.027
	(0.035)	(0.035)	(0.035)
Age	0.043***	0.043***	0.043***
	(0.002)	(0.002)	(0.002)
Sex	-0.326***	-0.326***	-0.326***
	(0.020)	(0.020)	(0.020)
High Caste	0.256***	0.256***	0.255***
	(0.026)	(0.026)	(0.026)
Muslim	-0.194***	-0.194***	-0.194***
	(0.031)	(0.031)	(0.031)
Household Size	-0.038***	-0.038***	-0.038***
	(0.004)	(0.004)	(0.004)
Rural	-0.095***	-0.095***	-0.088***
	(0.023)	(0.023)	(0.024)
Income	4.35e-06***	4.34e-06***	4.33e-06***
	(3.42e-07)	(3.42e-07)	(3.42e-07)
School Features	No	Yes	Yes
Full-Time Teachers	No	No	Yes
N	51821	51821	51821
R^2	0.098	0.098	0.098

Notes:

***: p<0.01, **: p<0.05, *: p<0.10

Robust Standard Errors are reported in parentheses.

Table 1.4: Current Enrollment and Toilets, Individuals Aged 5-24

	(1)	(2)	(3)
Toilet	0.072	0.0683	0.022
	(0.058)	(0.059)	(0.060)
Age	-0.214***	-0.214***	-0.214***
	(0.003)	(0.003)	(0.003)
Sex	0.073***	0.072***	0.072***
	(0.021)	(0.021)	(0.021)
High Caste	0.044*	0.044*	0.044*
	(0.026)	(0.026)	(0.026)
Muslim	-0.22***	-0.22***	-0.22***
	(0.038)	(0.038)	(0.038)
Household Size	-0.009*	-0.009*	-0.009*
	(0.005)	(0.005)	(0.005)
Rural	-0.001	-0.003	0.019
	(0.026)	(0.026)	(0.026)
Income	2.69e-06***	2.7e-06***	2.67e-06***
	(3.14e-07)	(3.14e-07)	(3.14e-07)
School Features	No	Yes	Yes
Full-Time Teachers	No	No	Yes
N	51821	51821	51821
R^2	0.4	0.4	0.4

Notes:

***: p<0.01, **: p<0.05, *: p<0.10.

Robust Standard Errors are reported in parentheses.

Table 1.5: Current Enrollment and Water, Individuals Aged 5-24

	(1)	(2)	(3)
Water	0.019	0.018	0.038
	(0.027)	(0.027)	(0.028)
Age	-0.214***	-0.214***	0.205
	(0.003)	(0.003)	(0.139)
Sex	0.072***	0.072***	0.072***
	(0.021)	(0.021)	(0.021)
High Caste	0.046*	0.045*	0.043*
	(0.026)	(0.026)	(0.026)
Muslim	-0.220***	-0.220***	-0.224***
	(0.038)	(0.038)	(0.038)
Household Size	-0.009**	-0.009**	-0.010**
	(0.005)	(0.005)	(0.005)
Rural	-0.010	-0.012	0.020
	(0.026)	(0.026)	(0.026)
Income	2.71e-06***	2.72e-06***	2.66e-06***
	(3.12e-07)	(3.12e-07)	(3.13e-07)
School Features	No	Yes	Yes
Full-Time Teachers	No	No	Yes
N	51821	51821	51821
R^2	0.4	0.4	0.4

Notes:

***: p<0.01, **: p<0.05, *: p<0.10

Robust Standard Errors are reported in parentheses.

Table 1.6: Current Enrollment and Both, Individuals Aged 5-24

	(1)	(2)	(3)
Both	0.052	0.051	0.062*
	(0.034)	(0.034)	(0.034)
Age	-0.214***	-0.214***	-0.214***
	(0.003)	(0.003)	(0.003)
Sex	0.072***	0.072***	0.073***
	(0.021)	(0.021)	(0.021)
High Caste	0.045*	0.045*	0.042
	(0.026)	(0.026)	(0.026)
Muslim	-0.221***	-0.221***	-0.225***
	(0.038)	(0.038)	(0.038)
Household Size	-0.009**	-0.009**	-0.01**
	(0.005)	(0.005)	(0.005)
Rural	-0.005	-0.007	0.024
	(0.026)	(0.026)	(0.026)
Income	2.70e-06***	2.70e-06***	2.65e-06***
	(3.12e-07)	(3.12e-07)	(3.12e-07)
School Features	No	Yes	Yes
Full-Time Teachers	No	No	Yes
N	51821	51821	51821
R^2	0.4	0.4	0.4

Notes:

***: p<0.01, **: p<0.05, *: p<0.10

Robust Standard Errors are reported in parentheses.

Table 1.7: Completed Years of Education and Toilets, Individuals Aged 5-24

	(1)	(2)	(3)
Toilet	0.274***	0.272***	0.257**
	(0.104)	(0.105)	(0.107)
Age	0.423***	0.423***	0.423***
	(0.004)	(0.004)	(0.004)
Sex	-0.659***	-0.659***	-0.659***
	(0.037)	(0.037)	(0.037)
High Caste	0.779***	0.779***	0.778***
	(0.045)	(0.045)	(0.045)
Muslim	-0.47***	-0.47***	-0.471***
	(0.060)	(0.060)	(0.060)
Household Size	-0.129***	-0.129***	-0.129***
	(0.009)	(0.009)	(0.009)
Rural	-0.332***	-0.333***	-0.325***
	(0.046)	(0.046)	(0.046)
Income	1.56e-05***	1.56e-05***	1.56e-05***
	(5.45e-07)	(5.55e-07)	(5.56e-07)
School Features	No	Yes	Yes
Full-Time Teachers	No	No	Yes
N	51821	51821	51821
R^2	0.465	0.465	0.465

Notes:

***: p<0.01, **: p<0.05, *: p<0.10

Robust Standard Errors are reported in parentheses.

Table 1.8: Completed Years of Education and Water, Individuals Aged 5-24

	(1)	(2)	(3)
Water	0.069	0.069	0.082*
	(0.046)	(0.046)	(0.047)
Age	0.423***	0.423***	0.423***
	(0.004)	(0.004)	(0.004)
Sex	-0.661***	-0.661***	-0.661***
	(0.037)	(0.037)	(0.037)
High Caste	0.785***	0.784***	0.782***
	(0.045)	(0.045)	(0.045)
Muslim	-0.469***	-0.469***	-0.471***
	(0.060)	(0.060)	(0.060)
Household Size	-0.13***	-0.13***	-0.13***
	(0.009)	(0.009)	(0.009)
Rural	-0.366***	-0.367***	-0.347***
	(0.043)	(0.043)	(0.044)
Income	1.57e-05***	1.57e-05***	1.57e-05***
	(5.52e-07)	(5.52e-07)	(5.54e-07)
School Features	No	Yes	Yes
Full-Time Teachers	No	No	Yes
N	51821	51821	51821
R^2	0.465	0.465	0.465

Notes:

***: p<0.01, **: p<0.05, *: p<0.10

Robust Standard Errors are reported in parentheses.

Table 1.9: Completed Years of Education and Both, Individuals Aged 5-24

	(1)	(2)	(3)
Both	0.112*	0.112*	0.118**
	(0.059)	(0.059)	(0.059)
Age	0.423***	0.423***	0.423***
	(0.004)	(0.004)	(0.004)
Sex	-0.66***	-0.66***	-0.66***
	(0.037)	(0.037)	(0.037)
High Caste	0.783***	0.783***	0.781***
	(0.045)	(0.045)	(0.045)
Muslim	-0.471***	-0.471***	-0.472***
	(0.060)	(0.060)	(0.060)
Household Size	-0.129***	-0.129***	-0.13***
	(0.009)	(0.009)	(0.009)
Rural	-0.356***	-0.357***	-0.339***
	(0.044)	(0.044)	(0.045)
Income	1.57e-05***	1.57e-05***	1.56e-05***
	(5.51e-07)	(5.51e-07)	(5.53e-07)
School Features	No	Yes	Yes
Full-Time Teachers	No	No	Yes
N	51821	51821	51821
R^2	0.465	0.465	0.465

Notes:
***: p<0.01, **: p<0.05, *: p<0.10
Robust Standard Errors are reported in parentheses.

Table 2.1a: Literacy and Sanitation, Aged 5-13

	Toilet			Water			Both				
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	N	R^2
All	0.059	0.060	0.052	0.021	0.021	0.025	0.062	0.062	0.064	23842	0.281
	(0.072)	(0.072)	(0.072)	(0.038)	(0.038)	(0.039)	(0.046)	(0.046)	(0.046)		
Females	0.129	0.133	0.128	-0.078	-0.079	-0.076	-0.019	-0.019	-0.017	11450	0.263
	(0.102)	(0.102)	(0.102)	(0.055)	(0.055)	(0.055)	(0.065)	(0.065)	(0.065)		
Males	-0.195	-0.021	-0.032	0.108**	0.108**	0.116**	0.129**	0.129**	0.132**	12392	0.304
	(0.102)	(0.102)	(0.102)	(0.052)	(0.052)	(0.053)	(0.064)	(0.064)	(0.064)		
High Caste	-0.137	-0.139	-0.136	0.012	0.012	0.011	0.078	0.078	0.076	11450	0.263
	(0.176)	(0.176)	(0.176)	(0.089)	(0.089)	(0.089)	(0.106)	(0.106)	(0.107)		
SC/ST	0.18**	0.18**	0.173**	-0.024	-0.024	-0.018	0.039	0.039	0.039	15106	0.295
	(0.086)	(0.086)	(0.086)	(0.047)	(0.047)	(0.0479	(0.057)	(0.057)	(0.058)		
School Features	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes		
Full-Time Teachers	No	No	Yes	No	No	Yes	No	No	Yes		

Notes:

***: p<0.01, **: p<0.05, *: p<0.10. Robust Standard Errors are reported in parentheses.

Table 2.1b: Literacy and Sanitation, Aged 13-18

	Toilet			Water			Both				
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	N	R^2
All	-0.042	-0.049	-0.053	0.024	0.024	0.026	0.002	0.005	0.005	15953	0.124
	(0.126)	(0.129)	(0.135)	(0.070)	(0.070)	(0.072)	(0.097)	(0.096)	(0.096)		
Females	0.056	0.051	-0.017	-0.110	-0.109	-0.084	-0.138	-0.134	-0.128	7887	0.124
	(0.169)	(0.172)	(0.179)	(0.098)	(0.096)	(0.099)	(0.131)	(0.129)	(0.130)		
Males	-0.168	-0.172	-0.075	0.172*	0.170*	0.141	0.183	0.183	0.175	8066	0.125
	(0.167)	(0.169)	(0.173)	(0.090)	(0.090)	(0.092)	(0.118)	(0.118)	(0.117)		
High Caste	0.025	0.045	0.008	0.073	0.074	0.086	0.107	0.125	0.125	3456	0.15
	(0.288)	(0.291)	(0.293)	(0.132)	(0.132)	(0.133)	(0.156)	(0.158)	(0.159)		
SC/ST	0.109	0.104	0.101	0.015	0.017	0.022	0.014	0.019	0.019	9914	0.124
	(0.154)	(0.157)	(0.166)	(0.090)	(0.090)	(0.090)	(0.128)	(0.126)	(0.126)		
School Features	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes		
Full-Time Teachers	No	No	Yes	No	No	Yes	No	No	Yes		

Notes:

***: p<0.01, **: p<0.05, *: p<0.10. Robust Standard Errors are reported in parentheses.

Table 2.2a: Current Enrollment and Sanitation, Aged 5-13

	Toilet			Water			Both				
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	N	R^2
All	0.121	0.122	0.049	-0.104	-0.104	-0.076	-0.080	-0.082	-0.072	23842	0.105
	(0.139)	(0.139)	(0.146)	(0.066)	(0.066)	(0.068)	(0.082)	(0.082)	(0.083)		
Females	0.175	0.173	0.068	-0.093	-0.093	-0.058	-0.057	-0.057	-0.053	11450	0.111
	(0.169)	(0.169)	(0.176)	(0.101)	(0.101)	(0.102)	(0.118)	(0.118)	(0.120)		
Males	0.059	0.056	0.013	-0.138**	-0.14**	-0.123*	-0.134	-0.142	-0.131	12392	0.111
	(0.225)	(0.220)	(0.228)	(0.069)	(0.070)	(0.073)	(0.107)	(0.105)	(0.107)		
High Caste	-0.47	-0.471	-0.5	-0.088	-0.088	-0.087	-0.162	-0.163	-0.164	5093	0.137
	(0.335)	(0.335)	(0.340)	(0.221)	(0.220)	(0.223)	(0.256)	(0.255)	(0.254)		
SC/ST	0.080	0.083	0.017	-0.153**	-0.156**	-0.126*	-0.103	-0.11	-0.097	15106	0.093
	(0.170)	(0.168)	(0.178)	(0.069)	(0.069)	(0.069)	(0.092)	(0.092)	(0.092)		
School Features	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes		
Full-Time Teachers	No	No	Yes	No	No	Yes	No	No	Yes		

Notes:

***: p<0.01, **: p<0.05, *: p<0.10. Robust Standard Errors are reported in parentheses.

Table 2.2b: Current Enrollment and Sanitation, Aged 13-18

	Toilet			Water			Both				
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	N	R^2
All	0.167*	0.149*	0.098	0.042	0.037	0.062	0.091*	0.085	0.097*	1953	0.141
	(0.087)	(0.088)	(0.090)	(0.044)	(0.044)	(0.045)	(0.055)	(0.055)	(0.056)		
Females	0.199*	0.176	0.116	0.138**	0.133**	0.166***	0.207***	0.202***	0.216***	7887	0.121
	(0.121)	(0.121)	(0.125)	(0.061)	(0.061)	(0.062)	(0.077)	(0.078)	(0.078)		
Males	0.129	0.115	0.073	-0.059	-0.064	-0.048	-0.032	-0.039	-0.03	8067	0.16
	(0.124)	(0.125)	(0.127)	(0.063)	(0.063)	(0.065)	(0.078)	(0.078)	(0.079)		
High Caste	0.082	0.085	0.024	0.069	0.067	0.083	0.070	0.07	0.075	3560	0.15
	(0.200)	(0.201)	(0.204)	(0.101)	(0.101)	(0.101)	(0.123)	(0.123)	(0.124)		
SC/ST	0.077	0.055	0.007	0.022	0.020	0.042	0.072	0.068	0.079	9914	0.134
	(0.108)	(0.108)	(0.112)	(0.057)	(0.057)	(0.060)	(0.073)	(0.073)	(0.074)		
School Features	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes		
Full-Time Teachers	No	No	Yes	No	No	Yes	No	No	Yes		

Notes:

***: p<0.01, **: p<0.05, *: p<0.10. Robust Standard Errors are reported in parentheses.

Table 2.3a: Completed Years of Education and Sanitation, Aged 5-13

	Toilet			Water			Both				
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	N	R^2
All	0.133**	0.129**	0.138**	0.046	0.045	0.045	0.078*	0.076*	0.076*	23842	0.673
	(0.065)	(0.065)	(0.065)	(0.035)	(0.035)	(0.036)	(0.041)	(0.041)	(0.042)		
Females	0.188*	0.183*	0.185*	0.067	0.065	0.069	0.107*	0.104*	0.106*	11450	0.659
	(0.010)	(0.010)	(0.010)	(0.052)	(0.052)	(0.054)	(0.059)	(0.059)	(0.060)		
Males	0.081	0.079	0.093	0.028	0.027	0.022	0.047	0.047	0.043	12392	0.689
	(0.082)	(0.083)	(0.083)	(0.044)	(0.044)	(0.045)	(0.055)	(0.055)	(0.055)		
High Caste	0.086	0.086	0.098	0.119*	0.119*	0.116	0.107	0.107	0.103	5134	0.727
	(0.143)	(0.145)	(0.145)	(0.071)	(0.071)	(0.071)	(0.083)	(0.083)	(0.083)		
SC/ST	0.18**	0.176**	0.158**	0.002	0.001	0.013	0.067	0.067	0.074	15106	0.676
	(0.078)	(0.078)	(0.078)	(0.044)	(0.044)	(0.045)	(0.053)	(0.053)	(0.054)		
School Features	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes		
Full-Time Teachers	No	No	Yes	No	No	Yes	No	No	Yes		

Notes:

***: p<0.01, **: p<0.05, *: p<0.10. Robust Standard Errors are reported in parentheses.

Table 2.3b: Completed Years of Education and Sanitation, Aged 13-18

	Toilet			Water			Both				
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	N	R^2
All	0.331*	0.315*	0.229	0.044	0.039	0.081	0.136*	0.128	0.151	15953	0.207
	(0.188)	(0.190)	(0.196)	(0.089)	(0.089)	(0.092)	(0.113)	(0.113)	(0.114)		
Females	0.533*	0.507*	0.321	-0.148	-0.155	-0.078	-0.07	-0.08	-0.041	7887	0.2
	(0.287)	(0.291)	(0.302)	(0.139)	(0.139)	(0.142)	(0.183)	(0.184)	(0.184)		
Males	0.099	0.095	0.107	0.174	0.172	0.176	0.273**	0.271**	0.271**	8066	0.238
	(0.221)	(0.223)	(0.224)	(0.107)	(0.107)	(0.111)	(0.122)	(0.122)	(0.124)		
High Caste	0.32	0.319	0.249	0.246*	0.25*	0.269**	0.273	0.276	0.284*	3560	0.213
	(0.382)	(0.382)	(0.383)	(0.137)	(0.137)	(0.137)	(0.170)	(0.171)	(0.171)		
SC/ST	0.619***	0.588**	0.471**	-0.067	-0.071	-0.008	0.101	0.093	0.127	9914	0.183
	(0.241)	(0.246)	(0.254)	(0.125)	(0.125)	(0.129)	(0.162)	(0.162)	(0.163)		
School Features	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes		
Full-Time Teachers	No	No	Yes	No	No	Yes	No	No	Yes		

Notes:

***: p<0.01, **: p<0.05, *: p<0.10. Robust Standard Errors are reported in parentheses.