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Impact of Indoor Piped Drinking Water on Educational Outcomes in Rural India

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Abstract
This paper estimates the effect of the presence of indoor piped drinking water on the educational outcomes of children in rural India. This paper uses the IHDS-II (2011-2012) data. The main result suggests that the presence of indoor drinking water has a positive and significant effect on the educational outcomes of children for various demographic individuals and household controls. In particular, the presence of indoor water in households increases the study time of children by around 103 minutes per week. In households where the burden of fetching water from outside is disproportionately borne by women, child outcomes are significantly lower, particularly for girls.

Keywords: Drinking Water, Gender Disparity, Girls Education, Educational Outcome.

Introduction

The majority of India's population in rural areas depends heavily on publicly provided water and, as such, has to deal with economic hardship due to sustained water shortage. In addition to poverty and inequality, historically persistent social divisions are intricately linked to access to water in rural India (Banerjee et al., 2005). A large proportion of households in rural India rely on fetching water for their domestic purposes from rivers and community wells, as close to 50% of the households still do not have access to water (Jessoe, 2013). This unproductive burden is disproportionately placed on women and children in patriarchal societies of developing economies, affecting the intra-household allocation of labour and the distribution of time allotment across other daily activities (Singh & Pattanaik, 2020). Among others, the lack of access to water in the household has also been associated with an increase in short-term morbidities (fever, cough, diarrhoea) and has been argued to disallow the reallocation of domestic chores that allow children to attend school (Merid et al., 2023). Because water availability often depends on local infrastructure development, its lack might disproportionately affect women's time allocation in domestic work, taking time away from productive or caring activities (Choudhuri & Desai, 2021). This induced time poverty impacts childcare activities by reducing the time available to supervise children and promote their cognitive development. Women's intensive engagement in unpaid work for household production, such as cooking, cleaning, fetching water, and numerous such activities, may come at the cost of adverse spill-over effects on their children and may induce children to join their parents in doing those household chores, thereby reducing the time available for educational pursuits. The lack of maternal supervision can adversely affect children's cognitive development, which can be exacerbated for mothers who have to spend time away from home routinely. Parental time inputs, particularly those of the mother, are critical for children's cognitive and non-cognitive development and later life outcomes (Flavio & James, 2009). Because time is both constrained and finite, such limits are felt more acutely when the mother is heavily involved in domestic responsibilities due to a lack of infrastructure, diverting time away from childcare and related activities. We use the nationally representative 2011–12 data from the India Human Development Survey (IHDS) to study the potential impact of women's time use for their children's education to answer broadly how access to infrastructure, indoor piped water connections impact the children's educational outcomes and how in the absence of such household resources does the gender inequality inherent in the free collection of goods such as water affect children's educational outcomes. The IHDS is unique in that it provides data on gendered differences in the time spent in paid or unpaid work and educational outcomes.

Hypothesis

H_1: Access to Indoor piped water is expected to positively affect the children's educational outcomes or cognitive development.

H_2: When the burden of fetching water falls more on women, it negatively impacts the children's educational outcome.

This uses individual and household level data for rural India to capture the impact of such infrastructure on the children's cognitive ability measured by their learning outcomes. It captured the measures of children's educational outcomes by having two different measures. For our study, we considered children between the ages of 6 and 14 years in rural India. We constructed a variable to capture the share of maternal time on unpaid activity to see if maternal supervision can adversely affect children's cognitive development measured via educational outcomes. The paper's main result suggests that the presence of indoor water in households increases the study time of children by around 103 minutes per week and also increases the probability of undertaking rudimentary arithmetic by operations by 0.16 points. We also found that a share of a mother's time spent fetching water negatively impacts the time spent by children studying. Our performance results in maths tests are robust to gender differential effects, with girl children being affected more when their mother has to spend time outside to fetch water.

Existing literature (Choudhuri & Desai, 2021) has shown that inadequate access to infrastructure, such as piped water, toilets, and clean fuel, can imperil health outcomes for children, which, in turn, can adversely affect children's learning outcomes. There is evidence that not only does lack of access to piped water have implications for women's time use, but such access also improves a range of outcomes for children. Ravallion and Jalan found evidence of improvement in children's health in rural India (Mangyo, 2008), using panel data on China, which showed that it positively affected children's health. This paper contributes to the literature by looking into the impact of piped water connections on the educational outcomes of children beyond enrollments and how a mother's time investment in such unproductive activity to fetch water impacts the children's educational outcomes.

Data and Variable Description

Data

We use the nationally representative sample from wave II (2011-12) of the India Human Development Survey. IHDS is a nationwide multi-topic gender-desegregated sample survey covering wide-ranging household, individual, village and school topics on demographic, health, education and socio-economic characteristics. The survey covers key gender disaggregated labour and non-labour market characteristics, employment: wage, salary, farm, non-farm employment, annual earnings, work days, self-reported health, and household infrastructure, among others, at the individual level. While the whole data is based on 42,152 households in 1,420 villages and 1,042 urban neighbourhoods across India, for our study, we consider households in rural India. So, for this study, the population is defined as the "children in the age group of 6-14 years", while the sample size considered (irrespective of any missing values) is 25,453. However, as we look for the missing values of the variables we control for, this number gets pruned further down.

Other Covariates

To capture the type of school the child studies, we created a dummy variable, School Type, which takes the value 1 if the child studies in a government or government-aided school and 0 if he studies in a private school. We also considered the distance of school from the child's home, as that would also have a bearing on whether the child visits school, as a longer distance will mean that the child faces difficulty in reaching the school in the first place. We also take into account the standard of the child, standard as a control.

We also consider mother's education to be our covariate, as the level of the mother's education will also have a bearing on the child's education. We consider 5 categories to construct the dummy variable depicting Mother's education: Reference category is Illiterate, Studied between 1st to 4th standard (1-4), Studied between 5th to 9th standard (5-9), studied between secondary and senior secondary (10-12), studied beyond class 12, including graduation (12 & above).

We also include religion, social group and gender as additional control variables. For the Social group, we have the following categories: General (base category), SC, ST, OBC, and others. We have the following categories for religion: Hindu (Base category), and the 2 dummy variables are for Muslims and others. For gender, we have boys as our reference category, and we take girls as the covariate in our regression. Apart from them, we also take the log of the total Income of the household Income as a control variable. We also consider whether the household has electricity (electricity), as having electricity or not also has a bearing on the child's education, and because having electricity will allow the house to have a water connection, since the water connections run on electricity. All these covariates affect the child's educational outcomes and will be argued subsequently.

Summary Statistics

Table 1 provides the summary statistics of the variables relevant to our model. We represent the Mean and standard deviation of the variables. From the table, on average, a child spends nearly 40 hours a week in studies, including time spent in school and doing homework. The average household in each study has an annual income of around Rs 76460; close to 73% of the households have electricity. Around 48% of the children in our sample are girls, and we will use this fact later on in the subsequent section. 27% of the mothers in our sample have studied in middle school (5th to 9th standard), and only 2% have done studies beyond class 12th. Around 75% of the schools are government or government-aided in the sample. We have 9,476 observations, based on which we will analyse. Given the background of those surveyed, is there an impact on the educational outcome for those children who have piped water systems installed in their households, and because of that, do they get sufficient attention from their mothers to develop their cognitive ability?

Empirical Specification

We estimate an OLS model at the individual children's level. The central regression specification equation is given below. Our key dependent variable, i.e., Study Time, is measured in minutes per week and is a variable that varies at the individual child level. Hence, we can apply a simple OLS method to estimate our coefficients. Thus, the empirical model we estimate is:

$$Y_{ihv} = \alpha_v + \beta_1 IndoorPipedWater_{hv} + \beta_2 ShareofTime_{ihv} + \beta X_{ihv} + \delta Z_{hv} + \varepsilon_{ihv}$$
(1)

Where i denotes the individual child, h the household in which he/she is residing and v the village, α_v denotes a mean for each village, and this is just a way of denoting village fixed effects being considered. Y_{ihv} the educational outcome variable we constructed for our analysis (Study Time). The primary coefficient of interest is β_1 to test for H_1, which basically shows the impact of having indoor piped water on the educational outcome of the child. To test H_2, we have β_2 as our primary coefficient of interest, which shows the impact of the share of maternal time being spent on fetching water on the child's educational outcome.

The variable Indoor piped water varies at the household level. We notice that once the network for installing such a piped water system is available in the village, the cost of installing a piped water system in any household is relatively small. Thus, we use the intra-village variation to look into the role of installing indoor piped water, as the cost of installing them for a particular household is not large, given that the infrastructure is already in the village. Hence, we shall consider the village fixed effects to take care of any inter-village variation. Thus, the ultimate variation we are using is that of intra-village variation.

X_{ihv} represents the vector of covariates at the individual level that we considered like age, gender, standard in school and the mother level covariate of their education. These variables are important in determining the educational outcomes of the children. Z_{hv} the vector of covariates that vary at the household level include controls like religion, social group, household income, and whether the household has electricity. The child, mother, and household-level covariates help us capture the broad spectrum of the sociodemographic characteristics of the households. The motivation to include Religion in our model specification as a control is drawn from (Asadullah et al., 2014), who show that social divisions, particularly the Hindu - Muslim gap, are important determinants of educational attainment. Additionally, the lower caste is known to have poor educational outcomes and may also independently influence development, both rationalised by the historical discrimination faced by them.

Our specification includes village fixed effects, which we have consolidated as αv in our specification, which controls for all geographic, economic and social factors common to all individuals within a village. So, ultimately, we are allowing for exogenous intra-village variation. Finally, the term represents i.i.d. unobserved factors that might influence educational outcomes clustered at the village (PSU) level.

Apart from the dependent variable of Study time, we also considered another measure of educational outcome in the form of scores on skill tests in maths, namely Test scores in Maths, considered for a sub-sample of 8-11 years age children. In this case, the dependent variable, Test score in Maths, is dichotomous. Thus, we do a probit regression to estimate the coefficients and draw a conclusion on the marginal effects. We defer the exact specification to the section on results, where we consider the same.

Results

First, we consider the results for testing H_1 i.e., how the presence of an Indoor piped water system impacts the educational outcome of the children, the setting is that of Rural India and for children in the

age group of 6-14 years. Table 2 reports the OLS estimates for the impact of indoor piped drinking water on children's educational outcomes for various specifications. Column 1 of Table 2 includes only the primary variable of interest, i.e., indoor piped drinking water in the household. This shows that the presence of indoor piped water increases the children's study time by around 133 minutes per week, and this coefficient is significant at the 10% level. Adding the village fixed in column 2 decreases this coefficient to 124 minutes per week, which is significant at the 10% level. Adding individual level controls in column 3 of the table, we find that the leading coefficient reduces to 114 minutes per week, still significant at the 10% level. School type is highly significant and shows that being in a government school reduces students' study time compared to private schools. In column 4, we add the controls for the mother's education as the mother's education level also has a bearing on the time she devotes to her child's education, which can impact the study time of children. The leading coefficient of interest is still significant but has reduced in magnitude to 119 minutes per week. Mothers who have acquired higher education (12th std. onwards) positively impact their children's educational outcomes. Next, in column 5, we add household-level controls to find that the coefficient of piped water is still significant but has further reduced in magnitude. And so is the presence of electricity in the household. Further, in column 6, we add demographic controls for controlling social groups and religion. The coefficient for indoor piped water is no longer significant at any level. However, the presence of religion in the household seems to matter (the coefficient is highly significant) for the educational outcome, which shows that the religion of the household also matters, whether the members devote time to educating their children. We also added the standard of the child in column 7, but the results remained unchanged, with the main coefficient of interest still insignificant. We don't consider the standard of the child in our results.
To test H_1 as to whether the burden on the mother to fetch water hurts the educational outcome of the child, we now consider the variable share of the mother's time, which we constructed from the data and the results of which are present in Table 3. In column 1, we have just kept the two variables of interest, and the results suggest that though the coefficient of piped water is significant, the coefficient of the mother's time is insignificant. In column 2, we add the village fixed effects, and the results reflect the fact that the higher the burden on the mother to fetch water from outside, the more it negatively impacts the educational outcome of the child and is significant at the 10% level. Next, column 3 adds the mother's education and other individual controls. We find that the coefficient of the mother's time is significant at the 10% level and has a negative sign, but indoor piped water is still insignificant. Column 4 reports the results with additional household-level controls. However, we still find that the coefficient of indoor piped water is insignificant, but that of the mother's time is significant with the expected sign. By adding demographic controls in column 5, the coefficients of indoor piped water and that of mother's time are significant at the 10% level and 5% level, respectively. We also checked this result with the standard of child dummies, but the results are insignificant and do not change much. Thus, they are not reported.
Apart from the Study Time of children being one measure of educational outcome/attainment, we also considered another measure of educational outcome, namely the test score in the Maths skill test conducted for a subsample of 8-11-year-old children, conducted with the help of PRATHAM organisation. The empirical specification now becomes

$$\boldsymbol{Y_{ihv} = \alpha_v + \beta_1 IndoorPipedWater_{hv} + \beta_2 ShareofTime_{ihv} + \beta X_{ihv} + \delta Z_{hv} + \varepsilon_{ihv}}$$
(2)

where Y_{ihv} is the Math Test Score and is an indicator variable that takes the value of 1 if the child can subtract/divide a number and zero otherwise. We apply a PROBIT model to estimate the relationship, and later in the subsequent section, we show that our results are robust to other methods of estimating limited dependent variables models. In estimating the probit model, we have considered the non-linearity in marginal effects, and hence the coefficients in the reported tables reflect the actual marginal impact only. These results are based on a subsample of around 3,334 children.

Table 4 reports the PROBIT model results of the impact of the presence of indoor piped water on being able to undertake rudimentary arithmetic operations. In column 1, we have only taken the primary variable of interest and found that the presence of indoor piped water increases the probability of performing well in the Math test by 0.27. This result is significant at the 1% level. In column 2, we add village fixed effects to find that the coefficient of interest is still significant at the 1% level, and the magnitude has not changed much. After adding the individual level controls in column 3, we find that neither the magnitude nor the significance of indoor piped water has changed much. The child's age now matters compared to our earlier results for study time as a dependent variable. In column 4, we add the mother's education as the control and find that the magnitude of indoor piped water has reduced to around 0.22, which remains highly significant. We also see that a mother's education highly matters in increasing the probability of performing well in the Math skill test, as all the levels of a mother's education are significant. Column 5 reports the results after adding household-level controls. We found that the magnitude of indoor piped water has reduced further, but it remains significant. Being a girl reduces the probability of being able to undertake rudimentary arithmetic operations, and this can be a potential explanation for the household chores girls in this age group are made to do rather than being educated. In the last column, we have added the demographic controls; the magnitude of the coefficient of interest has reduced slightly but continues to be significant at the 1% level. From this column, we can see that religion and social groups also matter in the probability of obtaining a better result on the test. The results show that the SC and ST castes are at a disadvantage compared to the upper castes in attaining better results in the Math test.

To test H2 again for the Math skill test, we add the variable of the share of the mother's time spent fetching piped water to our specification. Table 5 reports the results. In column 1, we add the 2 variables of interest only and find that indoor piped water is highly significant at a 1% level. However, the coefficient of the share of mother's time is insignificant. Adding village fixed effects in column 2 does not alter the magnitude or significance. Individual controls are added in column 3, but the coefficient of the share of the mother's time remains insignificant. In columns 4 and 5, the mother's education level and household level controls are added, but the coefficient of share of the mother's time remains insignificant. However, the coefficient of Indoor piped water remains highly significant, and the magnitude does not alter much between the 2 columns. In the last column, we add the complete specification with demographic controls as well, but still, the coefficient of share of mother's time is insignificant. The rest of the variables remain the same in significance, sign and magnitude, as seen in Table 4. The type of school continues to matter in all the columns, with being in a government school reducing the probability of obtaining better test scores than in private schools.

Heterogeneity and Robustness

Heterogeneity

In this section, we check the heterogeneous effects of the share of mothers' time spent fetching water from outside at the level of gender of the child. When mothers are made to fetch water from outside wells and rivers without piped water at their home, this burden also sometimes falls on the girl child in the house to aid her mother in fetching water. Often, the eldest girl is made to accompany her mother in such non-productive activities, and thus, they spend significantly less time attaining education or studies. Thus, the expectation is that this adverse effect of the burden of accompanying mothers falls more on girls rather than boys due to the patriarchal nature of rural India. Thus, women's time away from home for carrying out non-market unpaid tasks and their subsequent inability to tap into the labour market not only results in reduced time spent on caring for and teaching children, but due to the fact that the girl child also accompanies her mother, will further affect her educational outcomes and attainability.

To check this possibility, we interacted with the dummy variable for girls with the share of the mother's time fetching water from outside sources. Table 6 presents the results for the study time (in minutes per week) and math test scores using OLS and probit models. In column 1, we show the results for Study time as the dependent variable and find that the interaction term of the dummy for the girl and the share of the mother's time is insignificant, and so is the dummy for a girl. This shows that concerning study time, the fact that an increase in the mother's share in time to fetch water does not adversely affect the girls. The coefficients of Indoor piped water and share of mother's time are significant at a 10% level and with expected magnitudes.

In column 2 of Table 6, we present the results for Math's test score. We find a significant adverse effect of increasing the share of others' time spent fetching water on girls in terms of their probability of undertaking rudimentary arithmetic operations, as both the coefficients of girls and the interaction term are significant. However, the share of the mother's time remains insignificant, whereas indoor piped water presence is significant at a 5% level.

Robustness

We invoke an alternate estimation methodology to validate the robustness of our PROBIT model, i.e., for our dependent variable of Math's test score. Estimation of logit and LPM(linear probability model) models with the same variables as specified in our principal regression leaves the results unchanged regarding the direction of the effect, with only slight differences in the magnitude. Table 7 estimates the Logit and the LPM specifications for the Math test score. We have only shown the main variables of interest in the table. As can be seen for the two columns, columns 1 and 2, the marginal effect of Indoor piped water is almost the same as what we had in our probit specification, and it is significant at a 1% level. Meanwhile, the share of mothers' time to fetch water remains insignificant even in these specifications.

Bound Analysis

Though the main regression model controls for individual and demographic controls, a concern is the possibility of other unobserved abilities not entirely subsumed by them and household factors, potentially biasing our estimated results. In this section, we assess the extent of potential bias due to the exclusion of these variables in the model following the strategy developed by (Altonji et al., 2005) and (Oster, 2017). We look for a bound analysis only to determine the impact of indoor piped water on study time. The results are presented in Table 8.

To operationalise this method, we start with a baseline regression where Study Time is regressed on Indoor piped water. Next, we posit what is R_{max}, we use the conventional method of considering R_{max} is 0.1. Following (Oster,2017), we found that the interval in our case $\beta_i(0.1, 1)$ = 85.24 and doesn't contain 0. Moreover, we provide the value of δ for which β_i will become 0. The obtained value of 8 is very high since (Oster 2017) found that the average value of δ is between [0,1]. Alternatively, we show the R_{max} equal to zero when δ equals 1. This value is 0.08 in our case.

Discussion

This section discusses the potential endogeneity bias in the OLS specification and tries to provide suggestions to overcome the same. The primary variable of interest in our model, i.e. access to Indoor piped water, lacks complete homogeneity, and thus, our results must be interpreted as a mere association between indoor piped water availability and the educational outcome of the child; we cannot comment on causality per se from our paper.

Though we argued that endogeneity is less of a challenge for piped water, as the cost of installing a piped water system, once such a network is available in the village, is relatively small, we cannot be completely sure that the decision to install piped water is free from endogeneity. Since the household has an indoor piped water system if the required infrastructure is present in the village or not but this decision is not random as there can be the inherent motivation of the households themselves to install a piped water system in them to make sure the women in that household do not need to travel out and also that those households have a higher aspiration to invest in children's education which prompts them to install the piped water system in their houses. This inherent motivation is unobservable; thus, the decision to install piped water is not completely random. Thus, this motivation to educate the children in their household might cause the household to install a piped water system hence such an unobservable is not controlled for in our regression specification and this impact not only the installation of piped water but also has better educational outcomes for the children in that particular household.

Also, the fact that the piped water infrastructure in the village is not absolutely random in our setup but rather correlates with several unobservable characteristics related to the functionality/development of a village, political power, awareness and attitudes towards public provisions, etc., which also happens to explain educational outcomes and this has also bearing an installing piped water in the household. While we acknowledge the presence of such unobservable (all part of the error term ε), the lack of data availability prevents us from controlling for such factors.

Thus, a different identification strategy should be considered to address this potential endogeneity issue.

Conclusion

In this paper, we studied the impact of the presence of household amenity infrastructure, namely Indoor piped drinking water, on the educational outcome for children in rural India for individuals in the age group of 6-14 years. Our findings suggest that children in households that do not spend time collecting water have substantially higher educational outcomes in both the measures of educational outcome that we considered. Increasing the share of mothers in unpaid work, in the event of lack of adequate access to time-saving infrastructure, may lead to substitution of time away from childcare and related activities. Hence, it is pertinent to improve the village water distribution network to alleviate the burden it imposes on women's time endowment, as such time constraints get further exacerbated in the summer months or drought years, especially in regions that face an acute water crisis, with women typically facing the brunt of such adversarial conditions. More recently, the government announced a nationwide initiative to ensure that all households in rural and urban regions have access to safe drinking water by 2024, and these initiatives have the potential to generate significant time savings, particularly for women

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Table 1
Summary Statistics

Mean	SD	Min	Max	
Minutes studies by child in home and school	2403.47	593.54	0	6240
Indoor Piped Water	0.02	0.14	0	1
Distance from school	1.66	3.09	1	99
Standard in school	4.13	1.62	0	9
HQ Total income	76460.09	127750.15	350	3900500
Dummy: girl	0.48	0.5	0	1
Dummy: School type	0.78	0.42	0	1
Household has electricity	0.73	0.44	0	1
1st to 4th standard	0.08	0.27	0	1
5th to 9th standard	0.27	0.44	0	1
10th to 9th standard	0.07	0.25	0	1
12th std onwards	0.02	0.13	0	1
Dummy: SC	0.26	0.44	0	1
Dummy: ST	0.15	0.36	0	1
Dummy: OBC and other	0.42	0.49	0	1
Dummy: Muslim	0.08	0.27	0	1

Other religion groups	0.03	0.16	0	1
Age of the child	9.48	1.12	6	14

Table 2
Impact of Piped Water on Study Time of Children Dependent Variable: Study Time (min per week)

	1	2	3	4	5	6	7
VARIABLES	Baseline	Village F.E.	Individual Controls	Mother's Education	Household controls	Demographic controls	Standard Dummies
Indoor Piped Water	133.71*	124.07*	114.21*	93.78**	93.3*	110.68	81.45
	(102.63)	(97.347)	(97.353)	(93.519)	(97.276)	(102.178)	(100.268)
Dummy: School type			-56.20**	-41.51*	-43.71*	-40.4	-74.04**
			(23.391)	(22.247)	(23.026)	(23.774)	(27.147)
Distance from school			2.21	1.31	1.27	0.71	-0.48
			(4.708)	(4.799)	(4.824)	(4.933)	(5.105)
Dummy: girl			-0.71	-1.03	-1.39	-2.51	-0.73
			(28.29)	(26.643)	(26.442)	(27.492)	(28.536)
Age of the child			129.94	150.58	150.04	147.2	134.44
			(129.276)	(119.699)	(117.118)	(116.605)	(99.494)
1st to 4th standard				17.68	15.2	10.73	2.35
				(51.844)	(51.262)	(52.921)	(51.9)
5th to 9th standard				128.28***	126.18***	121.23***	105.66***
				(12.799)	(13.428)	(16.484)	(16.473)
12th std onwards				212.88*	215.01*	209.45*	194.82

				(117.306)	(120.059)	(120.3)	(122.059)
Log of Income					-9.42	-8.88	-9.3
					(11.763)	(11.151)	(11.222)
Household has electricity					22.37*	27.70*	9.79
					(11.967)	(15.605)	(15.867)
Dummy: SC						-31.85	-29.02
						(50.658)	(51.238)
Dummy: ST						26.06	37.5
						(50.62)	(52.047)
Dummy: OBC and other						42.45	43.32
						(53.38)	(53.706)
Dummy: Muslim						-138.34***	-120.08***
						(39.198)	(35.07)
Other religion groups						-95.5	-104.65
						(98.033)	(95.626)
Constant	2,400.84***	2,412.24***	1,723.77***	1,579.20***	1,671.54***	1,676.29***	1,782.52***
	(15.03)	(2.149)	(600.999)	(547.089)	(510.18)	(510.936)	(448.092)
Observations	3,359	3,359	3,359	3,359	3,359	3,359	3,359
R-squared	0.001	0.029	0.033	0.044	0.044	0.05	0.06
Village Dummies	NO	Yes	Yes	Yes	Yes	Yes	Yes
Robust standard errors in parentheses							

*** p<0.01, ** p<0.05, * p<0.1					
Standard errors clustered at the village (fsu) level and adjusted for heteroscedasticity					

Table 3
Impact of Piped Water and maternal time spent on fetching water on Study Time of Children
Dependent variable: Study time (min per week)

To test H2					
	1	2	3	4	5
VARIABLES	Baseline	Village F.E.	Mother's Education	Household controls	Demographic controls
Indoor Piped Water	128.44*	117.68*	86.67	85.21	103.21*
	(102.69)	(97.206)	(93.995)	(97.894)	(102.664)
Share of mother's time	-75.73	-91.63	-100.67	-104.22	-106.67**
	(62.89)	(60.15)	(61.573)	(61.104)	(60.969)
Dummy: School type			-40.60*	-42.82*	-39.71
			(22.834)	(23.574)	(24.466)
Distance from school			1.21	1.16	0.59
			(4.85)	(4.882)	(4.98)
Dummy: girl			-0.48	-0.91	-2.05
			(26.812)	(26.646)	(27.722)
Age of the child			154.7	154.39	151.89
			(119.993)	(117.242)	(116.613)
1st to 4th standard			18.43	15.54	11.25
			(50.938)	(50.461)	(52.082)
5th to 9th standard			129.99***	127.40***	122.87***
			(13.124)	(13.772)	(16.559)

12th std onwards			212.13*	213.62*	208.58*
			(117.519)	(119.846)	(120.203)
Log of Income				-9.69	-9.04
				(12.082)	(11.458)
Household has electricity				26.12**	31.85*
				(12.451)	(15.758)
Dummy: SC					-27.35
					(49.119)
Dummy: ST					29.78
					(50.08)
Dummy: OBC and other					46.27
					(52.646)
Dummy: Muslim					-137.62***
					(39.702)
Other religion groups					-98.56
					(96.574)
Constant	2,449.44***	2,471.81***	1,621.82***	1,715.99***	1,715.67***
	(39.75)	(39.332)	(549.561)	(506.394)	(508.126)
Observations	3,359	3,359	3,359	3,359	3,359
R-squared	0.002	0.03	0.045	0.045	0.052
Village Dummies	NO	Yes	Yes	Yes	Yes
Robust standard errors in parentheses					

*** p<0.01, ** p<0.05, * p<0.1					
Standard errors clustered at the village (psu) level and adjusted for heteroscedasticity					

Table 4
Impact of Piped Water on Math Test Score (Probit Model) Dependent variable: Math Test Score

Main regression						
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Baseline	Village F.E.	Individual Controls	Mother's Education	Household controls	Demographic controls
Whether the household has piped water	0.27***	0.28***	0.24***	0.22***	0.18***	0.16***
	(0.065)	(0.063)	(0.059)	(0.06)	(0.06)	(0.059)
The type of school in which child studies			0.16***	0.15***	0.14***	0.12***
			(0.021)	(0.02)	(0.021)	(0.022)
Distance from school			0.005*	0.004	0.003	0.002
			(0.002)	(0.002)	(0.002)	(0.002)
Dummy: girl			0.04***	0.04***	0.05***	0.051***
			(0.01)	(0.009)	(0.011)	(0.011)
Age of the child			0.09**	0.09**	0.09***	0.09***
			(0.007)	(0.007)	(0.007)	(0.007)
1st to 4th standard				0.07**	0.06*	0.05

				(0.03)	(0.036)	(0.035)
5th to 9th standard				0.12***	0.10***	0.08***
				(0.02)	(0.023)	(0.028)
12th std onwards				0.19**	0.15	0.13
				(0.09)	(0.09)	(0.09)
Log of Income					0.02*	0.018
					(0.01)	(0.013)
Household has electricity					0.14***	0.13***
					(0.017)	(0.017)
Dummy: SC						0.08***
						(0.027)
Dummy: ST						0.17***
						(0.05)
Dummy: OBC and other social groups						0.03*
						(0.019)
Dummy: Muslim						0.06**
						(0.03)
Other religion groups						0.14***

						(0.054)
Constant	-0.36***	-0.46***	-4.44***	-5.10***	-6.79***	-6.76***
	(0.03)	(0.004)	(1.488)	(1.662)	(1.441)	(1.419)
Observations	3,334	3,326	3,326	3,326	3,326	3,326
Village Dummies	NO	Yes	Yes	Yes	Yes	Yes
Robust standard errors in parentheses						
*** p<0.01, ** p<0.05, * p<0.1						
Standard errors clustered at the village (fsu) level and adjusted for heteroscedasticity						

Table 5: Impact of Piped Water and maternal time spent on fetching water on Math's Test score (Probit Model)

Dependent Variable: Maths Test Score

Main regression						
	1	2	3	4	5	6
VARIABLES	Baseline	Village F.E	Individual Controls	Mother's Education	Household controls	Demographic controls
Whether the household has piped water	0.28**	0.29**	0.25**	0.22***	0.18***	0.16***
	(0.065)	(0.06)	(0.06)	(0.06)	(0.06)	(0.058)
share of mother's time	0.05	0.04	0.04	0.03	0.16	0.02
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
The type of school in which child studies			0.16**	0.15***	0.14***	0.12***

			(0.02)	(0.02)	(0.02)	(0.02)
Distance from school			0.005**	0.004	0.003	0.003
			(0.002)	(0.002)	(0.002)	(0.002)
Dummy: girl			0.04**	0.04***	0.05***	0.05***
			(0.009)	(0.009)	(0.011)	(0.011)
Age of the child			0.09	0.09	0.09***	0.09***
			(0.007)	(0.007)	(0.007)	(0.007)
1st to 4th standard				0.07***	0.06*	0.05
				(0.036)	(0.03)	(0.03)
5th to 9th standard				0.12***	0.10***	0.08***
				(0.02)	(0.02)	(0.02)
12th std onwards				0.20**	0.15	0.13
				(0.09)	(0.09)	(0.017)
Log of Income					0.02*	0.018
					(0.013)	(0.013)
Household has electricity					0.14***	0.13***
					(0.017)	()0.017
Dummy: SC						0.08***
						(0.02)
Dummy: ST						0.18***

						(0.05)
Dummy: OBC and other social groups						0.03***
						(0.19)
Dummy: Muslim						0.06***
						(0.032)
Other religion groups						0.15***
						(0.054)
Constant	-0.44***	-0.54***	-4.52***	-5.16***	-6.82***	-6.80***
	(0.07)	(0.073)	(1.533)	(1.697)	(1.463)	(1.432)
Observations	3,334	3,326	3,326	3,326	3,326	3,326
Village Dummies	NO	Yes	Yes	Yes	Yes	Yes
Robust standard errors in parentheses						
*** p<0.01, ** p<0.05, * p<0.1						
Standard errors clustered at the village (fsu) level and adjusted for heteroscedasticity						

Table 6: Differential effect by Gender of child

	1	2
VARIABLES	Study Time	Maths Test Score
Whether the household has piped water	98.38	0.15***
	(67.191)	(0.177)

share of mother's time	-88.73*	0.06
	(43.634)	(0.203)
Dummy: girl	-5.16	-0.14
	(38.007)	(0.176)
Girl*Mother's time share	-6.55	0.02*
	(51.625)	(0.193)
Constant	2,189.36***	-
	(115.4)	-
Observations	9,476	3,326
R-squared	0.066	
Village Dummies	Yes	Yes
Robust standard errors in parentheses		
*** p<0.01, ** p<0.05, * p<0.1		

Table 7: Logit and LPM models

	1	2
VARIABLES	Logit Model	LPM Model
Whether the household has piped water	0.16***	0.19***
	0.059	(0.063)
share of mother's time	0.023	0.02
	0.041	(0.042)
Constant		-1.20***
		(0.427)
Observations	3,326	3,334
R-squared		0.142
Village Dummies	Yes	Yes
Robust standard errors in parentheses		

*** $p<0.01$, ** $p<0.05$, * $p<0.1$		

Table: 8 Robustness to Omitted variable Bias Coefficient of indoor piped water

	Uncontrolled	Controlled	Identified Estimated Bias		
			$R^2_{Max} = 0.1$		$\delta = 1$
			β_i for $\delta=1$	δ for $\beta_i = 0$	R^2_{Max} for $\beta_i=0$
βi	133.70731	103.21486	85.24159	8	0.080
R2	0.001	0.052			