Education, Gender and School Enrollment

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Abstract

This paper delves into the intersection of gender, sanitation, and school enrollment within the framework of developing countries, specifically examining how improved sanitation facilities influence educational access and the particular challenges faced by female students. Despite the global commitment to educational equity, as highlighted by the United Nations Sustainable Development Goals, disparities remain stark, particularly in environments lacking basic sanitation facilities. Utilizing data from the India Human Development Survey (IHDS-II, 2011-12), this study employs both a linear probability model and a probit model to analyze the impact of sanitation on school enrollment. The findings reveal that while improved sanitation significantly boosts overall enrollment by 3.19%, the provision of gender-separated toilets for females does not conclusively affect current enrollment.

1 Introduction

Sanitation is a critical global issue that intersects significantly with gender equality and educational access, particularly in developing countries. It is also recognized by United Nations Sustainable Development Goals, which has included targets for gender equality and universal access to clean water and sanitation by 2030. Globally, nearly 2 billion people still lack basic sanitation facilities, and of these, 673 million still defecate in the open, contributing to an environment that propagates communicable diseases, which are responsible for nearly 21 percent of the communicable disease burden worldwide (WHO, 2002; UNICEF, 2013). India, despite being home to a third of the world's population, has the highest number of people without toilet access approximately 732 million people. (Water Aid, 2017).

India has made strides with initiatives like the Total Sanitation Campaign (1999) and Swachh Bharat Mission (2014), aimed at eradicating open defecation. Proper sanitation facilities are not only crucial for public health but also constitute a basic necessity of life. Sanitation, as a fundamental human right, is deeply tied to the quality of life and the realization of other human rights, such as the right to education. When hygiene and education are combined, children can live longer and be healthier. The direct connection between sanitation and educational attainment demonstrates the potential of improved sanitation facilities to break the cycle of poverty and enhance societal well-being (Freeman et al., 2013; Tyagi et al., 2010). Therefore, the paper largely tries to look at effect of sanitation on current enrollment school enrollment.

There is a well-established consensus on the importance of girls' education. Numerous studies highlight how educating girls not only boosts their productivity in the workforce but also improves various other aspects of life, such as health, fertility rates, and children's learning achievements (Appiah & McMahon, 2002; Foster & Rosenzweig, 2001; King & Hill, 1995; Schultz, 2001).The lack of sanitation facilities has been linked to increased risks of infection and higher absenteeism among students, particularly girls, underscoring the need for comprehensive policies and effective sanitation solutions (Birdthistle et al., 2011; Willmott et al., 2015). This issue compounds gender disparities in education and contributes to a cycle of poverty and marginalization.(Adukia, 2013; Mason et al., 2015). Inadequate sanitation facilities in schools, such as the absence of gender-separated toilets and clean water, directly impact girls' school attendance, particularly during menstruation. This is the second aspect that the paper tries to explore whether having gender-separate toilets has a profound effect on school enrollment for females.

The central question of whether improved sanitation influences school enrollment and impacts gender-based outcomes is crucial because it touches on interconnected areas critical to societal progress. Addressing this can significantly improve public health by reducing disease spread, enhance educational opportunities particularly for girls, and contribute to breaking the cycle of poverty. By ensuring safe and gender-sensitive sanitation facilities, especially in schools, we can foster an environment that promotes not only educational attainment but also gender equality and economic development.

The remainder of this paper is organized as follows: Section 2 gives a brief overview of the literature associated with this paper, Section 3 describes the data, Section 4 presents empirical strategy, Section 5 presents the results followed by the conclusion in Section 6.

2 Literature Review

The literature on the impact of sanitation on educational outcomes, particularly among girls in developing countries, underscores the profound implications of adequate sanitation facilities for public health, educational attainment, and gender equality. Studies by Hammer and Spears (2016) and Patil et al. (2014) establish a direct link between improved sanitation facilities and better health outcomes, such as increased child height and reduced incidences of waterborne diseases, which indirectly contribute to enhanced learning capabilities and school attendance. This is further supported by evidence from studies like those by Glewwe and Miguel (2008), who highlight the significant positive impacts of child health on school participation, pointing to infrastructural investments in sanitation as a critical factor in increasing school attendance by mitigating health-related school absences.

On the specific issue of gender disparities in education exacerbated by inadequate sanitation, research consistently demonstrates that the absence of gender-specific sanitation facilities significantly hinders school attendance among adolescent girls. For instance, Adukia (2017) articulates that sex-separate toilets dramatically increase enrollment and attendance for pubescent girls, illustrating the necessity of such facilities for maintaining educational participation during menstruation. Furthermore, studies by Ray and Datta (2017) explore the nuanced impact of these facilities across different social strata, noting that while overall improvements are evident, scheduled-caste students may not experience the same benefits, suggesting a complex interplay between caste and gender in access to education.

These findings collectively argue for the essential role of tailored sanitation solutions in educational settings, particularly in addressing the specific needs of female students in developing countries. This study contributes to the above literature by focusing on sanitation of toilets and inclusion of gender-separate toilets on enrollment outcomes.

3 Data

I use data from the 2011-12 India Human Development Survey (IHDS), which is a nationally representative, multi-topic survey of over 42,152 households in 971 urban neighbourhoods and 1,503 villages. The data is collected by the National Council of Applied Economic Research in New Delhi and the University of Maryland (Desai & Vanneman, 2018). I use the data collected on an individual level to examine the characterstics of households with individuals between the age of 5-18 for school enrollment and combine it with the data collected on school level to study how sanitation and gender norms can affect enrollment outcome. Data from 9 states is not included in my research since their political and economic landscapes differ from those of India's main states.

The descriptive statistics (Table 1)provided reveal distinct trends in literacy and current enrollment across various demographic factors such as gender, caste, religion, and wealth quintiles. In terms of gender, males consistently show higher literacy rates and current enrollment figures than females, indicating a slight gender disparity favoring males. The literacy rate for males stands at approximately 87.8% with current enrollment at about 91.7%, compared to 87.2% literacy and 89.3% enrollment for females.

When analyzed by caste, higher caste groups like Brahmins and Forward Castes exhibit superior literacy and enrollment rates compared to Other Backward Classes (OBCs), Scheduled Castes (SCs), and Scheduled Tribes (STs). Brahmins, in particular, have the highest literacy at 93.1% and enrollment rates at 97.3%. The data show a clear decline in educational outcomes as one moves from higher to lower caste groups, with STs having the lowest literacy at 82.5% and enrollment at 87.3%.

Religious affiliations also play a significant role in educational outcomes. Christians and Sikhs outperform other groups with literacy rates of approximately 94.3% and 93.5% respectively, and similarly high enrollment figures. In contrast, Muslims have the lowest literacy at 82.8% and enrollment at 85.8%, indicating significant disparities based on religious background.

Finally, the wealth quintile analysis reveals a progressive improvement in both literacy and current enrollment as wealth increases. The poorest quintile records the lowest literacy at 83.5% and enrollment at 90%, whereas the richest quintile shows the highest figures, with literacy at 91.3% and enrollment at 93.1%. This trend underscores the significant impact of socioeconomic status on educational access and achievement.

In alphabetical order, the excluded states are: Arunachal Pradesh, Goa, Jammu and Kashmir, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, and Tripura.

4 Empirical Strategy

The primary focus of study is to ascertain if there is indeed a difference in the school enrollment of individuals between the age of 5-18 based on sanitation and gender-separate toilets. In order to examine this, the paper employs two empirical specifications: a linear probability model and a probit model. In either of these models, the dependent variable is current school enrollment.

Linear Probability Model

The first empirical specification is that of a linear probability model. Given that the dependent variable is a binary variable that takes the values 0 or 1, the model is fit by linear regression. We estimate two linear probability specifications:

$$\text{Enrollment}_{is} = \beta_0 + \beta_1 \text{Sanitation}_{is} + \beta_2 \text{Separate}_{is} + \gamma X_{ih} + \delta S \tag{1}$$

The variable of primary interest is sanitation which represents whether the toilets in a school are clean or not. The gender norms are captured by the variable separate which shows whether having gender-separate toilets has an effect on current school enrollment of students. X*ih*is a vector of covariates that includes several controls including the standard of study, socioeconomic indicators including caste, religion, wealth quintile, and household characteristics including the number of members in a household. It also includes the interactions between females and wealth quintiles to examine more closely how the private schooling choice for girl children differs across the wealth levels of the household. Although some covariates such as caste, religion, capture the household characteristics, we also run these equations with and without school fixed effects to control for the other unobserved school characteristics that may affect the enrollment outcomes.

Probit Model

The second empirical specification that this study uses is a probit regression. While the linear probability model may estimate probabilities for the variables in study out of the unit interval, a probit regression does not do so thereby being the better model among the two and being widely used in the literature as well. The probit model for this study is represented in vector notation as follows:

$$\Pr(E_{is} = 1 \mid X) = \Phi(X_{ih}^T \beta) \tag{2}$$

where the variables are as described in the linear probability model: E*is* is the dependent variable of interest X*ih* and is the vector of covariates which affect E*is*. Φ denotes the cumulative distribution function of the standard normal distribution and the parameters are estimated by the method of maximum likelihood. The vector of covariates is identical to the linear specification and the explanatory variables are identical as well.

5 Results

The results from the linear probability models provide insightful findings regarding the influence of sanitation facilities and the presence of gender-separate toilets on school enrollment. Across all four models, the coefficient for the sanitation variable is positive and statistically significant, with values ranging from 0.0160 to 0.0180. This consistency indicates that schools with cleaner toilets are more likely to see higher enrollment rates. The positive effect of improved sanitation facilities underscores their crucial role in promoting school attendance. Cleaner facilities likely contribute to better health outcomes for students, reducing absenteeism due to illness and making the school environment more appealing. This finding aligns with broader public health literature that emphasizes the importance of hygiene in educational settings as a critical factor for enhancing learning conditions.

Female variable shows a negative association with enrollment, suggesting that girls are less likely to be enrolled in school compared to boys. This highlights existing gender disparities in educational access and may point to broader societal and structural challenges that affect girls' education. The variable representing the availability of gender-separate toilets, however, shows a different trend. The coefficients for separate toilets are positive in models where it is included but are not statistically significant, indicating a lack of strong evidence that gender-separate toilets alone significantly influence enrollment decisions. Although the intent behind providing separate toilets is to create a safer and more private environment for both genders, which could theoretically increase enrollment, especially among females, the data does not demonstrate a compelling impact on overall enrollment.

This could be due to several factors such as the overall quality of the facilities, cultural norms, or other unmeasured aspects of the school environment that also affect student attendance.

In the Probit model, the coefficient for sanitation is significant, indicating that improvements in sanitation facilities positively influence school enrollment. This finding aligns with the results from the LPM, where sanitation also showed a significant positive impact. Both models suggest that better sanitation facilities at schools are likely to increase student attendance, underscoring the importance of clean and accessible toilets in promoting education. The coefficient for separate toilets, however, remains non-significant but positive in the Probit model, similar to its impact in the LPM. In the Probit model, the estimated marginal effect of sanitation implies that improving these facilities could increase the probability of school enrollment by about 3.19%. The positive impact of sanitation across both models highlights it as a critical intervention point for educational policies aimed at increasing school participation rates.

6 Conclusion

This paper revisits a critical issue concerning the intersection of sanitation, gender, and school enrollment, particularly within the context of developing nations like India. Addressing whether improved sanitation facilities influence school enrollment and impact gender-based outcomes is paramount, as these factors are intertwined with broader societal progress. The implementation of better sanitation facilities has proven to be a significant determinant of increased school enrollment, a finding consistent across both the linear probability model (LPM) and the probit model employed in this study. Notably, sanitation facilities directly correlate with higher enrollment rates, illustrating their crucial role in promoting educational participation and public health.

The results for sanitation highlights that having clean toilets can increase the enrollment outcomes by 3.19%. However, the results concerning separate toilets for different genders were less definitive. This indicates that while separate toilets are a step toward addressing gender-specific needs, they alone may not be sufficient to drastically change enrollment patterns without broader systemic and cultural changes.

Moreover, the analysis provided in this paper contributes to the existing literature by quantifying the effects of sanitation on enrollment and examining the nuanced implications of gender-separated facilities. It underscores the necessity for comprehensive policies that not only improve physical infrastructure but also address cultural and social norms that may hinder educational access, especially for girls.

In conclusion, this study highlights the persistent challenges at the intersection of hygiene, gender, and education. It calls for integrated strategies that combine infrastructure enhancement with social reforms. Ensuring access to improved sanitation facilities and addressing gender disparities in education are not only about improving health and educational outcomes but are also critical for achieving equitable social progress. The findings advocate for policy interventions that can effectively leverage sanitation improvements to foster greater educational inclusion, thereby contributing to the broader goals of social equity and public health.

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Appendix

Table 1: Descriptive Statistics

Variables	Literacy		Current Enrollment	
	Mean	**SD**	**Mean**	**SD**
		Gender		
Female	0.8717	0.3344	0.8926	0.3096
Male	0.8780	0.3273	0.9170	0.2759
		Caste Groups		
Brahmins	0.9312	0.2532	0.9726	0.1633
Forward Castes	0.9028	0.2962	0.9224	0.2675
OBCs	0.8725	0.3335	0.9026	0.2965
SCs	0.8619	0.3451	0.8928	0.3094
STs	0.8252	0.3798	0.8733	0.3326
		Religion		
Hindu	0.8807	0.3241	0.9131	0.2816
Muslim	0.8282	0.3772	0.8580	0.3491
Sikh	0.9346	0.2473	0.9185	0.2737
Christian	0.9432	0.2315	0.9272	0.2600
		Wealth Quintiles		
Poorest	0.8354	0.3709	0.8995	0.3006
2nd Quintile	0.8657	0.3409	0.8956	0.3058
3rd Quintile	0.8854	0.3185	0.8947	0.3069
Richest	0.9134	0.2813	0.9305	0.2543

Table 2: Linear Probability Model Results

Variables	Coefficients (Standard Errors)			
	(1)	(2)	(3)	(4)
Sanitation	0.0179***	0.0163***	0.0182***	0.0171***
	(0.00375)	(0.00383)	(0.00382)	(0.00390)
Separate Toilets			0.00590	0.00499
			(0.00356)	(0.00362)
Caste	0.0414***	0.0420***	0.0421***	0.0425***
	(0.00317)	(0.00319)	(0.00319)	(0.00321)
Religion	-0.0745***	-0.0749***	-0.0756***	-0.0761***
	(0.00517)	(0.00521)	(0.00520)	(0.00525)
Q1	-0.00655	-0.00549	-0.00561	-0.00479
	(0.00541)	(0.00544)	(0.00548)	(0.00551)
Q2	-0.0106**	-0.0101*	-0.00945	-0.00900
	(0.00517)	(0.00521)	(0.00520)	(0.00525)
Q3	0.0142**	0.0138*	0.0135	0.0132*
	(0.00580)	(0.00585)	(0.00588)	(0.00592)
Female	-0.0294***	-0.0290***	-0.0285***	-0.0281***
	(0.00417)	(0.00420)	(0.00422)	(0.00425)
FemalexQ1	-0.0155***	-0.0154***	-0.0151***	-0.0151***
	(0.00509)	(0.00506)	(0.00507)	(0.00508)
FemalexQ2	-0.0100	-0.00979	-0.00850	-0.00856
	(0.00672)	(0.00675)	(0.00684)	(0.00689)
FemalexQ3	0.00779	0.00775	0.00894	0.00895
	(0.00802)	(0.00805)	(0.00815)	(0.00820)
Household Size	0.000854***	0.000848***	0.000858***	0.000859***
	(0.000142)	(0.000144)	(0.000145)	(0.000149)
Constant	0.905***	0.914***	0.899***	0.935***
	(0.0662)	(0.0246)	(0.00723)	(0.0248)
Observations	40,352	40,308	39,677	39,636
R-squared	0.015	0.016	0.015	0.017
School Fixed Effects	No	Yes	No	Yes

Note: *Robust standard errors in parentheses*
**** p¡0.01, ** p¡0.05, * p¡0.1*

Table 3: Probit Model Results

Variables	Coefficients	Standard Errors
Sanitation	0.0799***	(0.0205)
Separate Toilets	0.0208	(0.0200)
Caste	0.277***	(0.0221)
Religion	-0.418***	(0.0235)
Female	-0.112***	(0.0377)
FemalexQ1	-0.0889*	(0.0519)
FemalexQ2	-0.0539	(0.0509)
FemalexQ3	-0.00861	(0.0503)
Q1 (Poorest)	-0.0852**	(0.0386)
Q2	-0.123***	(0.0372)
Q3	-0.191***	(0.0503)
Household Size	(coefficient)	(std. error)
Constant	(coefficient)	(std. error)
Observations	39,711	
Note:	*Robust standard errors in parentheses* **** p¡0.01, ** p¡0.05, * p¡0.1*	

Table 4: Marginal Effects from Probit Model

Variables	Marginal Effects	Standard Errors
Sanitation	0.0319***	(0.0205)
Separate Toilet	0.0083	(0.0200)
Caste	0.1106***	(0.0221)
Religion	-0.1669***	(0.0235)
Female	-0.0447***	(0.0377)
FemalexQ1	-0.0355*	(0.0519)
FemalexQ2	-0.0215	(0.0509)
FemalexQ3	-0.0034	(0.0503)
Q1 (Poorest)	-0.0340**	(0.0386)
Q2	-0.0491***	(0.0372)
Q3	-0.0762***	(0.0503)
Household Size	0.0025*	(0.0049)
Constant	-	(0.0449)
Observations	39,711	
Note:	*Robust standard errors in parentheses* **** p¡0.01, ** p¡0.05, * p¡0.1*	