

## **The Relationship between Inadequate Sanitation Facilities and the Economic Well-Being of Women in India**

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### **Abstract**

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The present study attempts to ascertain the relationship between inadequate sanitation facilities and two key measures of the economic well-being of women in India: literacy rates and labor force participation rates. A two-stage regression model and correlation analysis are employed. All data is district-level for the year 2011. Results from a simple correlation analysis suggest that there is a positive correlation between latrine availability and female literacy rate but a negative correlation between latrines and the female labor force participation rate. Results from a two-stage analysis, however, indicates that latrine availability is positively related to both female labor force participation and female literacy rates. These results suggest that the availability of latrines positively impacts the economic well-being of women. This is one of the first studies that examines the relationships between latrine availability and female labor force participation and literacy rates in India, and this is one of the few studies on this topic to use district-level data. Hence, these results are significant and suggest that the government of India should invest more in proper sanitation facilities for all of its citizens. These types of investments would greatly improve the economic lives of India's women.

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**Keywords:** latrines; India; women; labor force; literacy

**JEL Codes:** O15, O18

### **Introduction**

On May 27, 2014, two "low-caste" teenage girls ages 14 and 15 stepped out of their home in a village in northern India to relieve themselves. It is safe to assume that their home did not have an indoor toilet.

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Tragically, the girls did not return home. They were later found, gang-raped and murdered, their bodies hanging from a tree. This terrible and graphic incident captures in many ways the persistent dangers that rural women in India constantly face while carrying out such a basic action as relieving themselves. Often, people from low-castes, living in rural areas, do not have access to toilets. Men and women are forced to relieve themselves in the open. Women are especially vulnerable to constant threats and bear the brunt of societal violence( Angre & Mehrotra, 2014).

Even though India has experienced tremendous economic growth over the past decade and now boasts the world's largest middle class, less than one-third of homes in Indian villages have toilets, and 53 percent of Indians defecate in the open on a regular basis. Putting aside the health and safety issues associated with such unsanitary practices, this lack of indoor toilets also has an economic impact on the lives of Indian women. Given the social constraints of traditional societies, women must go to extraordinary lengths in order to relieve themselves in relative peace and security. Even access to public toilets does not translate into a less stressful situation. Public toilets in India are typically very dirty, and men tend to congregate near them in order to verbally abuse and sexually assault women as they attempt to use the facilities. In order to avoid these potentially dangerous situations, women must go to the public toilets in groups. This creates scheduling issues, not to say anything of the health issues that are created because women must wait to use a toilet.

For women who don't have access to public toilets, the situation is even more dire. Women must wait until it is dark to defecate. Defecating in the open creates its own problems in the form of polluted water, increased prevalence of water-borne illnesses, and an increased likelihood of sexual assault. All of these issues result in women in India having to devote an extraordinarily large amount of time to the tasks of urinating and defecating, much more time than women who live in countries with universal access to indoor toilets. There are also economic impacts, such as the costs of water filtration, children's ability to attend school, and the restriction of movement which in turn restricts women's ability to find work and stay employed. The problems are huge, cover several intersecting areas, and cannot be addressed in one paper. Thus, this study takes a more narrow focus and attempts to ascertain the relationship between latrine availability (private indoor latrines) and two key measures of the economic well-being of women in India: literacy rates and labor force participation rates.

## **Prior Research on Sanitation and India**

The problem of inadequate sanitation infrastructure and well as the socio-cultural aspects of poor sanitation practices have increasingly become the focus of several health and human-rights organizations. However, there is a distinct lack of research by academics in this area. Most of the literature comes from reports generated by UN aid agencies and NGOs. The existing research is mostly qualitative, and generally focuses on the economic impacts of the lack of toilets and sanitation practices in a cultural context. Very little of this prior research focuses specifically on women, and very few reports focus on the economic impacts of inadequate sanitation facilities. Some of the prior works on this topic are discussed below.

The economic costs of inadequate sanitation facilities in India were estimated in a recent study by the Water and Sanitation Program (2011). According to this report, the total annual economic impact of inadequate sanitation in India in 2006 was \$53.8 billion. This cost was broken down into four categories: health (\$38.49 billion), access time (\$10.73 billion), water (\$4.21 billion), and tourism (\$260 million). It was noted in this report that many negative effects of inadequate sanitation were not accounted for in these estimates, including the economic impacts of water-borne illnesses, reductions in livestock and agricultural production due to lack of clean water, and negative social effects associated with defecating in public.

Another report by the National Sampling Survey Office (NSSO) has shown a clear stratification of sanitation facilities between urban and rural areas. The NSSO Report titled "Key indicators of drinking water, sanitation, hygiene and housing conditions in India" (NSSO, 2013) shows that 59.4 percent of rural households, and 8.8 percent of urban households do not have any latrine facility, while 31.9 percent of rural households and 63.9 percent of urban households have exclusive (rather than shared) use of latrine facilities. Urban areas seem to fare very well in comparison to rural areas with respect to the availability of latrine facilities. However, this is no reason for comfort, considering that 833 million people (or 69 percent) of India live in rural India. It is safe to assume that the lack of sanitation facilities has a negative impact on the Indian economy as a whole.

In particular, the lack of adequate sanitation affects women's welfare in India resulting in further negative consequences.

According to Indian Census data (2011), the female population is 587 million and constitutes 48 percent of the population. Yet, women's participation in the workforce is only 29 percent of women aged over fifteen years. This figure is the lowest of the BRICS countries (i.e. Brazil, Russia, India, China and South Africa) and most of the MINT countries (i.e. Mexico, Indonesia, Nigeria and Turkey – of these, only Turkey has the same participation as India)(Rathi, 2014). At least part of the reasons for this could be attributed to the inadequate safety of women which could in turn be related to inadequate access to toilets.

The lack of toilets is very prevalent in several South Asian countries, and some social commentators and researchers have tried to ascertain and ascribe the reasons for this situation. Soutik Biswas notes that while the lack of toilets is endemic in India, the government has been making efforts rectify the situation by providing many incentives to build and maintain both private and public toilets. Despite this, the problem of public defecation seems to persist to the point that Biswas sees it as a deep rooted socio-cultural issue rooted in the caste-system. The lower castes were always assumed to be too poor to have any toilets in their homes. Access to water, as well as places to dispose of solid waste, was not available, leading them to simply defecate in the open. Biswas notes that even after Independence and the abolition of the caste system, many Indians continued to relieve themselves in the open, while keeping their houses spotlessly clean. He also notes that of the various religious groups, Sikh and Christian households had the highest access to sanitation (70 percent), whereas Hindus had the least access (45 percent)(Biswas, 2012).

A 2011 report by Water Aid, FANSA and WSSCC titled "South Asian people's perspective on sanitation: Synthesis review" (Water Aid, FANSA and WSSCC, 2011) notes that people in villages are often unaware of basic hygiene practices, and that their ideas about hygiene are unclear. The Water Aid, FANSA and WSSCC report was based on interviews of people from the following South Asian nations: India, Pakistan, Bangladesh, Nepal and Sri Lanka. The study focused on getting perspectives regarding sanitation among people from rural as well as urban areas, and reveals interesting facts about attitudes as well as the politics that are prevalent. We list them below (adapted from (Water Aid, FANSA and WSSCC, 2011)):

- **Dignity and privacy:** People see toilet facilities as an important function of maintaining their privacy and dignity. Women interviewed often stated that a clean home is a source of immense satisfaction to them. Yet, as noted above, people in villages were often not aware of basic hygiene practices. Many expressed the need for more education and awareness efforts from the government.
- **Community involvement and leadership:** The study showed that, for sanitation efforts to succeed, there was a clear need for leadership and community involvement. Merely setting up public latrines without getting community “buy-in” was likely to be unsuccessful.
- **Toilets in schools:** There was a clear support for toilets in schools. While there were sporadic efforts to build these, poor maintenance and corruption often caused these toilets to become unusable. It was noted that menstruating girls simply did not go to school for at least five days of a month due to inadequate toilet facilities. In many cases, girls stopped going to school after reaching puberty.
- **Vested interests and corruption:** In the rural areas of India, vested interests (such as the caste system) restricted access to latrines to members of certain lower castes. In addition corrupt officials had no incentive to correct the situation to make it work.
- **Sub-standard materials:** It was noted that even though the government undertook efforts to build toilet facilities, these were often constructed using sub-standard materials and methods (due to corrupt officials and inadequate oversight), thus rendering these efforts meaningless.
- **Lack of water:** The study’s participants noted that, in many cases, when toilets were built, there were inadequate efforts to provide access to water and drainage systems, thus rendering the toilets unusable.
- **Community toilets:** Another interesting aspect that was revealed in these studies was that, as more people built their own in-house toilets, community toilets fell into disuse. This resulted in a lack of public amenities to commuters and other traveling public.

As can be ascertained from the above literature review, the lack of sanitation facilities is gaining increased attention in India among policy makers and civil society. While the above reports have helped to bring the problem into clear focus, there has not been any specific research on how this lack of sanitation facilities affects the women of India, especially in rural areas. Very little research has been devoted to the topic of the impact of inadequate sanitation on the economic well-being of women.

Women in India are affected to a greater extent than are men because of the social constraints Indian women face due to the traditional and conservative attitudes that are prevalent in rural India. Therefore, it would be informative to ascertain the relationship between latrine availability (private indoor latrines) and two key measures of the economic well-being of women: literacy rates and labor force participation rates.

Regarding prior research on the determinants of these two economic measures, there are unfortunately, few studies on either topic. Most studies that examined the determinants of literacy and labor force participation were for specific countries (Lahoti and Swaminathan, 2013; Kiana, 2009; Naqvi and Shahnaz, 2002; Charette and Meng, 1998; Kozel and Alderman, 1990; Behrman and Wolfe, 1984). None of these studies examined the relationship between latrine availability and female labor force participation or literacy rates.

The present study differs from this prior research in several ways. First, very recent data (2011) on a large, rapidly developing economy (India) is used. Second, district-level data is used. Third, the present study attempts to estimate the relationship between sanitation facilities and female literacy and labor force participation rates; most other studies just looked at overall literacy or labor force participation rates, or they employed very simplistic statistical methodologies.

### **Empirical Technique and Data**

In order to estimate the determinants of female literacy rates and labor force participation rates, guidance was obtained from several prior studies (Lahoti and Swaminathan, 2013; Kiana, 2009; Naqvi and Shahnaz, 2002; Charette and Meng, 1998; Kozel and Alderman, 1990; Behrman and Wolfe, 1984). Unfortunately, as noted previously, none of these prior studies examined the relationships between latrine availability and female labor force participation or latrine availability and female literacy. Most of these prior studies acknowledge that educational attainment and income are related to labor force participation. In addition, it is assumed that female literacy would be related to the literacy rates of men and various demographic measures (rural residence; household size). Finally, it is assumed that latrine availability would increase the likelihood that a women would be able to work and to pursue an education so as to become literate.

Although there are many other factors that may affect labor force participation and literacy, it is reasonable to assume that the presence of proper sanitation facilities would increase the time available for both work and education.

It is important to note, however, that latrine availability may be endogenous in the estimation of the determinants of labor force participation and literacy. Districts that have higher than average rates of latrine availability may also possess other measures of economic well-being and sufficiency, such as higher than average female labor force participation and literacy rates. In order to control for this possible endogeneity, a two-stage regression is estimated, where it is assumed that latrine availability is endogenous.

An important issue in a two stage analysis is the selection of an appropriate instrument for latrine availability. It is necessary that this instrument be exogenous in the estimation of latrine availability and be uncorrelated with the error term in the second stage regression. It is assumed in this analysis that a variable denoting the per capita number of publicly available toilets constructed during the period 2001-2011 is a reasonable instrument for the estimation of district-level latrine availability. The reason for this is because it is assumed that a district that had constructed a larger number of toilets would also have more toilets available in general, including private latrines. It is highly unlikely that this instrument is correlated with either measure of the economic well-being of women. Hence, in the first stage of this regression, district-level latrine availability is regressed against a series of control variables, including the instrumental variable per capita number of toilets constructed 2001-2011. Given the above, the following two-stage regression model is estimated for female labor force participation rates:

First-Stage:  $\text{Latrine}_i = \alpha_0 + \alpha_1 \text{Toilets Constructed} + \alpha_2 \text{Income} + \alpha_3 \text{Control Variables}$

Second-Stage:  $\text{Labor Force Participation Rates}_i = \beta_0 + \beta_1 \text{Estimated Latrine} + \beta_2 \text{Control Variables}$

In the above equations, Latrine denotes the percentage of households with indoor toilets, Toilets Constructed is the per capita number of toilets constructed during the period 2001-2011, Income is per capita income, and Control Variables are a set of various socioeconomic factors.

Toilets Constructed and Income are instrumental variables used to estimate Latrine in the first stage. In the second stage, the dependent variable is female labor force participation rates.

In order to estimate the determinants of female literacy rates, the following two-stage regression model is estimated:

First-Stage:  $\text{Latrine}_i = \alpha_0 + \alpha_1 \text{Toilets Constructed} + \alpha_2 \text{Income} + \alpha_3 \text{Control Variables}$

Second-Stage:  $\text{Literacy Rates}_i = \beta_0 + \beta_1 \text{Estimated Latrine} + \beta_2 \text{Control Variables}$

All variables are as defined above. All data is district-level, except for income; income data is state-level. All data is for the year 2011. Data was obtained from the Census of India and other Indian government sources.

## Results

Before estimating the two-stage regressions discussed above, simple correlations were estimated. These results are presented on Table 1. These results suggest that there is a positive correlation between income and Latrine and between Latrine and female literacy rate, which are not unexpected. However, there is a negative correlation between Latrine and the female labor force participation rate. This result is interesting because it indicates that districts that have higher percentages of indoor toilets actually have lower labor force participation rates. This may suggest that, in those districts where income is sufficiently high, women do not work outside the home.

On Tables 2 and 3, the second-stage results are presented for literacy rates and labor force participation rates; first-stage results are available upon request. As can be seen from these results, Latrine is positively related to both female labor force participation and female literacy. Hence, the availability of indoor latrines increases the probability that women will be better off economically. Regarding the other variables, the female literacy rate and household size are negatively related to the labor force participation rate, but percent rural and percent female are positively related to the labor force rate. Household size is negatively related to female literacy rates, but percent female and male literacy rates are positively related to the female literacy rate.

These results suggest that indoor latrines are positively related to the economic well-being of women. Even after controlling for the possible endogeneity of indoor toilets, the presence of indoor latrines will increase women's economic well-being.

### **Concluding Remarks**

As noted in the above results, greater access to latrines generally corresponds to higher female literacy rates and greater female labor force participation. Given that women's literacy is positively related to the availability of indoor toilets, it is critical for policy makers to focus their efforts on improving the sanitation infrastructure of India. Such capital improvements would do much to improve the lives of women in India. Indeed, a multi-strategy approach should be used, wherein proper planning of sanitation infrastructure should take into account access to adequate water and drainage, education, community leadership and participation. Many commentators have pointed to the fact that lower caste villages are typically neglected by politicians when it comes to planning for sanitation infrastructure, schools and protection. Given the link between literacy and sanitation, such neglect must be overcome in order to better the lives of all Indian women.

Finally, it is important to note that more studies should be conducted in this area. As we pointed out earlier, the only studies conducted so far have been by government agencies and some NGOs. However, these may lack the objectivity and clarity of neutral academic researchers. There is a need for more accurate data collection and more analysis. This paper is merely a first step in the process. We hope that more work will emerge on this important socio- and political-economic area in the future.

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**Table 1: Simple Correlations**

	Percent Indoor Latrine	Female Literacy Rate	Female Labor Force Participation Rate
Percent Indoor Latrine	1	0.679	-0.161
Female Literacy Rate		1	-0.104
Female Labor Force Participation Rate			1

<b>Table 2: Female Labor Force Participation Rate Second-Stage Regression Results</b>		
Variable	Coefficient	Test Statistic
Constant	-0.629	-2.066**
Percent Indoor Latrine (percentage of households with indoor latrines)	0.900	5.495***
Household Size	-0.113	-7.544***
Female Literacy Rate	-1.492	-6.079***
Percent Rural (percentage of households living in rural areas)	0.389	5.793***
Percent Female (percentage of district population that is female)	3.290	5.222***
Notes: Adjusted R <sup>2</sup> = 0.145 Instrumental Variables: Income, Number of Toilets Constructed 10 percent level = * 5 percent level = ** 1 percent level = ***		

<b>Table 3: Female Literacy Rate Second-Stage Regression Results</b>		
Variable	Coefficient	Test Statistic
Constant	-0.417	-6.643***
Percent Indoor Latrine (percentage of households with indoor latrines)	0.182	7.877***
Household Size	-0.015	-5.928***
Male Literacy Rate	0.894	27.281***
Percent Rural (percentage of households living in rural areas)	0.002	0.146
Percent Female (percentage of district population that is female)	0.702	6.065***
Notes: Adjusted R <sup>2</sup> = 0.903 Instrumental Variables: Income, Number of Toilets Constructed 10 percent level = * 5 percent level = ** 1 percent level = ***		