

RESEARCH ARTICLE

# Impact of Safe Domestic Water Source on Female Labor Force Participation Rates and Female Literacy Rates in India

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## Abstract

Access to a clean domestic water supply can have a significant impact on the overall well-being of individuals, particularly women and girls. In many parts of India, women and girls are responsible for collecting water for their households at publicly accessible sources. The quality and cleanliness of water collected from these untreated sources can result in various illnesses such as diarrhea, cholera, and typhoid. The purpose of the present study is to determine if access to treated domestic water sources is associated with increased literacy rates and labor force participation rates for women in India. Using district-level data from India for the year 2013, results indicate that access to treated domestic water has a statistically significant and positive relationship on both female literacy rates and female labor force participation rates. Hence, when households have access to clean tap water, women can use their time to engage in more productive uses, such as schooling or working.

**Keywords:** Water, Domestic Source, Female, Literacy, Labor Force.

## 1. Introduction

Access to a clean domestic water supply can have a significant impact on the overall well-being of individuals, particularly women and girls. In many parts of India, women and girls are responsible for collecting water for their households at publicly accessible sources. In addition to the considerable amount of time spent collecting water, the quality and cleanliness of water collected from these untreated sources can result in various illnesses such as diarrhea, cholera, and typhoid. Hence, not only do many women spend a considerable amount of time and energy in collecting water, but the water they collect may very well cause a host of diseases, thus resulting in additional productive time wasted. However, when communities have access to clean and readily accessible water sources, much less time is required to collect water, and much less time is potentially spent on recovering from water borne

illnesses. Hence, without the need to collect water, women can spend more time on various productive activities, such as education and work. The purpose of the present study is to determine if access to treated domestic water sources is associated with increased literacy rates and labor force participation rates for women in India.

Interestingly, there has been little prior research conducted on the association between safe domestic water supplies and indicators of female productivity. Many prior studies only briefly examined the topic (Bhardwaj, Gupta, Shukla, Mishra, Mudgal, and Amritphale, 2017; Mitra and Rao, 2019; Prokopy, 2005; Watmough, Atkinson, and Hutton, 2013). One of the few studies that examined a related area was Gius and Subramanian (2015). In this study, the authors examined the relationship between inadequate sanitation facilities and female literacy rates and labor force participation rates. A two-stage regression model

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and correlation analysis were used. Results indicated 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. A similar analysis will be employed in the present study.

## 2. Empirical Technique and Data

To estimate the determinants of female literacy rates and female labor force participation rates, the following regression model was employed in the present study:

$$Y_i = \beta_0 + \beta_1 \text{Water} + \beta_2 \text{Control Variables}$$

(1) Two dependent variables were estimated: female literacy rates and female labor force participation rates. Water denotes the percentage of households in a district in India with access to treated public water. Control variables include the following: household size; percent of district that is rural; percent of district

population that is female; percent of ground water developed in district; and the percent of water used by industry.

It was assumed that the variable Water is endogenous and is simultaneously determined with both female literacy rates and female labor force participation rates. To control for this endogeneity, two-stages least squares was used to estimate equation (1). The instrumental variables that were used include per capita median income, the percentage of homes with indoor bathrooms, and the male labor force participation rate for the labor force regression and the male literacy rate for the literacy regression.

All data is for India and is district-level; the year of the data is 2013. The sample size is 516. Data on water usage was obtained from Dynamic Ground Water Resources of India. All other data was obtained from the Census of India and other Indian government sources. Descriptive statistics are presented on Table 1.

**Table 1.** Descriptive Statistics

Variable	Mean	Standard Deviation
Female Labor Force Participation Rate	0.276	0.111
Female Literacy Rate	0.54	0.12
Percent of Households with Treated Tap Water	0.244	0.20
Household Size	5.02	0.75
Percent of District that is Rural	0.753	0.172
Percent of District Population that is Female	0.515	0.014
Percent of Ground Water Developed	0.627	0.274
Percent of Water Used by Industry	0.211	0.268
N= 516		

## 3. Results and Concluding Remarks

As noted previously, it was assumed that the variable Water is endogenous. To control for this endogeneity, two-stages least squares regression was used to estimate equation (1). The instrumental variables that were used include per capita median income, the percentage of homes with indoor bathrooms, and the male labor force participation rate for the labor force regression and the male literacy rate for the literacy regression. First stage results are available upon request. Second stage results are presented on Tables 2 and 3.

Results indicate that access to treated domestic water has a statistically significant and positive relationship with both female literacy rates and female labor force participation rates. Hence, when households have access to clean tap water, women can use their time to engage in more productive uses,

such as schooling or working. Regarding the other variables, household size and percent of ground water developed are negatively related to both literacy rates and labor force participation rates, while percent female and percent of water used in industry are positively related. These results suggest that larger households and the over-development of ground water resources result in lower economic indicators for women.

Given that these results suggest that access to clean water is positively related to increased economic opportunities for women, it is imperative that governments focus their efforts on improving the water supply infrastructure. Given the link between literacy, work, and clean water, improvement of the water infrastructure is imperative to better the lives of all Indian women.

**Table 2.** Second Stage Regression Results. Dependent Variable: Female Literacy Rate

Variable	Coefficient	Test Statistic
Intercept	0.133	0.72
Percent of Households with Treated Tap Water	0.335	5.75***
Household Size	-0.0311	-4.45***
Percent of District that is Rural	-0.114	-2.34**
Percent of District Population that is Female	1.149	3.53***
Percent of Ground Water Developed	-0.021	-1.74*
Percent of Water Used by Industry	0.106	5.97***

Notes: Adjusted R<sup>2</sup> = 0.396, F = 57.3, 10% Significance = \*; 5% Significance = \*\*; 1% Significance = \*\*\*

**Table 3.** Second Stage Regression Results. Dependent Variable: Female Labor Force Participation Rate

Variable	Coefficient	Test Statistic
Intercept	-0.317	-1.70*
Percent of Households with Treated Tap Water	0.147	2.50**
Household Size	-0.048	-6.78***
Percent of District that is Rural	0.303	6.17***
Percent of District Population that is Female	1.19	3.63***
Percent of Ground Water Developed	-0.029	-2.41**
Percent of Water Used by Industry	0.041	2.31**

Notes: Adjusted R<sup>2</sup> = 0.269, F = 32.70, 10% Significance = \*; 5% Significance = \*\*; 1% Significance = \*\*\*

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