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**Can Women Empowerment Help to Reduce Open
Defecation in India: Evidence from NFHS 4**

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Amrita Chatterjee and Shriya Agarwal

Abstract

In this paper, it is argued that women, because of being disproportionately affected by lack of sanitation, can influence the household to build a toilet at home and therefore reduce the incidence of open defecation. Thus, the objective of this paper is to analyze the role that women empowerment can play in reducing open defecation at the household level. Using the National Family Health Survey (NFHS-4) for 2015-2016 for a cross section of 17 major states of India, the paper suggests that greater women autonomy in the form of higher decision making power and greater freedom of movement leads to increased chances of toilets in the house. Secondly, women can be influential neither by virtue of being the head of the household nor by working but only if such positions of power are complemented with education and media exposure. A district level analysis using Quantile regression suggests that the role of women autonomy is more pronounced in the well performing districts compared to districts with more open defecation. The importance of media exposure and education got reinforced.

Key words: *Sanitation; women empowerment, education, logistic regression, quantile regression*

JEL Codes: *020, J16, D1, B23*

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INTRODUCTION

The UN General Assembly, in 2010, recognized access to sanitation as a human right along with safe drinking water and called for international efforts to help countries to provide safe, clean, accessible and affordable drinking water and sanitation. However, as per WDI (World Development Indicators) data during the period 2000-2015 even if percentage of global population defecating in open has come down from 22.05 percent to 10.4 percent, the figure in rural area was about 20.5 percent. Compared to global scenario the picture is much grim in India where almost 31 percent of the population was practicing open defecation in 2015 coming down from approximately 73 percent in 2000. In rural India this value was 42 percent during the same time though in urban area it was considerably lower (7 percent compared to global value of 2 percent). Nearly half of the households residing in the four states of Bihar, Madhya Pradesh, Rajasthan and Uttar Pradesh are not having toilets at home and therefore defecate in the open (National family health Survey (NFHS 4)). Inadequate sanitation can lead to infectious diseases such as cholera, typhoid and dysentery world-wide apart from stunting and impaired cognitive function, lifelong impact on well-being through fall in school attendance, rise in anxiety over safety, especially for women and girls (WHO, 2018). There is not much doubt about the fact that women are the worst sufferer in terms of physical, mental and psychological stress originating from open defecation and therefore should be more proactive in demanding a toilet at home. However, the household power dynamics of women has not got much attention in the context of reducing open defecation in relevant literature. The current paper intends to investigate if women empowerment through decision making power, control over assets and freedom of movement strengthened by education and labor force participation can help them build toilets at the household level. The analysis is further extended to district level to see whether the individual effort gets converted to the aggregate level and more importantly contributes to the literature by

highlighting if these factors affect districts with low open defecation differently from the districts with high level of open defecation using evidence from NFHS 4 data.

Literature Review

It is well documented in literature that lack of access to water and proper sanitation facility can be a source of detrimental effects on human health, especially, among children such as child stunting and infant mortality (Spears, 2013; Von Medeazza, 2013; Coffey *et. al.* 2013, Ghosh *et. al.*, 2014; Hathi *et. al.* 2016). There are evidences suggesting that access to high-quality sanitation reduces child diarrhoea, stunting and mortality by 13 percent, 27 percent and 23 percent respectively (Fink, Gunther, and Hill, 2011). Spears and Lamba (2013) found that early life exposure to better sanitation because of the Total Sanitation Campaign in India lead to better cognitive abilities of six-year old children. More generally, public defecation leads to larger prevalence of water-borne and vector-borne diseases in individuals which in turn reduces their working capabilities and adversely impacts the GDP of the country. Incidentally, the World Bank reported that 6.4 percent of India's GDP is lost due to inadequate sanitation and its resultant costs. For the sub-Saharan Africa, the corresponding number is 4.3 percent. The ill effects of open defecation only get exacerbated in areas of high population density (Spears, 2013).

The literature regarding women and sanitation can broadly be classified into two categories as relevant to the research question of this work: the channels through which women are disproportionately affected by lack of sanitation facilities which supports the hypothesis to view sanitation as a female good and secondly, the widely studied links of gender and provision of sanitation facilities.

Lack of adequate sanitation disproportionately affects women and girls and adversely affects their health and well-being (Mehta, 2013; Mahon and Fernandes, 2010). Apart from the widely acknowledged

health impacts of poor sanitation, women suffer uniquely from poor sanitation in the form of emotional and mental stress from being seen by men while relieving themselves (Fisher, 2006; O'Reilly, 2010; Truelove, 2011), increased prospects of non-partner sexual violence (NPSV) and psychosocial stress (Jadhav *et. al.*, 2016). More astoundingly, the strength of association between open defecation (OD) and NPSV is twice the association between OD and child diarrhea, thus, exposing the intensity of the problem of OD for women. Several studies report that women and girls are at bigger risk of experiencing sexual harassment, violence and insecurity when travelling to and from grounds for OD (Benjamin, 2000; Fisher, 2006; WaterAid, 2012). Truelove (2011), have highlighted the case of urban slums in Delhi where defecation in open is a harsh reality which is extremely unsafe and vulnerable especially at night. Those risks force women to reduce intake of food and water so that they can avoid urinating or defecating for long hours (Fisher, 2006; McFarlane, 2008; O'Reilly, 2010). These practices are even more harmful for pregnant women and increase the risk of poor maternal health as well as child mal-nourishment such as low birth weight, pre-term births, spontaneous abortions and still births. (Mara, Lane, Scott and Trouba, 2010, Padhi *et. al.*,2014). As found by Caruso *et. al.* (2018) in rural Odisha, access to a functional household latrine was associated with higher well-being scores, but not with anxiety, depression or distress. Biswanathan *et al* (2015) have shown that better sanitation facilities among others have a significant and large influence on BMI. In a qualitative study, Sahoo *et. al.* (2015) broadened the concept of sanitation to include menstrual hygiene apart from defecation and urination. They found that during the aforementioned activities women encountered three major stressors - (1) physical environment which included barriers to access of sanitation and water facilities, poor management of existing facilities (2) social environment which encompassed inadequate privacy and (3) sexual issues which included peeping by males during sanitation activities and gender-based sexual violence such as sexual assault and rape in some cases. These stressors were experienced by at

different life stages in urban slum, rural and indigenous areas in Eastern India. Thus, for women, private household latrines are a source of both personal dignity and physical security (WSP, 2010).

In primary schools, toilets are often inadequate to serve the needs of girls, resulting in nonattendance during menses. Conversely, school enrolment and retention of girls, increases where there are water and sanitation services. Adukia (2016) find that across all ages the presence of school latrines increases female enrollment moderately more than male enrollment. But pubescent-age girls benefit more from sex-specific latrines as compared to unisex latrines. Nallari (2015) concludes that in urban settlements of Bangalore where sanitation facilities are lacking, adolescent girls face many deprivations of education, free time and independent mobility and are exposed to risks of sexual harassment and assault. Thus owing to the disproportionate impact of better sanitation to women, women are expected to assign a higher preference vis-à-vis men towards toilets and women's health hazards can be a significant driver of this preference. However, it will be contingent on their financial status.

The demand-driven approaches explaining the low success rate of the sanitation schemes point towards a low demand for toilets at the household level (O' Reilly and Louis, 2014, Banerjee et al, 2017). While tracing the link between women and provision of sanitation facility we must accept the fact that in South Asian countries women don't have much control over the financial resources which are mostly controlled by men (Ahmed, 2010; Muller and Mobarak, 2013). However, there are some evidences of community-level interventions with women playing a central role to bring about radical reductions not only in the number of people defecating in the open but also prompting behavioral changes in the attitudes of people towards open defecation. The Kalanaur and Dharnai panchayats of Bihar in India, for example, have been declared open defecation free by the State government. This was possible because

of "Jeevika didis"¹ who constructed a toilet in their homes by taking a loan from their Self-Help Groups and then motivated other rural women to follow suit. They did so by holding community meetings at night to discuss the ill-effects of open defecation and adopting practices like "Lota Jalao" where plastic bottles in which water was carried to the fields were confiscated and burnt². Besides, the role of women legislatives in providing public services which are of higher utility to women is well documented. Chattopadhyay and Duflo (2004), using a primary survey data based on 265 Village Councils in West Bengal and Rajasthan, show that the public good provided depends directly on the needs of their own gender. More specifically, in West Bengal more investments went into drinking water and roads in Gram Panchayats reserved for women; whereas in Rajasthan, women led Panchayats are more concerned about drinking water but less often about roads. Clots-Figueras (2005) added the dimension of caste to role of women legislatures and showed that Scheduled Caste (SC)/ Scheduled Tribe (ST) representatives are more concerned about health, early education and women friendly laws. Ban and Roy (2007), however, contradicted the previous studies to conclude that panchayats reserved for women leader do not perform well, though they acknowledged the fact that men and women differ significantly in their preferences for public goods such as water, sanitation and roads. Anderson *et. al.* (2008), through a game theoretic experiment, also confirms that agents in the matriarchal societies tend to contribute more to the provision of public goods vis-à-vis agents in the other societies. Women are expected to interact with a wider group of people in the investment decision-making process (Kathlene, 2001), can be more socially-minded in their spending (Eckel and Grossman, 2008), and be

¹ The Jeevika programme was launched by the state government with the assistance of the World Bank in 2006. Jeevika promotes rural livelihoods and enhances social and economic empowerment of the poor, particularly women. Those benefitting under the programme are called the Jeevika Didis or the livelihood sisters.

² Taken from an article published in the Wire: Women Take the Lead in Building Toilets in Rural Bihar; Link: <https://thewire.in/gender/women-toilets-rural-bihar>

less likely to be corrupted in office (Brollo and Troiano, 2014). More recently, Yu Jung Lee (2018) has taken the Indian case to show that in closely fought elections, women legislators have positive impact on providing high quality latrine to the households also emphasizing the role of female literacy.

The studies discussed so far have mostly highlighted the role of women legislators in providing women-friendly public services more efficiently than their male counterpart. However, the literature broadly overlooks the role of women and their empowerment at the household level in making use of these services. There is a group of studies focusing on the role of women empowerment on child health such as stunting (Spears, 2013) or malnutrition (Smith, Ruel and Ndiaye , 2005); but impact of women empowerment on household decision making regarding building latrine is neglected in the literature. Though Yu Jung Lee (2015) highlighted that women's regular mass media usage and higher intra-household status is positively associated with household latrine ownership; the paper only narrowly investigates the intra-household status of women from the point of view of whether the woman takes the financial decision of the household in purchasing expensive household items. This calls for a detailed analysis of the determinants of higher intra- household status of women and its effect on investing in and using sanitation facilities. In Indian context there are some small sample quantitative and qualitative studies attempting to bring in the gender dimension of sanitation such as Coffey *et. al.* (2014) which states that people who are most likely to use latrines (such as women and the old) are the least likely to have the intra-household power to allocate resources to build a toilet. Breaking the popular view, Coffey *et. al.* (2016) claim that even if women had decision making power, they would not necessarily choose to build latrines despite benefitting more from its construction. This is because they are concerned about pit-emptying and ritual pollution. Stopnitzky (2017) evaluated the impact of "No Toilet No Bride " campaign on household - level latrine ownership to conclude that

the success of this campaign largely rested on the relative scarcity of women driven by the skewed sex ratio in Haryana. In other words, this campaign succeeded by capitalizing on the increased bargaining and decision-influencing power of women. However, this is one such circumstance which naturally boosted women's role in influencing sanitation-related decisions of the households. The current paper is dedicated to find other factors which enhance the role of women and whether they lead to improved sanitation facilities for the household.

Objective

The primary contribution of the paper is to bring in several measures of women empowerment and investigating the association between women's autonomy and ownership status of a latrine at home which has not been explored in India at the sub-national level. It also intends to highlight the role of female labor participation and female education in influencing the family members in building toilets which also did not get much attention in existing literature. On the other hand, women have shown resistance towards using toilets as defecating in the open gave them freedom to venture out of the house and escape the "cooped up" life inside (Coffey *et. al.*, 2016). It is vital to note that this resistance stems from their limited freedom of movement. Though Khanna and Das (2016) have highlighted the role of gender-based power dynamics at the household level in their Uttar Pradesh based study; by and large, the role of women's decision making power, control over financial assets and freedom of movement as catalysts for improved usage and construction of toilets has largely been ignored. Thus the present paper intends to study the association of household level toilet ownership with women empowerment after controlling for individual as well as household level characteristics using a logistic regression.

Another aspect that needs attention is that individual willingness to build a toilet at home may influence some households privately to stop open defecation. But that may not be sufficient for a district to achieve

reduction in open defecation substantially. Some districts may do very well in terms of reduction in open defecation and some may be lagging behind. Thus the role of women empowerment in achieving better sanitation facility can also be different in different districts. As suggested by Ghosh and Cairncross (2013), based on 2001 and 2011 census data there is a wide range of disparity in terms of achievement towards latrine ownership across states and among districts within each state. Whereas some districts are far ahead in terms of achieving OD free status and some are experiencing negative growth rate. They attributed this difference to women literacy. The reasons for slow progress in the low performing states can also be subsidy-driven interventions (like the Total Sanitation Campaign, Government of India) focused on latrine construction which have not been successful as they could not reach the poor people and because of poorly designed and culturally inappropriate toilets (Barnard, Routray, Majorin, Peletz, and Boisson, 2013; Coffey et. al., 2014; Mara et. al., 2010). Novelty of the current paper lies in its contribution to this aspect of disparity across districts and states, through its district level analysis which tries to investigate how women empowerment acts differently in districts with different level of open defecation. This leads to the second objective of the paper which is to investigate the effect of woman empowerment/autonomy on the district level achievement of reduction in open defecation by acknowledging the fact that it can be different for districts with different level of open defecation using a Quantile regression.

Rest of the paper is arranged as follows. The next section deals with the data description and the methodology used. The following section discusses the major findings followed by a conclusion in the last section.

DATA AND METHODOLOGY

Source of Data

This analysis makes use of the cross-sectional data from National Family Health Survey (NFHS-4) which was carried out in the year 2015-16. NFHS is a large-scale, multi-round survey conducted in a representative sample of 601,509 households throughout India. As a development from NFHS-3, for the first time, in addition to the 29 states, NFHS-4 also includes all six UTs and provides estimates of most indicators at the district level for all 640 districts in the country as of the 2011 census. A household questionnaire is used to collect information on household member's composition and characteristics of the household's dwelling unit while the biomarker questionnaire takes care of the physical and health characteristics of household members. More importantly, it is used to identify members of the household eligible for an individual interview for either the Men's or Women's questionnaire. In NFHS-4, the sample for women's questionnaire was 699686 comprising of all women in the reproductive age from 15 to 49 years. The corresponding sample size for men was 112122 for men between the ages of 15 and 54.

Unit of Analysis and Empirical Framework

The current study uses cross-section data on 16 major states of India drawn from NFHS-4. For the household level analysis, the main dependent variable is a binary variable assuming 1 for having a toilet at home and 0 for not having a toilet. As far as the concept of women empowerment is concerned one may refer to the definition given by Batliwala (1995) which defines it as "the process and the outcome of processes, by which women gain greater control over material and intellectual resources and challenge the ideology of patriarchy and the gender-based discrimination against women in all the institutions and structures of society". The literature unanimously agrees that women empowerment is a multi-dimensional concept which can be captured through various domains. Decision making power is one of the most

widely used domain (Pitt *et. al.* 2006, Mahmud *et. al.* 2012, Akter and Chindarkar (2019). This reflects “agency” of the woman to act the way she wishes which has been established as a core element of empowerment by Kabeer (1999). Another important element outlined by the same scholar and subsequently, subscribed by many scholars (Sathar and Kazi 2000, Alkire *et. al.* 2013) is “access to and control over resources”. This is inclusive of ownership of fixed assets such as land, house, business, etc. and control over own finance. The freedom of movement enjoyed by women to visit public places, maternal home, friend’s house, health centers, etc. without permission is yet another commonly used domain to capture women empowerment (Kabeer *et. al.* 2011, Mahmud *et. al.* 2012, Chindarkar and Akter 2016). More recently, freedom from domestic violence has also emerged as an important aspect in the literature pertaining to women empowerment (Heath 2014, Ellsberg *et. al.* 2015, Arestoff and Djemai 2016). Based on the literature on women empowerment discussed above, we identify three major indices as our key independent variables relevant to our analysis. These are Decision Making index, Control over assets and financial resources and Freedom of Mobility Index. The method of construction of these indices largely follows that of Gupta and Yesudian (2006)³.

Decision Making Index

Decision making power is one of the most widely used domains of women empowerment (Gupta and Yesudian 2006, Pitt *et. al.* 2006, Mahmud *et. al.* 2012, Chindarkar and Akter 2016). It is inextricably linked with provision of sanitation facilities. We hypothesize that if a woman is the primary decision maker in the household (say, in terms of making purchases of other durable goods or in allocating the husband’s income), she would also have the power to invest in building and using a toilet owing to the higher preference she places on toilet as a good. More

³ Refer to appendix for the details of the methodology. PCA was not used as only 3 to 4 dimensions were there under each index and there was no evidence supporting different weights to different dimensions as assigned under PCA.

generally, a higher agency of women in the household should lead to better sanitation outcomes.

Control over Assets and Financial Resources Index

This variable consists of two components: (1) Asset ownership (for example, whether the woman owns the place of residence or any land) and; (2) Financial resources control (pos- session of any bank account or cash for personal use only). While the decision-making index concentrates on the woman's de-facto power to guide construction decisions in the household, this index focuses on her rights over resources. This subtle distinction is vital because it may be the case that women may have property rights on paper but the effective power to make decisions might lie in the hands of some other older or male member of the household. Conversely, albeit less frequent, even in the absence of legal rights of woman, they may exercise considerable control over major decisions in the household.

Freedom of Mobility Index

Coffey *et. al.* (2016) cites the restricted freedom of mobility of women as the primary reason for not adopting toilets. If women are considerably free to venture out of the house to the market or visit a friend's place or health facility, they may not see open defecation as an opportunity to escape the house. This gives the basic rationale behind including an index which measures how free women are in an analysis of sanitation.

Logit Estimation for Household Level Toilet Usage

Logistic regression method is used when the dependent variable is either binary or categorical in nature. It analyzes the relationship between multiple independent variables and a categorical dependent variable, and estimates the probability of occurrence of an event by fitting data to a logistic curve. If the probability of an event occurring is p , the probability of the event not occurring is $(1-p)$, then the corresponding odds is a value given by : Odds [of event]= $p/1-p$. Since logistic regression calculates the probability of an event occurring over the probability of an

event not occurring, the logistic regression takes a log transformation of the odds and model that as a linear function of the explanatory variables.

$$\text{logit}(y) = \ln(\text{odds}) = \ln(p/1-p) = \alpha + x'\beta$$

where p is the probability of interested outcome and x is the explanatory variable.

$$p = P(Y = \text{interested outcome} | X = x, \text{ a specific value}) = \frac{e^{x'\beta}}{1 + e^{x'\beta}}$$

The predicted probabilities are limited between 0 and 1.

The odds ratio (OR) is a comparative measure of two odds relative to different events. For two events A and B, the corresponding odds of A occurring relative to B occurring is

$$\text{Odds ratio } \{A \text{ vs. } B\} = \frac{\text{odds}\{A\}}{\text{odds}\{B\}} = \frac{p_A / (1-p_B)}{p_B / (1-p_A)}$$

The OR represents the odds that an outcome will occur given a particular exposure compared to the odds of the outcome occurring in the absence of that exposure. The exponential function of the regression coefficient (e^β) is the OR associated with a one unit increase in the independent variable.

For the current paper we estimate the following equation at the household level:

$$\text{latrine} = \alpha + \beta_1 \text{ working woman (dummy)} + \beta_2 \text{ head of household} + \beta_3 \text{ various indices} + \beta_4 \text{ household size} + \beta_6 \text{ exposure to media} + \text{control variables}$$

Variables

The main dependent variable of the study, toilet ownership, does not distinguish between the various categories of toilets mentioned above but only considers whether there is a usable toilet or not. Thus, the toilet variable is a dichotomous variable that takes one when there is a toilet facility and zero when there is no toilet facility which means household members defecate in the open. Regarding toilet ownership, the survey

asked the following question (Question 31) in the household questionnaire: "What kind of toilet facility do members of your households usually use?" Respondents could choose from a variety of options like flush toilets (with various subcategories reflecting the disposal system of the toilets), pit latrines, twin pit/composting latrine, dry toilet or no facilities / uses open space or field.

As far as the independent variables are concerned, three key domains of women empowerment and their indicators already outlined are used in the analysis. Each indicator was sourced from the women's questionnaire. Eligible women are those between 15-49 ages that are currently married or in union women. As per NFHS-4, currently married women include married women and those women who are living with a partner (in union women). The resulting sample is, thus of 86173 women. However, there might be many women in the same household having different levels of autonomy. In order to arrive at the unit of analysis under consideration i.e. households, only the woman with highest level of autonomy per household is considered. Consequently, the final sample has reduced to 72239 women and their corresponding households.

Working Woman and Women-Headed Household

In addition to the indices of women empowerment, two direct measures of women empowerment: whether the head of the household is a female or not and whether she is working or not are considered. A working woman is defined to be an eligible woman who gets remunerated for her work in the form of either cash or kind or both (Ques 916).

Media Exposure

Another aspect that drives woman's preference for toilet is her awareness about the detrimental impacts of open defecation and government policies which incentivize latrine use (Yu Jung Lee, 2015). Exposure to mass media captures this. In NFHS, the following four questions were asked to eligible women to assess their exposure to electronic and print

media. (a) "Do you read a newspaper or magazine almost every day, at least once a week, less than once a week or not at all?"; (b) "Do you listen to the radio almost every day, at least once a week, less than once a week or not at all?"; (c) "Do you watch television almost every day, at least once a week, less than once a week or not at all?"; (d) "Do you usually go to a cinema hall or theatre to see a movie at least once a month?" For the analysis, responses from the questions (a), (b) and (c) are considered and those who ever watch television or listen radio or read a newspaper will be considered as exposed to mass media.

Education of Woman

As suggested by a lot of studies, educated women play a very significant role in reducing open defecation at the household level (Wei *et. al.*, 2004; Ghosh and Cairncross, 2014; Banerjee et al, 2016), we have taken different levels of female education such as no education, primary, secondary and tertiary.

Institution/Household Infrastructure

J-Pal (2012) suggests the importance of institutional factors. Banerjee and Banik (2014) show the importance of in-house water connection in encouraging the households to use toilets. Thus we realize apart from individual characteristics, household characteristics serve as important control variables. For instance, in the absence of proper drinking water facilities or presence of only a thatched roof, any household would choose to invest in these facilities prior to construction of a toilet. Thus, we control for household infrastructure using a composite index consisting of four variables: sources of lighting and drinking water, type of wall material and type of roof material.

Household Size

Household size is another important characteristic of the household which we control for.

Household Standard of Living

It has been found that toilets fare poorly even in comparison to other durable goods such as television, radio, watch, motor-cycles etc. (Banerjee *et. al.*, 2017). On the other hand, households with higher standards of living are more likely to afford latrines. To incorporate this in the analysis, a standard of living index is constructed consisting of household's ownership of durable goods such as television, radio, bicycle, car, etc. Details about such goods are available in the household dataset. It must be noted here that NFHS-4 also provides a pre-constructed wealth index based on principal component analysis to give a composite view of household's standard of living but they have used toilet facilities along with other durable goods to construct it.

Religion

Both Bonu and Kim (2009) and Banerjee et al (2016) show that people from certain religion have some reservation against using in-house toilets. This calls for religion to be included as a control variable.

Area of Residence

It is well documented that there is wide-spread disparity in terms of availability of safe sanitation facility between urban and rural areas (Office of the Registrar General and Census Commissioner, India, 2012; UNICEF and WHO, 2012). Thus we should control for the regional factor which is done by including the area of residence in terms of urban and rural segregation.

District Level Toilet Usage: Quantile Regression Estimates

As mentioned earlier, the district level analysis is undertaken to find if the effects of women empowerment on open defecation (if any) is translated into aggregate (district) level. As the households are heterogeneous in nature the effects at the household level may not get reflected at the community level. There can be considerable heterogeneity in the sanitation status and therefore in the level of open defecation across different districts. Moreover, different districts with different level of open

defecation may have different factors responsible for this difference in performance. Our hypothesis is that role of women in reducing open defecation may be more prominent in districts with lower level of open defecation than in districts which are performing poorly. To capture the effect of different independent variables on the entire conditional distribution of the dependent variable which is percentage of toilets at the district level we choose to use quantile regression. Quantile regression (QR), introduced by Koenker and Basset (1978), can be considered an extension of classical least squares estimation of conditional mean models to the estimation of a set of conditional quantile functions. A quantile regression models the relationship between x and the conditional quantiles of y rather than just the conditional mean of y as is done by OLS. The quantile regression is described by the following equation:

$$Y = x_i' \beta_q + e_i$$

Where is β_q the vector of unknown parameters associated with the q th quantile. The quantile regression minimizes $\sum_i q|e_i| + \sum_i (1 - q)|e_i|$, a sum that gives the asymmetric penalties $q|e_i|$ for under-prediction and $(1 - q)|e_i|$ for over-prediction.

The standard conditional quantile is specified to be linear: $Q_q(y_i|x_i) = x_i' \beta_q$ where $0 < q < 1$ and $Q_q(\cdot|x)$ is the conditional quantile function for the q th quantile. Each β_{qj} coefficient can be interpreted as the rate of change of the q th conditional quantile of the dependent variable per unit change in the value of the j th regressor: $\frac{\partial Q_q(y|x)}{\partial x_j} = \beta_{qj}$.

District level Equation

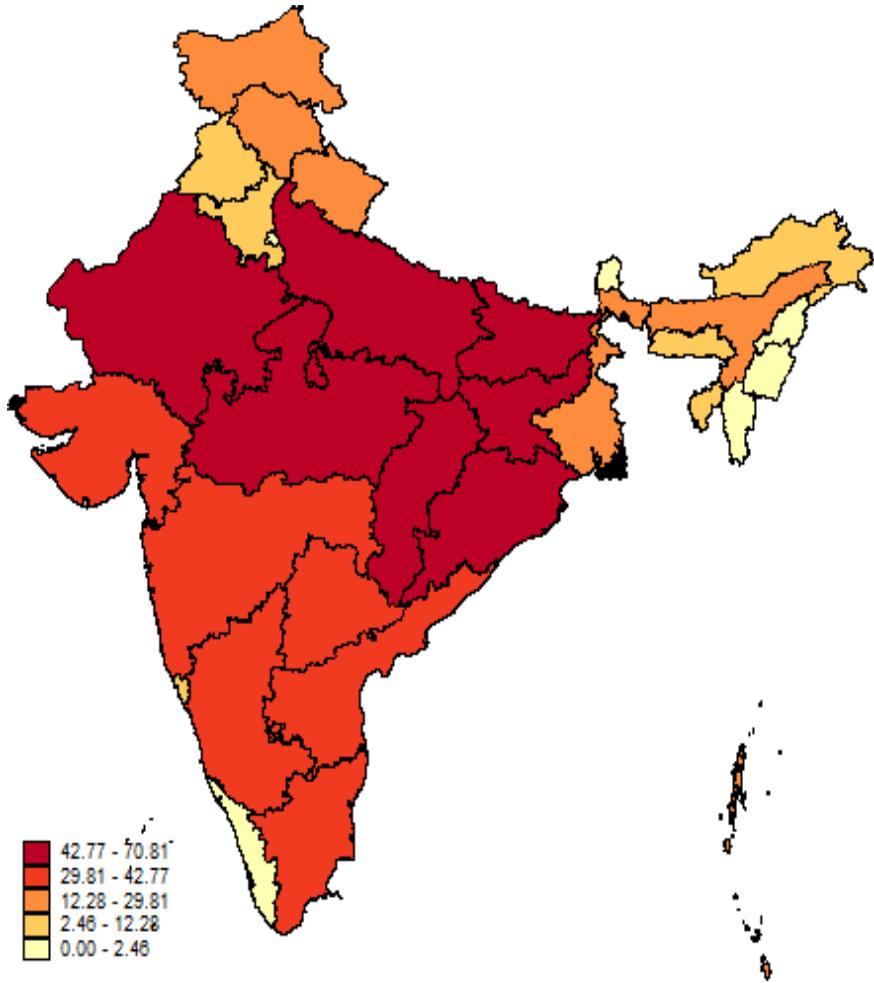
percent of open defecation = $a + \beta_1$ *decision making score* + β_2 *mobility score* + β_3 *control score* + β_4 *average household size* + β_5 *percent of household living in rural areas* + β_6 *district media-exposure* + β_7 *district SLI* + e_i

Data Description

Figure 1 gives an overall picture of open defecation (OD) rates in the country. The spatial differences across states is very evident with the poor performing states in terms of OD clustered together in the stretch extending from Rajasthan in the west to Orissa in the East. There is significant clustering in the Southern states as well with the exception of Kerala, thus, indicating that attitudes and behavior of neighbors might have a role to play in toilet usage patterns.

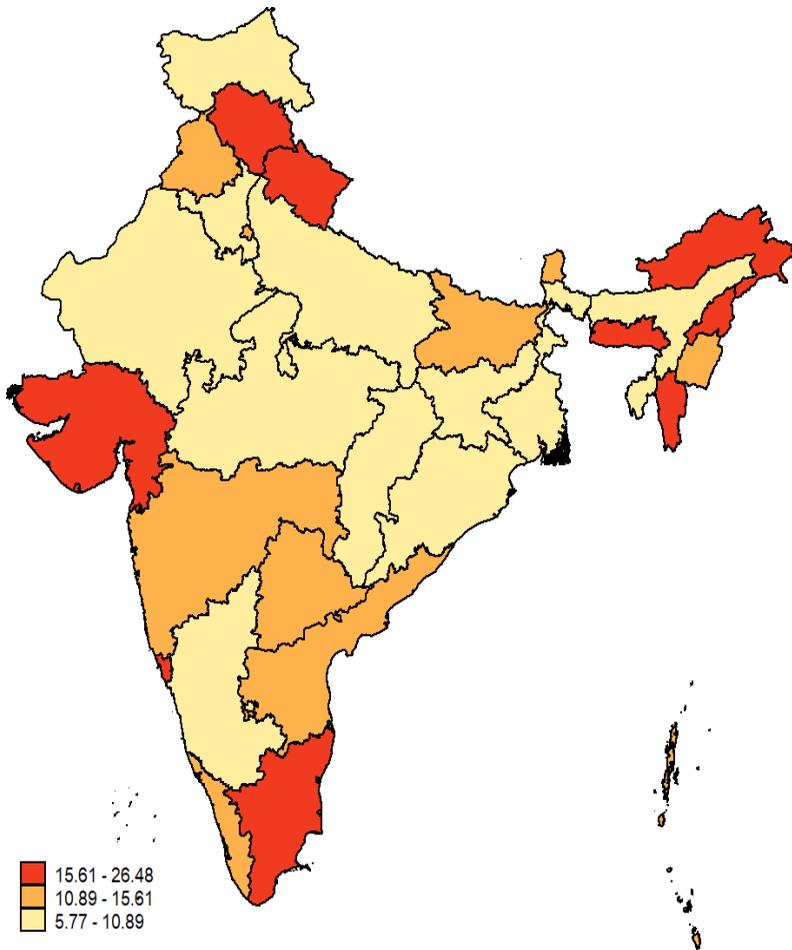
Figure 2 depicts the state wise proportion of women enjoying high decision-making power. The two maps (1 and 2) are approximately mirror images of each other with states displaying high rates of OD also having lower proportion of women with high autonomy. Similar observations are made when comparing Figure 1 with Figure 3 which depicts high freedom of mobility for women. This presents some preliminary support to the hypothesis that higher intra-household status of women has a positive impact on toilet adoption. However, the percentage of women with high control over assets and financial resources is not strongly related with the percentage of open defecation. As Figure 4 suggests in 5 out of 7 states (Bihar, Jharkhand, Orissa, MP, UP) which have the highest rates of open defecation, women who enjoy greater control over assets is also high.

Figure 1: Percentage of Population with No Toilet



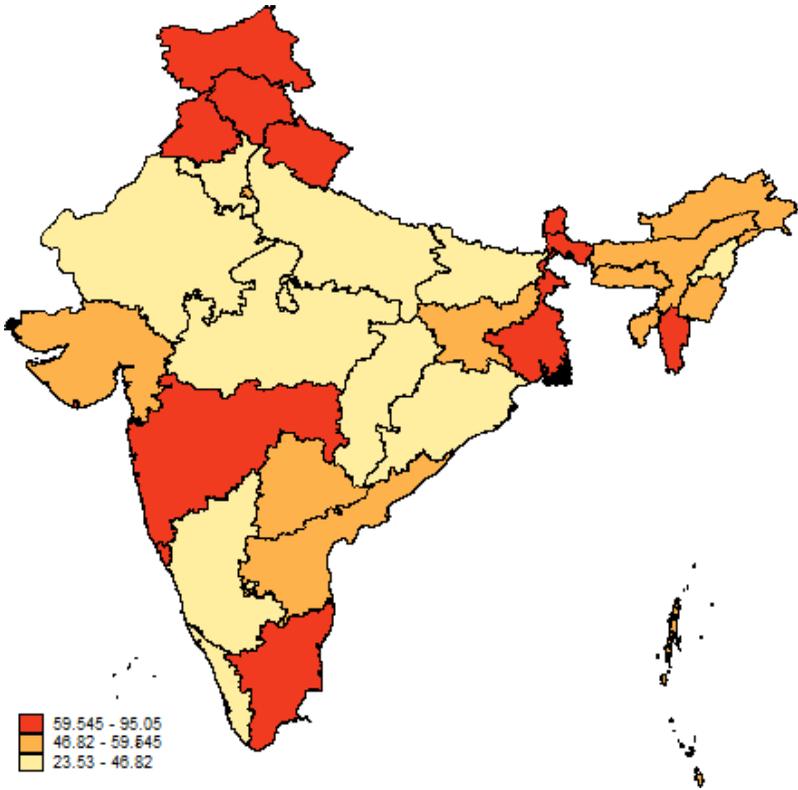
Source: based on author's own calculation

Figure 2: Percentage of Women With High Autonomy



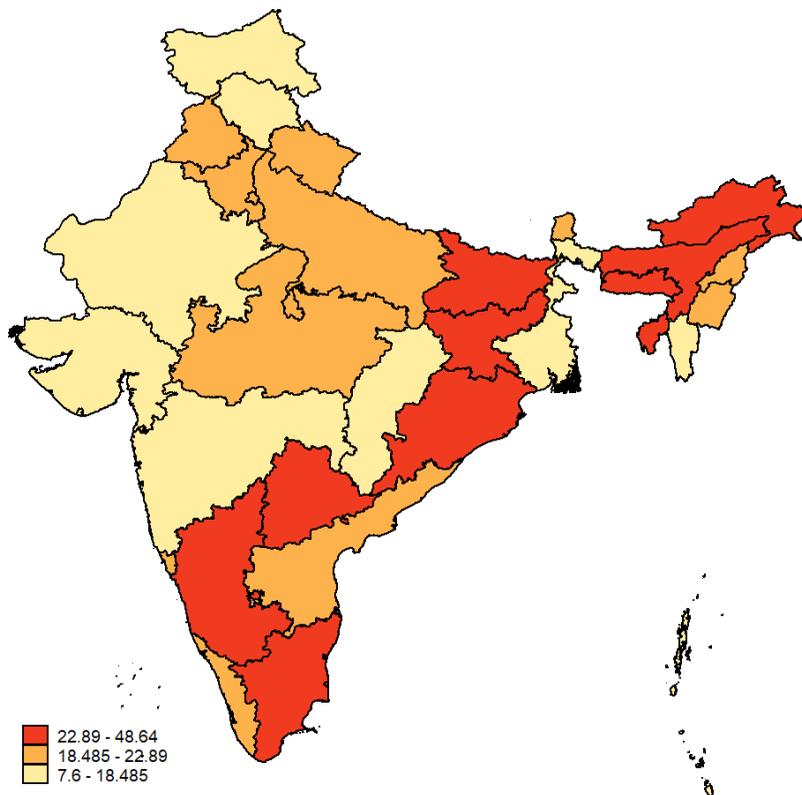
Source: based on author's own calculation

Figure 3: Percentage of Women with High Freedom



Source: based on author's own calculation

Figure 4: Percentage of Women With High Control



Source: based on author's own calculation

DISCUSSION OF THE FINDINGS

Household level Analysis

The household level analysis is undertaken to understand if greater autonomy of women at the household level can influence the members to build a toilet at home. For this, the main dependent variable is a binary variable assuming 1 for having a toilet at home and 0 for not having a toilet. Since the dependent variable is dichotomous, a logistic regression

framework was utilized. The odds ratios from the household-level logistic regression are outlined in Table 2.

Amongst, the main variables of interest i.e the three women empowerment indices, not only are the decision-making index and freedom of mobility index individually coming out to be significant but also with each increment level of women empowerment, the probability of having a toilet at home is increasing, although marginally. For instance, the household in which women have high freedom of mobility are 1.4 times more likely to have a toilet than a household in which women are highly restricted in their movement. This is in line with the findings of the earlier studies which suggest that as women are restricted in their households, they use the opportunity of open defecation to interact with their counterparts from other households. Surprisingly, the woman having a high control over assets and other financial resources of the household is less likely to have a toilet vis-à-vis a woman with no control. A plausible explanation of this seemingly contradictory result comes into light by delving deeper into the components of this index. Control over assets implies that the woman owns either land or house in her own name. It is noteworthy that it is usually the oldest woman of the household that owns these assets and they might be resistant towards toilet ownership because of traditional taboos against toilets in homes, or hostility towards change, in general.

Figure 5(a) (in appendix) brings about two major conclusions: (i) Women enjoying better decision- making status in the household have a higher predicted probability of having a toilet at home. The intuition behind this result is that apart from the obvious health impacts, women suffer uniquely from poor sanitation in the form of increased prospects of non- partner sexual violence while defecating in the open, emotional, mental stress and psycho-social stress, adverse pregnancy outcomes, lower school enrolment and retention of girls, etc. Thus, when empowered with the choice to make a decision about toilets in the

households, women are willing to spend on sanitation facilities. (ii) A woman who either listens to radio or reads newspaper or watches television frequently is more likely to have a toilet. Being exposed to any form of media and the knowledge gained from it, perhaps, enables her to better internalize the benefits from using a toilet. This is reflected in Figure 5(a) where the line showing not exposed to any media is consistently below the one where women are exposed to at least one form of media.

In addition to exposure of media, the highest level of education attained by the woman is also an important factor behind the presence of toilet at home. Although primary and secondary education add only slightly to the probability of a toilet, women with higher education can exert a large impetus and such households are almost 3 times more likely to have a toilet when compared to women with no education. This is in conformity with Wei *et. al.* (2004), Ghosh and Cairncross (2014) and Banerjee *et.al* (2017). While education is an important determinant, a working woman in herself does not exert an influence in building a toilet. This is a counter-intuitive result and to get a better insight into the influence of working woman, the interaction between working woman and her highest level of education is considered (refer to table 2). It is found that the woman who works and is either educated up to the secondary or higher level has a significant influence over having a toilet at home. In fact, a working woman with higher education is approximately 1.5 times more likely to have a toilet than a working woman with no education or a non-working woman with any level of education. Another point that can be made here that the working women those who are not exposed to any kind of education are actually coming from very poor economic status and are forced to join the workforce to supplement the family income. They cannot afford to have toilet at home. They either use some common toilets if they live in urban slum or defecate in open otherwise. Similar argument can be put forward for women-headed households as well. The odds of having toilet is less in female headed

households than in men-headed household. The reason can be that the households which are headed by women are not having a male counterpart. They are either widow or separated from husband and therefore economically very weak. They may not be willing to spend for building toilet. This finding is similar to Banerjee et al (2017) who have also got that with more number of women or women-headed households are less likely to have toilets at home and the reason behind this is poor standard of living of these households.

Along similar lines, Figure 5(b) (in appendix) suggests that the predicted probability of having a toilet at home is lower for female-headed households vis-à-vis male headed households. However, this difference is not statistically prevalent at higher levels of education for women. Such results underscore the importance of education in driving decisions regarding toilet construction and usage, notwithstanding gender differences. By and large, neither by virtue of being the head of the household nor by working, a woman exerts a positive influence on toilets. Women can be influential in such positions of power only when they are educated as well exposed to mass media. The problem of open defecation is an attitudinal problem which can only be reduced by bringing about a change in the mindsets of people.

The odds of having a toilet in rural areas is 0.3 times the odds of having a toilet in urban areas. This is expected as the problem of open defecation is more rampant in the rural areas. Hindus have a deeply engraved notion of "purity" and are generally averse to having a toilet along with their place of worship in their houses. In line with the hypothesis, the results suggest that compared to other religions, Hindus are less likely to have a toilet at home.

Table 2: Results of Household Level Analysis

	Odds ratio	
Women Empowerment Indices		
<i>Decision Making Index</i>		
Low Autonomy	1	(.)
Moderate Autonomy	1.123 ^{***}	(4.23)
High Autonomy	1.137 ^{***}	(3.31)
<i>Mobility Index</i>		
Low Freedom	1	(.)
Moderate Freedom	1.154 ^{***}	(3.89)
High Freedom	1.437 ^{***}	(9.91)
<i>Control Index</i>		
No Control	1	(.)
Low Control	1.020	(0.71)
High Control	0.916 ^{**}	(-2.77)
Individual Characteristics		
Male Headed Household	1	(.)
Female Headed Household	0.729 ^{***}	(-5.95)
Woman does not work	1	(.)
Works and is paid	0.692 ^{***}	(-10.40)
No Exposure to Media	1	(.)
Exposed to at least one media	1.219 ^{***}	(7.98)
<i>Highest Level of Education for Woman</i>		
No Education	1	(.)
Primary	1.409 ^{***}	(9.38)
Secondary	1.793 ^{***}	(20.06)
Tertiary	3.033 ^{***}	(15.50)
Female*Primary	1.078	(0.81)
Female*Secondary	1.285 ^{***}	(3.52)
Female*Tertiary	1.682 ^{**}	(3.05)
Works*Primary	1.059	(0.90)
Works*Secondary	1.170 ^{**}	(3.00)
Works*Tertiary	1.423 ^{**}	(2.66)

	Odds ratio
Household Characteristics	
Household Size	0.923 ^{***} (-16.75)
Infrastructure	2.030 ^{***} (23.41)
<i>Religion</i>	
Others	1 (.)
Hindu	0.111 ^{***} (-55.09)
Muslim	0.612 ^{***} (-10.17)
<i>Area of Residence</i>	
Urban	1 (.)
Rural	0.322 ^{***} (-40.97)
Standard of Living	639.8 ^{***} (69.09)
<i>N</i>	72239

Note: Exponentiated coefficients; z statistics in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

District Level Analysis

The previous section shows how women empowerment can play its role in influencing the household members in building a toilet. However, the household level effort is not enough to get reflected at the community level as the households are heterogeneous in nature. It is also not easy to infer about how the communities at an aggregate level would perform even if a section of the households gets enlightened. However, there are possibilities of some influence or inspiration from the neighbors or from the local administration that can get reflected in the performance of the districts. To get a better performance at an aggregate level we need to have better awareness among all the households at the community or say, village level. The local Government can actually play an important role here as most of the Government policies are targeted at the district level and a district administration can take up incentive schemes to improve the sanitation performance. Moreover, Panchayat can also undertake a number of steps in spreading awareness about the negative health effects that can emanate from open defecation. The women

sarpanch in Rajasthan do play an important role in convincing groom's family to have a proper toilet at home to get a bride. In fact, Rajasthan has amended the Panchayati Raj Bill to introduce two conditions for fighting the Panchayat election; such as having minimum educational qualification and no member of the candidate's family practicing open defecation. Both have potential for far-reaching impact on sanitation health of the villages. However, Panchayat may face fund constraints or may also be constrained by traditional conservative mindset. A district administration can be more effective in terms of availability of fund and can take a proactive role in implementing the various Government programs. Moreover, as we are more concerned about the role of women empowerment in achieving better sanitation environment, it can well happen that some districts are more influenced by women than the others. It can be due to better women representatives in legislature or higher educational attainment of women or better labor force participation of women. Other factors like rural-urban composition of population, average standard of living or media exposure etc can also have impact of different level at different districts. That brings us to the next analysis where we estimate a quantile regression (QR) at the district level. At this juncture, it is worthwhile to note that a community or village level analysis could have been a better source of insight, however, due to data constraints; this study has focused on the next level of aggregation, namely the district. There are all together 629 districts across 17 major Indian states and the percentage of households having a toilet in each of these districts is taken as the dependent variable in this analysis. The main independent variable is women autonomy at the district level which is the simple average of three scorers such as decision-making score, mobility score and financial control score. Each score is found by taking the average of the corresponding household level index values at each district. A higher score indicates greater decision-making power, higher freedom of mobility and larger control over assets and financial resources of the district. In this fashion, the categorical variables at the household levels are converted to district level continuous variables. Other

independent variables represent the percentage of rural population, the average number of members in the household, average level of standard of living index and average media exposure of the district.

The coefficients obtained by quantile regression as well as OLS regression are reported in table 3 with all the three women empowerment indices being included apart from controlling for a regional dummy⁴. To display the conditional quantiles we have taken three quantiles (0.25, 0.50 and 0.75). The results are graphically represented in Figure 2. The OLS regression provides a unique coefficient for all the districts but QR can give us better insights by discriminating among districts with different level of open defecation which would otherwise be judged equivalent using only conditional expectations which is done by OLS. With this objective, let us compare the coefficients of OLS and QR at different levels of quantiles. As far as the decision making index is concerned, it is not statistically significant in either of the regressions at the district level. This reflects the established fact that in South Asia as most of the resources are controlled by men, women don't have much role in decision making. In our analysis, the decision making index captures the aspects such as control over household purchases, health care, husband's income etc. Even if higher decision making power of women is having a significant impact at the household level, it is observed that it is not effective at the aggregate level. At the aggregate level, the supply side issues matter more than the demand side issues as district administration is expected to play bigger role in terms of providing services and incentivizing the toilet ownership.

The other important indicator of women empowerment, control over assets is significant for OLS regression but interestingly it is not having any significant impact at the lowest quantile though it is having a negative and significant level at the higher quantiles. This indicator

⁴ A categorical variable taking values for North, South, East and Western states.

basically captures land and house ownership and account in bank. Anyway, in India women do not enjoy much in terms of ownership of land. As per NCAER (2018) study, IHDS data shows even if women constitute 42 percent of agricultural labor force, only 2 percent of them own any farm land. Now, out of 586 districts considered in the study, only 47 percent districts have above average control over assets by women. But the average percentage of women-headed households is only 11 percent. That shows merely having a bank account or having some money in own possession is not enough to build a toilet at home. Unless the household is headed by women the final decision may not be in her hand. Moreover, even if she has the control over financial assets, mostly she will be the sole bread-earner of the family as most of them are either widow or separated from their husbands. Thus building a toilet comes very low in their priority list. This can well be the case with the districts with poor sanitation performance. In fact the value of control over the asset index is more or less constant over the lower half of the dataset and falls marginally beyond the median. Thus districts with higher percentage of in-house toilet ownership have relatively lower control of assets by women. On the other hand percentage of working women as well as women-headed household falls in the higher quantiles compared to lower quantiles. Moreover, on an average 75 percent of this population lives in villages and 41 percent of them are below poverty-line. These facts suggest that these women put less importance on toilet building if they have control over assets.

Women's mobility index seems to have the highest contribution towards safer sanitation process. The impact is lowest in the lower quantile and gradually improves in the higher quantiles. So the districts are getting much benefitted with women's mobility which includes mobility outside home towards market or neighboring villages or health center. This is also a kind of exposure that helps women to get enlightened, motivated and informed about healthy lifestyle. Women get to know about the incentives declared by the local administration and

women self-help groups also can come forward to make a difference. Moreover, exposure outside home reduces the need to go for open defecation just to socialize with others.

Looking at other covariates, the district standard of living index, which reflects household's possession of some basic durable goods, has considerably higher and positive impact on percentage of toilets in districts with low open defecation. In lowest and highest quantiles the estimates are significantly different from OLS. The impact is in similar line with OLS in case of central quantile. In the districts with lower OD, people are expected to have a certain level of awareness about the negative effects of poor sanitation system and they also enjoy a better standard of living compared to districts in lower quantile. But the districts with low level of toilets are struggling in meeting basic needs and therefore toilet is not in top priority for them. However, if they experience an improvement in standard of living they can build toilet at home as well. However, as suggested by Banerjee et al (2016), toilet comes much low at the priority list, the impact is lower in lower quantile. However, a deviation from the existing literature is observed in this study regarding household infrastructure. This index contains lighting, water, wall material and roof material. It is having a negative and significant impact at the district level. This may be because of the priority that they put on housing construction being more than an in-house toilet. This may involve other social issues and traditional mindset which prevents them to build a toilet at home.

Here we may note that religious beliefs do play a significant role in toilet ownership. Results suggest that as the percentage of Hindu population increases the toilet ownership at home falls. Moreover, as percentage of rural population increases district level toilet ownership falls. This highlights the rural-urban difference in terms of basic civic infrastructure, awareness, modern mentality and health-consciousness.

Another interesting result is the impact of media exposure which is not significant at the OLS regression and at 0.25 and 0.75 quantile. But it is significant only at the central quantile. That implies in the districts with higher level of open defecation, media exposure does not have any impact. That may be because of considerably low level of media exposure (average is 0.45) compared to higher quantiles (average is .80); not sufficient to make an impact. On the other hand, districts with reasonably low level of open defecation are aware and conscious. It is most effective at central quantile (about 59 percent households have toilet at home). At 0.75 quantile (districts with 86 percent households having toilets), the households are much more conscious about the sanitation health and that reflects in their behavior as well. Thus the district administration should invest more on awareness program so that a threshold level is reached beyond which media exposure can motivate people to build toilets at home in areas with high OD.

Average years of education play a positive and significant role in all the quantiles but the highest impact is in case of median quantile. Existing literature supports this observation. Ghosh and Cairncross (2014) highlight the positive role of female education on toilet ownership at the district level. Wei *et. al.*(2004) reports female literacy rates explain 24.3 percent of the variance in the ownership of household toilets. Banerjee et al (2016) observes household in which a woman has attained higher education (18years of schooling) is 3.1timesmorelikelytohavetoilets. Thus higher education for female is a precondition to make the locality OD free.

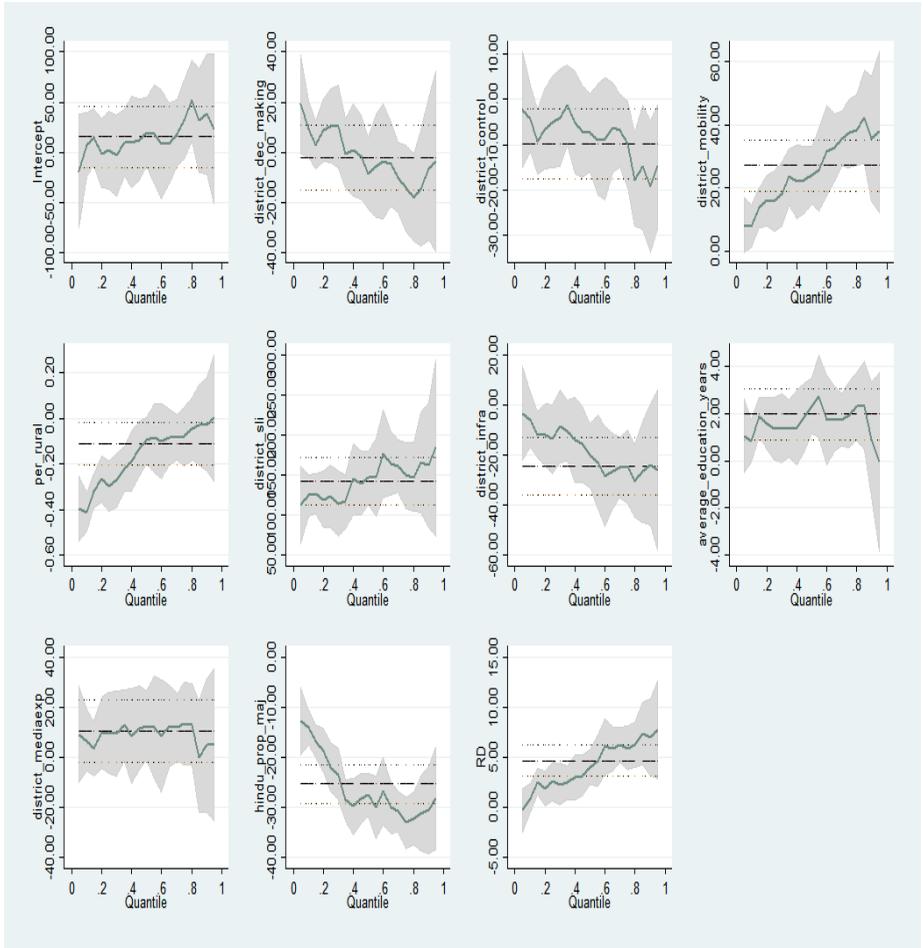
Figure 6 also suggests that CI for QR is different from the CI of OLS estimates for all the significant variables and mostly in lower and upper quantile therefore justifying the use of quantile regression.

Table 3: Quantile Regression Results With Respect to Women Empowerment and Toilet Ownership at the District Level

VARIABLES	(OLS) per_toilet1	(q=.25) per_toilet1	(q=.5) per_toilet1	(q=.75) per_toilet1
district_dec_making	-2.165 (6.611)	10.46 (7.560)	-8.438 (7.277)	-14.23 (8.708)
district_control	-9.929** (3.937)	-5.075 (5.114)	-7.459* (4.327)	-9.985** (4.832)
district_mobility	27.03*** (4.084)	15.67*** (4.855)	23.98*** (4.565)	37.30*** (5.472)
per_rural	-0.111** (0.0450)	-0.297*** (0.0566)	-0.0974* (0.0517)	-0.0811 (0.0644)
district_sli	142.1*** (17.46)	123.7*** (19.68)	146.4*** (16.90)	149.7*** (21.07)
district_infra	-24.50*** (5.925)	-13.78** (6.998)	-20.25*** (6.557)	-24.79*** (7.549)
average_education_years	1.970*** (0.571)	1.343** (0.665)	2.320*** (0.606)	1.947*** (0.713)
district_mediaexp	10.55 (6.573)	9.617 (8.200)	12.73* (7.085)	13.61 (8.362)
hindu_prop_maj	-25.28*** (2.460)	-21.87*** (2.517)	-27.47*** (2.137)	-32.97*** (2.606)
RD	4.691*** (0.856)	2.593*** (0.985)	4.019*** (0.877)	5.932*** (1.113)
Constant	15.42 (15.66)	2.081 (19.39)	20.08 (17.40)	32.43 (20.09)
Observations	585	585	585	585
R-squared	0.662			

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

Figure 6: LS and QR Results with Respect to Women Empowerment:



x-axis depicts the different conditional quantiles. In each panel the horizontal lines show the LS coefficients (dashed line) and the solid lines show the QR coefficients. Grey area is instead used to show confidence intervals of the QR coefficients while the dotted horizontal lines parallel to the dashed line show the CI of the OLS estimate.

CONCLUSION

The issues of drinking water, sanitation and hygiene (WASH) continue to remain a matter of concern in India's developmental path. The current paper dealing with the issue of sanitation tries to highlight the role of women empowerment in improving the sanitation practices of India, both at the household level as well as at the district level. Household level analysis shows that women's decision-making index and freedom of mobility index individually are not only coming out to be significant but also with each incremental level of women empowerment, the probability of having a toilet at home is increasing, although marginally, though control over financial assets is not having any impact. However, media exposure is one of the major factors that helps to educate women and makes them aware about the negative aspect of open defecation. They can also get to know the various incentive schemes they can avail from the Government to build toilet at home or by making their village open defecation-free. Local women legislatures can also play a decisive role in inspiring the women. A woman with higher education can exert a large impetus and such households are almost 3 times more likely to have a toilet when compared to women with no education. However surprisingly, a working woman in herself does not exert any influence in building a toilet; but the study shows that the woman who works and is either educated up to the secondary or higher level has a significant influence over having a toilet at home. In fact, a working woman with higher education is approximately 1.5 times more likely to have a toilet than a working woman with no education or a non-working woman with any level of education. Thus any form of labor force participation is not sufficient; what matters is whether the woman is empowered with adequate education to influence the family members. Thus, neither a woman-headed household nor a working woman but by being educated or by being exposed to mass media a woman can make a difference in attitude. The problem of open defecation is an attitudinal problem which

can only be reduced by bringing about a change in the mindsets of people.

As far as the district level analysis is concerned we presume that the impact of women's autonomy may not be identical across districts with different levels of open defecation. Thus QR is employed to test the hypothesis. The results justify the conjecture and shows that the districts with moderate level of open defecation (the central quantile; 56 percent household having toilet at home) have got more benefits out of their mobility outside residence and the women's decision making power not having any significant impact. However, control over financial asset has a negative and significant impact and that too only at the higher quantiles. Here comes the role of media exposure which seems to play a bigger role with districts where moderate percentage of households is having toilets at home. This is similar to the household level analysis. Thus media exposure that appears to be an important factor, calls for a bigger role for local administration which can create awareness through a lot of social campaigns and reward schemes. Individual standard of living also matters a lot but it matters more for districts with high incidence of open defecation. That implies the districts which are lagging behind in terms of sanitation facility; if the individual standard of living improves they can move towards building toilets at home. But still basic necessities like housing, electricity and water get more priority than toilet building for all section of population. Last but not the least female education plays positive and significant role at all quantiles showing that educating women is the best way forward to bring awareness about better performance in sanitation interventions. By and large, it can be inferred that there are a lot of scope for the poor-performing districts if women can be made more aware about the negative health effects of open defecation and the other social externalities, then they can play a significant role in inspiring the household as well as the locality to build toilets or if it is already there make use of it. It is another problem that even if people receive grants for making toilets, they don't use that. So

local administration at the district level as well as at the village level can use various forms of media to create awareness and inspire women to take up leading role in this regard. Various NGOs and self-help groups can also be utilized to educate women and impose conditions like “no toilet, no bride” among more and more villages. Steps such as denying panchayat election contesting taken up by the state of Rajasthan can also be effectively used by other states. Aspirational District Program, launched by Government of India in 2018, can play very important role to motivate the local women. They can use facilities such as Community radio (used in Mewat, Haryana) to spread awareness among women. More efficient and informative Anganawadi centre can be used to motivate even the young school children and their parents as well as the teachers.

Finally, we must acknowledge the fact that the decision of building a toilet at home is ultimately taken by men and in most of the cases they feel that defecating in open is much healthier than using a small toilet. They are worried about the small pits provided by the Government support which are expected to get filled up fast. With huge caste discrimination in place it is unlikely that even if toilets are built at home, people from upper caste will clean it frequently. Unless the toilet is equipped with a twin-pit which is required for safe and sustainable waste management, building toilets will not reduce the problem. However, women empowered with education and awareness should be able to convince the men at household that they must build toilets for the women members for the family as they are the worst sufferer. But all said and done people have to understand that toilet is not a facility only meant for women’s security and men cannot go for open defecation.

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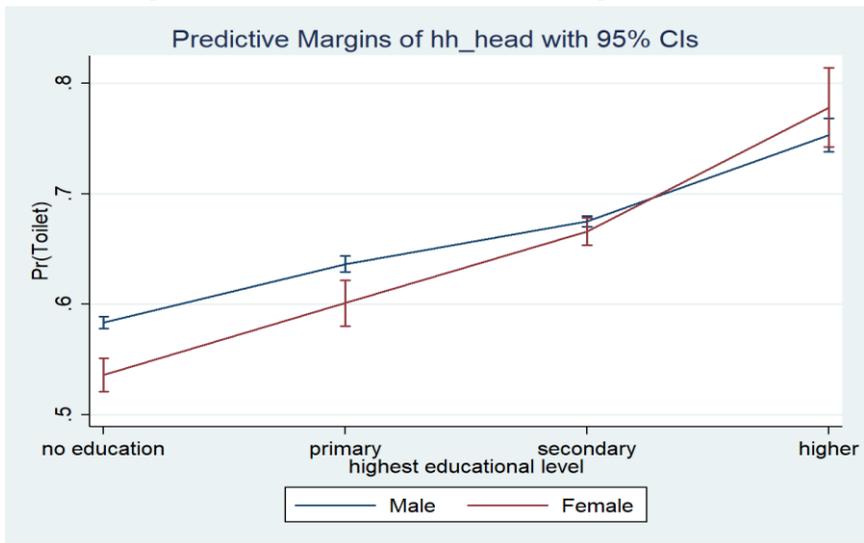
APPENDIX

Methodology for Construction of Indices

- A composite index for women's decision-making power was generated in the following manner. Answers to each of the four questions in Table 1 were coded as 3 if the woman alone makes the decision, 2 if her husband and she make the decision together and 1 if someone else apart from the woman makes the decision. This may either be the husband or someone else from the family. For each respondent the scores are then summed to get an aggregate score which ranged from 3 to 12. The higher the number, the higher is woman's say in the decision making of household. Each woman is then characterized into either of the three groups 'High Autonomy' with aggregate score of 9 and above, 'Moderate Autonomy' with aggregate score between 6 and 8 and 'Low Autonomy' with scores between 3 and 5.
- **Index on Financial Control:** The two questions (as described in Table 3.1 pertaining to asset (land and house) ownership had four possible answers, namely, the respondent: (i) does not own (ii) owns jointly only (iii) owns asset jointly and alone (iv) owns asset alone only. The latter two categories were merged together. Answers to each question was coded as 0 if they do not own anything, 1 if they own only jointly and 2 if they own alone or alone and jointly. On the other hand, the questions pertaining to control over financial resources (bank account or money) had two possible answers, either a yes or a no which were coded as 1 and 0 respectively. For each respondent the scores were then summed to get an aggregate score which ranged from 0 to 6. The higher the number, the higher is woman's control over assets and financial resources. Each woman is then characterized into either of the three groups 'No control' with aggregate score of 0 , 'Low Control' with scores between 1 and 3 and 'High Control' with scores between 4 and 6.
- **Index on Freedom of Movement:** This index was also constructed in a similar fashion as the two indices discussed

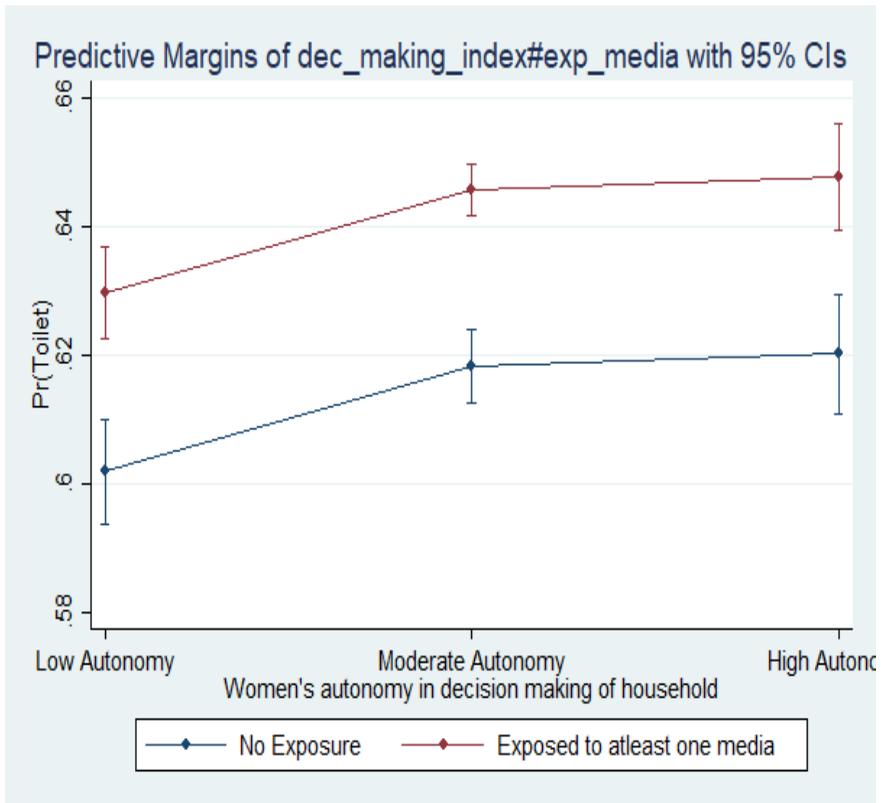
above. The answers to the three questions described in Table 3.1 were coded from 0 to 2 with 0 representing that the respondent was not at all allowed to go out on her own. On the other hand, '1' represented that she was allowed to go to the market or health facility or outside the village only when accompanied with someone else and '2' when she is free to go anywhere alone. For each respondent the scores were then summed to get an aggregate score which ranged from 0 to 6. A higher number indicated that the woman had greater freedom of mobility. The three categories that resulted from dividing the aggregate scores equally were characterized into low, medium and high freedom.

Fig 5 (a): Effect of Decision Making Index and Media Exposure on Predicted Probability of Toilets



Source: based on author's own calculation

Figure 5 (b): Effect of Female Heads at Different Education Levels



Source: based on author's own calculation.

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