

Research Paper

Determinants of rural sanitation in India and implications for public policy

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ABSTRACT

This article attempts to find the economic and non-economic factors determining sanitation coverage in a low income country like India. Based on National Sample Survey data of India, the analysis finds that income has a low impact, while non-economic factors have an equal or higher impact on access to and use of latrines. The number of household members has a negative impact on both access to and use of latrines. Access to and use of latrines depends on gender, age, and education of the household head. Both access and use also depend on the main occupation, religion, and caste of households. Access to water supply and dwelling materials also impacts access to and use of latrines. Households headed by younger people or those living in hired houses are more likely to access public or common latrines. Access to sanitation also depends on the region and hence the norms and customs of the region. Contrary to expectations, a lesser proportion of households have access to latrines if they own a house versus those who reside in hired dwellings. Quality, cleanliness of latrines and other personal preferences matter in the use of latrines. Public and community toilets for youths, more than one latrine for larger households, and social campaigning are suggested for public policy.

Key words | ethnicity, family size, income, infrastructure, public policy, sanitation

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INTRODUCTION

The coverage of sanitation in India is substantially lower compared to other developing nations. According to the World Bank, in 2015, the share of population with improved sanitation was 40% in India, while it was 61% in Bangladesh, 64% in Pakistan, 78% in Vietnam, and 95% in Sri Lanka. However, the GDP per capita of India is higher than its neighboring countries Bangladesh and Pakistan. This indicates that inadequate coverage of sanitation in India may not be solely attributable to low income but also to other embedded factors including culture, social customs, behavior, and institutions. Lack of sanitation contributes about 10% of the global disease burden including diarrheal diseases and stunting (Mara *et al.* 2010; Schmidt 2014). According to UNICEF, India shared a 38%

global burden of stunted children in 2011. Almost half (48%) of the children younger than five years of age are stunted in India. Chambers & Von Medeazza (2013) argue that undernutrition in India is attributable to lack of sanitation. Nevertheless, it is difficult to achieve improved sanitation coverage, especially in developing countries including India. The political will of the government and non-governmental organizations (NGOs), person-to-person contact, and political ecological factors including assured access to water, compatible soil type, and changing land use impact sanitation behavior (O'Reilly & Louis 2014). This paper investigates the economic and non-economic factors that determine sanitation coverage in India. Among the non-economic factors it focuses on education, region,

religion, caste, and household size. [Tiwari & Nayak \(2017\)](#) revealed that income, caste, and education are significant determinants of access to improved toilets in Indian cities. Studies also found that caste-based notions of purity and pollution make the simple latrines unattractive to rural Indians ([Hathi et al. 2016](#)). The lower castes are only responsible for disposing of human excreta from public and private latrines ([Srinivas 2002](#); [Ramaswamy 2005](#)). Apart from caste, this article looks into the impact of household size on sanitation behavior, and is the first of its kind. Conditions of housing and community infrastructure, such as availability of water, have also been considered in the analysis. Instead of analyzing unobservable social cost and benefits, this article focuses on observable factors which might impact social costs and benefits; the latter, in turn, have implications for household decisions regarding sanitation. The policy recommendations for improved sanitation coverage are based on the empirical results regarding the impact of those observable socio-economic variables on sanitation.

Non-economic factors, such as norms and practices, have a profound impact on sanitation through the collective behavior of the society. As private behaviors in sanitation have a very high public impact, collective behavior change is required to get rid of any negative impact of open defecation ([McGranahan 2015](#)). The cultural norms regarding human waste may create barriers for the development of appropriate and cost-effective excreta management systems ([Jewitt 2011](#)). Traditional notions of purity and pollution make it difficult to construct pit latrines that require emptying in the future. It is a time-consuming process to transform separate polluting (toilet) areas (as distinct from pure spaces at home) to a modern attached bathroom (see [Srinivas 2002](#)). In Africa, the historical and socio-economic factors embedded in cultural and religious beliefs and values are major hindrances for universal water and sanitation coverage ([Akpabio & Brown 2012](#); [Akpabio & Takara 2014](#)). A combination of income, education, and exposure to better information influences household decisions for in-house sanitation ([Akpabio & Brown 2012](#); [Tiwari & Nayak 2017](#)). Social networks are important for abandoning the practice of open defecation, as found in studies of peri-urban and informal settlements in Africa ([Tukahirwa et al. 2011](#); [Kennedy-Walker et al. 2015](#)). The cultural norms for sanitation are likely to vary

with the region and ethnic identity of the household ([Jewitt 2011](#)), which the article takes into account.

The rational choice of individuals depends on externalities or social consequences of social decision-making ([Akerlof 1980](#); [Becker & Murphy 2000](#)). Social customs which are detrimental or disadvantageous to individuals still persist if individuals are sanctioned with loss of reputation for disobeying the custom ([Akerlof 1980](#)). In smaller social distances, such as inherited relationship, caste, religion, or occupation, the incentives of conforming to regressive norms may be higher ([Akerlof 1980](#)). The paper takes into account household members, religion, caste, and occupation to explain access to and use of latrines. As indicated by [Jewitt \(2011\)](#), it also takes into account regional factors having implications for norms regarding sanitation.

METHODOLOGY AND DATA

The findings are based on quantitative analysis of data provided by the National Sample Survey, 69th round (July 2012–December 2012). All the states of India were covered in the survey with the exclusion of a few inaccessible areas. The sample households were collected through stratified multi-stage sampling where the first stage units (FSU) were census villages. The sample villages were selected by probability proportional to size with replacement (PPSWR). For each FSU, ‘hamlet-groups’ were formed for populations of 1,200 or more. Sample households were selected from a list of village households. Stratification was done for the second time for the selection of households according to dwelling structures. Finally, 53,393 households were selected from each stratum through simple random sampling without replacement (SRSWOR).

The survey provides information on types of access to toilets by households: exclusive use of households; common use of households in the building; public/community latrines without payment; public/community latrines with payment; others; and no latrine. It also provides types of toilet used: flush/pour-flush, pit latrine, etc. In addition, it captures information on usage of toilets by all members of households and the reasons for not using them in spite of having access. The survey also provides

information on demographic, economic, social, and housing characteristics of the households.

SURVEY RESULTS

Access to a latrine is available to only 41% of households, of which 32% have exclusive access to a latrine and 9% have access to a common or public latrine. According to the National Sample Survey, 69th round, if the latrine facility is for the use of households in the locality, or is for a specific section of the people, it will be considered as a common or public latrine. Female-headed households have marginally higher access to latrines as compared to male-headed households (Table 1). Surprisingly, access to a latrine, especially a common or public latrine, is higher for households headed

by members less than 18 years of age as compared to households headed by members 18 years of age or more. With the increase in highest level of education among male and female members, the exclusive access to a latrine also increases. The percentage of households having access to a common or public latrine increases with the highest education of male and female members up to the primary level but tapers down thereafter. The cultural and ethnic identities of households also correspond with latrine access. The lack of access to a latrine is much higher for Hindu households as compared to Muslim and other households. Lack of access to a latrine is highest for backward castes – scheduled castes and scheduled tribes.

The ownership of house and land does not improve the prospect of higher access to a latrine for households. Around 93% of households reside in their own houses.

Table 1 | Socio-demographic and economic characteristics of households by access to latrine

			Exclusive use of household	Common, public and other	No latrine	Total
		Households	32	9	59	100
Gender of the head of the household	Male		32	8	60	100
	Female		32	10	57	100
Age of the head of the household	Less than 18 years		12	46	42	100
	18 years and above		32	8	60	100
Principal occupation	Self-employed	Agriculture	33	5	62	100
		Non-agriculture	44	11	46	100
		Regular wage/Salary earning	52	14	34	100
	Casual labour	Agriculture	14	6	79	100
		Non-agriculture	23	8	69	100
		Others	34	21	45	100
Religion	Hinduism		29	8	63	100
	Islam		41	15	44	100
	Others		60	10	30	100
Castes	Backward castes	Scheduled tribe	18	7	75	100
		Scheduled caste	21	8	71	100
		Other backward class	30	7	63	100
	Others		53	12	35	100
	Tenure status of dwelling		Owned	32	7	61
		Hired and others	32	35	33	100
Land possessed (hectare)	Less than 0.005		18	19	63	100
	0.005–0.21		35	9	56	100
	0.21–2.01		33	5	62	100
	2.01 and above		42	5	53	100
Household consumer expenditure (Rs) during last 30 days	Purchase/Expenditure		6,082	4,018	3,450	4,340

The percentage of households with no access to a latrine is much higher for households with their own house (61%) as compared to others (33%). Agricultural households have lower access to latrines as compared to non-agricultural and others. Furthermore, the percentage of households with no access to a latrine demonstrates no particular trend with higher land-holding of households. However, higher ownership of land increases the access to a latrine for the exclusive use of the household. On the contrary, households residing in hired accommodation and with lower ownership of land (less than 50 square meters) have greater access to common or public latrines. This may be due to lower purchasing power on the part of the latter type of household. This is also alluded to by the corresponding decline of average household consumption expenditure. Households with the highest purchasing power have access to an exclusive latrine, while households with the lowest purchasing power have no access to a latrine.

Dwelling type also has a bearing on the access to a latrine. Around 60% of households residing in independent houses do not have latrines while around 45% of households residing in flats have common or public latrines. The dwellings are made of *katcha* and *pucca* materials. According to the National Sample Survey, 69th round, a *pucca* structure is one whose walls and roof are made of *pucca* materials such as cement,

concrete, oven burnt bricks, hollow cement/ash bricks, stone, stone blocks, jack boards (cement plastered reeds), iron, zinc or other metal sheets, timber, tiles, slate, corrugated iron, asbestos cement sheet, veneer, plywood, artificial wood of synthetic material and poly vinyl chloride (PVC) material. A structure which has walls and roof made of non-*pucca* materials is regarded as a *katcha* structure. Non-*pucca* materials include unburnt bricks, bamboo, mud, grass, leaves, reeds, thatch, etc. With regard to the dwellings, 49% of floors, 31% of walls, and 13% of roofs are made of *katcha* materials. A higher proportion of households do not have access to a latrine in the case where dwellings are made of *katcha* materials (Table 2).

Availability of water is likely to impact construction and access to latrines. The nearer the source of water availability, the higher the percentage of households with access to latrines. Latrines for exclusive use of households are proportionately higher if drinking water is available at the dwelling (Table 2). In the case where water supply is insufficient throughout the year, then a higher proportion of households lack access to latrines. Households with no access to latrines bear a greater number of months of insufficient water supply in a year.

Latrines are not used by any member for 2% of households. A major reason behind not using latrines is poor infrastructure or quality: 21% due to not having any

Table 2 | Living condition and basic amenities of households by access to latrine

		Exclusive use of household	Common, public and other	No latrine	Total
Dwelling type	Independent house	36	4	60	100
	Flat	28	45	27	100
	Others	8	18	75	100
Floor type	Mud	16	6	78	100
	Pucca	47	11	41	100
Wall type	Katcha	19	6	75	100
	Pucca	38	10	52	100
Roof type	Katcha	12	5	84	100
	Pucca	35	9	56	100
Distance to the principal source of drinking water	Within dwelling	56	7	37	100
	Outside dwelling but within the premises	40	14	47	100
	Outside premises	20	6	73	100
Drinking water throughout the year	Sufficient	33	9	58	100
	Insufficient	27	7	67	100
Number of months of insufficient water supply in year		0.36	0.31	0.47	0.42

superstructure and 22% due to malfunctioning of latrines. Unclean latrines, primarily due to paucity of water, are attributable to latrines not being used by 20% of households. Cultural factors and social norms hold back households from usage of latrines as indicated by 23% of households who do not use latrines due to personal reasons. The use of latrines is marginally higher for female members of households as compared to male members and also for elder members as compared to younger ones.

REGRESSION ANALYSIS

The determinants of access to and use of latrines have been investigated through regression analysis. The independent variables represent a demographic profile of households, economic condition, education, principal occupation, religion, caste, condition of housing, and access to water supply. The socio-cultural aspects are further captured by regional identifiers (dummy variables) which are constructed by clubbing with adjacent states. The economic condition of households has been captured by household consumer expenditure over the last 30 days. The socio-demographic profile of households has implications regarding conformity to social norms. The housing condition, access to other infrastructures including water, and economic condition represent the affordability and condition of complementary infrastructure.

Male-headed households are less likely (female-headed more likely) to have access to latrines for exclusive use and more likely (female-headed less likely) to have access to common or public latrines. Studies on informal settlements in urban areas of India and Africa reveal that fewer women are inclined to use communal facilities as compared to men due to lack of privacy, embarrassment, long walking distances to defecation places, and insecurity (Biran *et al.* 2011; Arku *et al.* 2013; Parikh *et al.* 2015; Sharma *et al.* 2015; Simiyu 2016). Therefore, under such circumstances, women may prefer private or exclusive sanitation facilities vis-à-vis community or public latrines (Reddy & Snehalatha 2011).

The likelihood of no access to a latrine is higher if all male and female members of the household are illiterate. Agricultural households (primary occupation agriculture) and large families (a higher number of members in households) are more likely, while households with very young heads are less

likely to conform to local customs and norms. Hence, the former two are more likely and the latter one is less likely to have no access to a latrine. The higher the number of household members, the more difficult to resolve hindrances to construction of latrines and use. The proximity and accessibility to open space could be one of the reasons for open defecation; hence, there is more likelihood of no access to latrines for households with agriculture as the main occupation. The Hindus and backward castes (88% of latter households are Hindus only) are more likely to have no access to latrines compared to households of other religions and castes due to local customs and norms. The sense of purity of Hindus may impair access to household latrines. Lack of exposure may result in lower access to latrines for backward castes. The likelihood of not using a latrine in spite of access is also more likely to be impacted by all the socio-demographic variables discussed above in a similar manner.

Households residing in hired dwellings are more likely to have less difficulty in ignoring local customs and norms; hence, there is a higher chance of having access to latrines and using them. There is a greater chance of having access to and using latrines for exclusive use in independent houses. The condition of the dwelling is also likely to have an effect on access to latrines. If the floor is made of mud, or the roof is made of *katcha* (mud, bamboo, wood, etc.) material then the likelihood of accessibility goes down. Access to drinking water supply is likely to have a positive impact on access to latrines and their use. The better the economic condition the higher the purchasing power and the living standard, which push up the possibility of access to and use of latrines.

The dependent variables are type of access to latrines (type_access_latrine), not having access to latrines (no_access_latrine), and latrines not used (no_use_latrine):

$$\text{type_access_latrine} = \begin{cases} \text{Exclusive use of household} \\ \text{Common or public latrine and other} \\ \text{No latrine} \end{cases}$$

$$\text{no_access_latrine} = \begin{cases} 1, & \text{if having no access to latrine} \\ 0, & \text{otherwise} \end{cases}$$

$$\text{no_use_latrine} = \begin{cases} 1, & \text{if not using latrine in spite of having access} \\ 0, & \text{otherwise} \end{cases}$$

The independent variables including their descriptions are presented here: *hh_head_gender*: household head male = 1, female = 0; *hh_head_age*: head of household less than 18; years = 1, 18 years and above = 0; *hh_all_male_illiterate*: all male household illiterate = 1, else = 0; *hh_all_female_illiterate*: all female of household illiterate = 1, else = 0; *hh_type_agricultural*: main occupation of household agriculture = 1, else = 0; *hindu_hh*: Hindu household = 1, else = 0; *backward_caste*: backward caste household = 1, else = 0; *hired_dwelling*: reside in hired dwelling = 1, else (owned) = 0; *independent_house*: reside in independent house = 1, else = 0; *mud_floor*: mud floor of dwelling = 1, else = 0; *katcha_roof*: katcha roof of dwelling = 1, else = 0; *total_members*: total number of members in the household; *months_insuffi_water*: number of months of insufficient water supply in a year; *dw_within_dwelling*: principal drinking water source within dwelling = 1, else = 0; *dw_hh_exclusive*: principal drinking water source for exclusive use of household = 1, else = 0; *purchase*: household purchase expenditure during last 30 days; *exclusive_latrine*: access to latrine for exclusive use of household = 1, else = 0; *maharastra*: State: Maharashtra = 1, else = 0; *south_india*: State: Andhra Pradesh, Karnataka, Goa, Lakshadweep, Kerala, Tamil Nadu, Puducherry = 1, else = 0; *northeast*: State: Sikkim, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura, Meghalaya, Assam = 1, else = 0; *east_india*: State: West Bengal, Jharkhand, and Odissa = 1, else = 0; *chattis_mp*: State: Chattisgarh and Madhya Pradesh = 1, else = 0; *up_bihar*: State Uttar Pradesh and Bihar = 1, else = 0; *west_india*: State Gujarat and Rajasthan = 1, else = 0; *north_west_india*: State Punjab and Haryana = 1, else = 0; *north_hills*: State Jammu & Kashmir, Himachal Pradesh, Uttaranchal = 1, else 0.

A few interaction dummy variables have also been generated. They are as follows: *hindu_indep* = *hindu_hh* × *independent_house*; *backward_indep* = *backward_caste* × *independent_house*; *all_male_illi_indep* = *hh_all_male_illiterate* × *independent_house*; *all_female_illi_indep* = *hh_all_female_illiterate* × *independent_house*; *hindu_hired*, = *hindu_hh* × *hired_dwelling*; *backward_hired*, = *backward_caste* × *hired_dwelling*; *all_male_illi_hired*, = *hh_all_male_illiterate* × *hired_dwelling*; *all_female_illi_hired* = *hh_all_female_illiterate* × *hired_dwelling*.

These interaction dummies would reveal the impact of religion, caste, and education if people reside in an independent or hired dwelling.

When *type_access_latrine* is the dependent variable then the multinomial probit model has been used for estimation of coefficients. The robust standard errors have been estimated in the model.

When *no_access_latrine* and *no_use_latrine* is the dependent variable then the binary probit model has been used for estimation of coefficients. The cluster robust standard errors have been estimated in these models. The clusters have been formed for state and region (within state); 88 clusters have been taken into account. These clusters are much disaggregated as compared to regional indicators used as independent variables.

The regional variables and interaction effects of religion, caste, and education with hired dwelling have not been considered when *no_use_latrine* is the independent variable due to lack of convergence of log likelihood ratio even after a series of interactions.

Regression results

The regression results are presented in Table 3. The results of binary probit models reveal that young (less than 18 years of age) and male-headed households are more likely to have no access to and not use latrines, respectively. If all the males and females of a household are illiterate then there are higher chances of having no access to a latrine and not using a latrine even when there is access. Agricultural and larger households are more likely to have no access to latrines and to not use them. The same holds true for Hindu and backward caste households. The households having independent houses are less likely to have access to a latrine and less likely to use a latrine. This may be because a very high proportion (81%) of households live in independent houses. Surprisingly, the results reveal that exclusive access to a latrine does not increase the chances of using a latrine as the coefficient for an exclusive latrine is statistically insignificant. Ownership status of houses does not have any stable impact on access or use. However, looking into interaction effects, a different narrative can be found. Backward caste households residing in hired dwellings are more likely to have access to a latrine. Hindus residing in independent houses are more likely to use a latrine. Households where all female members are illiterate but reside in independent houses are more likely to use a toilet.

Table 3 | Marginal effects of determinants of access to latrine and use

Independent variables	Type of access to latrine (multinomial probit model)				
	Exclusive use of household	Common, public and other	No latrine	No access to latrine (probit model)	No use of latrine (probit model)
hh_head_gender	-0.02*** (0.00001)	0.02*** (0.00001)	-0.001*** (0.00001)	0.003 (0.0151)	0.01*** (0.00279)
hh_head_age	-0.06*** (0.00002)	0.02*** (0.00001)	0.04*** (0.00002)	0.05* (0.02901)	0.03 (0.03328)
hh_all_male_illiterate	-0.05*** (0.00001)	0.001*** (0.000004)	0.05*** (0.00001)	0.07*** (0.02572)	0.01 (0.01381)
hh_all_female_illiterate	-0.08*** (0.00001)	-0.02*** (0.000003)	0.10*** (0.00001)	0.11*** (0.02387)	0.02** (0.01123)
hh_type_agricultural	-0.03*** (0.000004)	-0.02*** (0.000003)	0.05*** (0.000005)	0.06*** (0.0116)	0.01* (0.00333)
hindu_hh	-0.06*** (0.00001)	-0.03*** (0.000003)	0.09*** (0.00001)	0.17*** (0.03783)	0.03*** (0.00924)
backward_caste	-0.10*** (0.000005)	-0.02*** (0.000003)	0.12*** (0.00001)	0.19*** (0.03619)	0.02** (0.00813)
hired_dwelling	0.04*** (0.00001)	0.05*** (0.00001)	-0.1*** (0.00001)	-0.004 (0.08086)	0.01 (0.00851)
independent_house	0.12*** (0.00001)	-0.11*** (0.000003)	-0.01*** (0.00001)	0.05* (0.02853)	0.03** (0.01115)
mud_floor	-0.15*** (0.000005)	-0.03*** (0.000003)	0.18*** (0.00001)	0.17*** (0.0302)	0.01 (0.00696)
katcha_roof	-0.09*** (0.00001)	-0.01*** (0.000005)	0.09*** (0.00001)	0.09*** (0.02178)	-0.0004 (0.00512)
total_members	-0.02*** (0.000001)	-0.01*** (0.000001)	0.02*** (0.000001)	0.02*** (0.00356)	0.002*** (0.0008)
months_insuffi_water	-0.01*** (0.000002)	-0.004*** (0.000001)	0.02*** (0.000002)	0.02*** (0.00596)	0.001 (0.00096)
dw_within_dwelling	0.06*** (0.00001)	0.01*** (0.000005)	-0.07*** (0.00001)	-0.04* (0.0217)	0.001 (0.00613)
dw_hh_exclusive	0.15*** (0.000005)	-0.06*** (0.000004)	-0.09*** (0.00001)	-0.14*** (0.02305)	-0.02*** (0.00351)
purchase	0.00003*** (0.000000001)	0.000002*** (0.0000000006)	-0.00003*** (0.000000001)	-0.00003*** (0.000003)	-0.000002** (0.000001)
exclusive_latrine					-0.002 (0.00602)
hindu_indep				-0.02 (0.03025)	-0.05* (0.02811)
backward_indep				-0.02 (0.02586)	-0.001 (0.0118)
all_male_illi_indep				-0.004 (0.02729)	0.01 (0.01686)
all_female_illi_indep				0.03 (0.02675)	-0.01** (0.00462)
hindu_hired				-0.04 (0.06562)	
backward_hired				-0.09** (0.04469)	
all_male_illi_hired				0.05 (0.05086)	
all_female_illi_hired				-0.02 (0.03574)	
maharashtra	-0.18*** (0.00004)	-0.02*** (0.00002)	0.20*** (0.00005)		

(continued)

Table 3 | continued

Independent variables	Type of access to latrine (multinomial probit model)			No access to latrine (probit model)	No use of latrine (probit model)
	Exclusive use of household	Common, public and other	No latrine		
south_india	-0.16*** (0.00004)	-0.08*** (0.00002)	0.24*** (0.00005)		
northeast	0.22*** (0.00004)	0.05*** (0.00002)	-0.27*** (0.00005)		
east_india	-0.11*** (0.00004)	-0.02*** (0.00002)	0.13*** (0.00005)		
chattis_mp	-0.13*** (0.00004)	-0.05*** (0.00002)	0.19*** (0.00005)		
up_bihar	-0.19*** (0.00004)	-0.03*** (0.00002)	0.22*** (0.00005)		
west_india	-0.21*** (0.00004)	-0.08*** (0.00002)	0.28*** (0.00005)		
north_west_india	-0.08*** (0.00004)	-0.02*** (0.00002)	0.09*** (0.00005)		
north_hills	-0.04*** (0.00004)	-0.03*** (0.00002)	0.07*** (0.00005)		
No. of observations (unweighted)	49,604			49,604	21,884
Pseudo R ²				0.260	0.148
Correct prediction (%)				76	98

*Significant at 1% level; **significant at 5% level; ***significant at 10% level.

Note: Numbers in parentheses are standard error.

The results of multinomial probit models reveal that if the head of the household is male and young (less than 18 years of age) then the household is more likely to have access to a common or public latrine and less likely to have access to a latrine that is for the exclusive use of households. Households residing in hired dwellings are more likely to have access to either exclusive latrines or common or public latrines. Households with independent houses are more likely to have access to latrines for exclusive use but less likely to have access to common or public latrines. Should the dwelling be made of *katcha* materials (mud floor and *katcha* roof) then the possibility of access to latrines reduces. The higher the number of months of insufficient water supply, the lower the access to a latrine. Both source of water supply within dwellings and for exclusive use increase the chances of having a latrine for exclusive use. Finally, the higher the purchasing power, the higher the chances of access to all types of latrines and of using latrines. However, the marginal effect of

purchase (purchasing power) is the least among all the independent variables, implying that its impact is statistically significant or stable but low in magnitude. Ghosh (2017) also found weak influence of income on open defecation in a study on 86 countries including India.

The regional effects are both statistically significant and high compared to other variables. The effects are different across regions. While the effect of western states (Gujarat and Rajasthan) is negative regarding access to latrines (negative for no latrine), the effects of northeastern states (Sikkim, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura, Meghalaya, and Assam) are positive with regard to access; meaning, there is a much higher likelihood of having access to latrines in northeastern states compared to western states. The chances of having no access to latrines is also high for southern states – Andhra Pradesh, Tamil Nadu, Karnataka, Goa, Tamil Nadu, Lakshadweep, Kerala, Puducherry – taken together. Culturally speaking, the northeastern states are different from the rest of India. Matrilineal

societies in these states make women more competitive than men (Gneezy *et al.* 2009; Andersen *et al.* 2013) and provide more bargaining power to women, which, in turn, has a positive impact on access to latrines.

DISCUSSION AND CONCLUSION

This article highlights evidence that apart from purchasing power and dwelling type there are many factors that are attributable to the access to and use of sanitation. Even the impact of purchasing power is not high: a thousand-rupee increase in purchasing power increases the chances of access to a latrine by, at the most, 3% and its use by only 2%. Some of the evidence is counterintuitive. For instance, people having their own houses, as against rented houses, are more likely to have access to latrines yet the evidence indicates the reverse. Backward castes are less likely to have access to latrines but more likely if they are residing in a hired dwelling. Furthermore, the chances of having access to a latrine should increase with an increase in household members, but the evidence suggests the reverse. Both the chances of access to and use of latrines reduces when the number of household members is higher. The use of latrines is expected when households have latrines for exclusive use, but the econometric analysis does not find a statistically significant relationship. We find that region affects the chances of access to and use of latrines to a large extent. Households headed by youths are more likely to access common latrines rather than exclusive latrines. The households engaged in agriculture are more likely to have no access to latrines and also to not use them. Hindus and backward castes are more likely to have no access, as well as to not use latrines even if they have access. However, if Hindu households are residing in independent houses then there is a higher likelihood of using latrines. Although there are hardly any variables pertaining explicitly to social customs or norms in our regression models, the results suggest that factors such as region and religion, which subsume a set of customs and norms, impact the access to and use of sanitation. Hence, customs and norms are important determinants of sanitation coverage.

Public policy for sanitation should be directed towards better education, infrastructure, changing social norms,

and multiple options for types of sanitation. Education has a positive correlation to exclusive latrines and negative correlation to no latrine. Access to latrines heavily depends on basic amenities such as water supply and housing. The closer the water supply and lower the shortage of water, the higher are the chances of having access to a latrine. The marginal impact of an exclusive source of water supply is very high for access to a latrine and its use. The quality of the house floor also has a similarly high impact on access to an exclusive latrine. Perceptions about quality and cleanliness matter for latrine use. Governments should devise strategies to deal with regressive social customs and norms through information, education, and communication (IEC) campaigns. Finally, government programmes should be sensitive to age and household size. Shared latrines for youths and more than one latrine for larger households may bring discernable change.

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