



PHASE 1 PROJECT REPORT

Social Networks and
Norms: Sanitation in Bihar
and Tamil Nadu, India

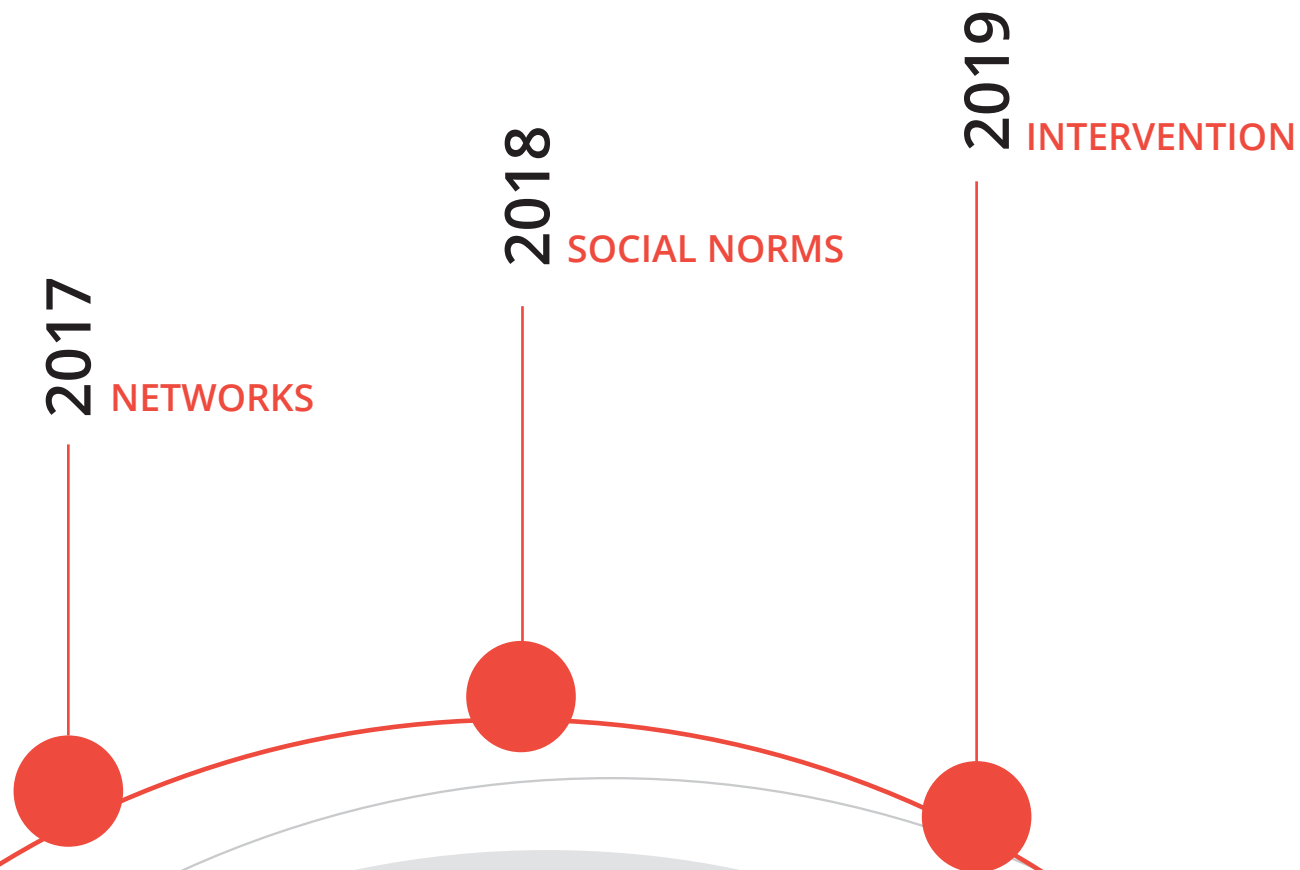
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DECEMBER 31, 2017

SOCIAL NORMS & SANITATION IN INDIA



Project Overview

This report summarizes the findings of the first wave of the Penn Social Norms Group (Penn SoNG) open defecation research project, conducted in rural and urban Bihar and Tamil Nadu, India. This research is part of a larger, three-year project designed to identify the social factors that affect individuals' propensity to engage in open defecation above and beyond infrastructure limitations. In this report, we discuss baseline usage and ownership rates, and how these rates diverge from previous research data. We then provide an analysis of the novel social network approach used in this study as applied to open defecation, investigating which networks are the most important to individuals when deciding to own and/or use a latrine as well as demographic patterns within these networks.

KEY FINDINGS

A

PEOPLE WHO OWN LATRINES LARGELY USE THEM

This finding contrasts with previous research that showed lower adherence to latrine use among individuals who have access to private latrines. This is consistent with the claim that the primary driver of latrine use is latrine ownership. This should not however be treated as a causal relationship or a policy implication at this stage of the study. In fact, there are multiple possible explanations for this observed finding such as the efficacy of behavioral change campaigns at the state level, the selectivity of toilet ownership among individuals who are more likely to use toilets among others.

B

A HIGH PROPORTION STILL DO NOT OWN LATRINES

More than half of rural and about a third of urban respondents did not own a latrine. Lack of access to private latrines is a significant determinant of open defecation. Richer and more educated families were more likely to own a latrine. This provides evidence supporting a strong supply-side component to future interventions.

C

OPEN DEFECTION REMAINS PREVALENT, PARTICULARLY IN RURAL AREAS

As a consequence of low latrine ownership, more than half of rural respondents reported defecating in the open. Although less frequently found in peri-urban areas and urban slums, open defecation is still common in these areas as well.

D

MEN AND WOMEN REPORTED SIMILAR RATES OF LATRINE USAGE

We did not observe significant differences in latrine use by sexes across age groups.

SCHEDULED CASTES ARE LESS LIKELY TO OWN A LATRINE EVEN WHEN SOCIOECONOMIC FACTORS ARE ACCOUNTED FOR

While this might be an indication of the imperfection of commonly used SES measures in the setting of India, it might also signify that the unique social position of scheduled castes in social networks is an important factor of latrine adoption.

INDIVIDUALS RELY ON GOVERNMENT IN TIMES OF SHORT-TERM DISTRESS, BUT THEY TURN TO FAMILIES FOR LATRINE CONSTRUCTION AND REPAIRS. IN GENERAL, INDIVIDUALS ALSO REPORTED RESPECTING FAMILY MEMBERS THE MOST

While government is seen as an important agent to address short-term economic distress, advice from family members is far more valued when considering long-term changes in the household. People are also much more likely to think of family members in response to the question about who they respect the most.

TOILET USE IS MOST ASSOCIATED WITH THE BEHAVIOR OF CLOSE RELATIVES AND FRIENDS

In comparison, toilet use is less strongly correlated with neighbors who live nearby. This suggests that social interventions focused on spatial proximity rather than familial and friendship ties may be less effective.

TOILET USE IS PREDICTED MORE BY THE BEHAVIOR OF YOUNG PEOPLE IN AN INDIVIDUAL'S NETWORK AS COMPARED TO THE BEHAVIOR OF OLDER PEOPLE

This is consistent with the claim that young people may be particularly influential trend-setters. It further suggests that interventions which focus on the behavior of young people may have more influence on the rest of the community than those which target senior members. Further research is needed to explore this possibility.

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PHASE 1

SOCIAL NORMS &
SANITATION IN INDIA

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INTRODUCTION

Over the past several months, the Penn Social Norms Group (Penn SoNG) has been conducting an intensive social network analysis of communities in rural and urban Bihar and Tamil Nadu, India. This research is part of a larger, three-year project designed to identify the social factors that affect one's propensity to engage in open defecation above and beyond infrastructure limitations. In this report, we will discuss which networks are the most important to individuals when deciding to own and/or use a latrine. We will review whose behavior and endorsements matter the most as well as the demographic patterns of social networks. In addition to these network insights, we will discuss how baseline usage and ownership rates have changed, and how these rates diverge from previous research.

We are far from the first to take on open defecation in India. To combat the serious sanitation challenges that the country faces, several large-scale campaigns have been waged with a focus on open defecation (Routray et al., 2017). These longstanding sanitation issues are certainly partially caused by material and technical issues, such as access to a well-functioning latrine and the provision of safe disposal of waste (Hueso & Bell, 2013). However, previous research (Coffey et al., 2014; 2017; Routray et al, 2015) and our WASH experience in other settings, such as neighboring Pakistan, tells us that access to a latrine does not guarantee use.

In such cases, the challenge, and frequently the solution, lies in the social expectations and beliefs that drive behavior.

Collective behaviors, such as open defecation, can be categorized in multiple ways, depending on which factors drive behavior (Bicchieri, 2006; 2016). The same behavior can be a custom, a descriptive norm, or a social norm, and therefore be supported by different motivational factors and so should be targeted by different kinds of interventions. To classify a collective behavior, we must determine whether an individual's willingness to engage in the behavior is contingent on what other people do, and possibly also on what other people think is appropriate. Open defecation is usually a custom, a behavior that most people engage in to meet their needs, not conditional on what other people do or approve of (Bicchieri 2016).

Although it may be a custom, it is worth investigating whether open defecation is supported by a variety of surrounding norms and other enabling conditions. Norms regulating caste (Ambedkar 1979), gender, purity, and pollution may prevent adoption and use of latrines. Indeed, some researchers argue that the role played by caste, gender, and untouchability constrains the sustainability of sanitation programs in India (e.g., Coffey et al., 2017). Social expectations about members of a specific

social networks may matter, and some social ties may be stronger than others. This context-dependence of social expectations lead us to identify the appropriate reference groups for latrine use, which may vary by sub-group, before attempting to test for any relevant supporting norms.

In rural India, other programs have found a link between community and behavior (Shakya, Christakis, & Fowler, 2015). Many social ties that one might find in rural settings are likely less strong (if present at all) in urban slums, which tend to have migrant and temporary populations. These transient communities reinforce the heterogeneity of urban areas, which present a very different social setting than rural areas. To create comprehensive, evidence-based interventions, it is important to first test how social networks and social motivations vary from setting to setting.

To complete our goal of understanding the social factors that support open defecation in India, our research has been structured into multiple phases. In the first phase, which we recently completed, we have mapped out the social networks of communities across Bihar and Tamil Nadu. In the second phase of our project, we conduct a social norms analysis to diagnose what sort of collective behavior open defecation is in India and whether it is supported by any underlying social norms. Based on the findings from the first two phases of our research, we will also

INTRODUCTION CONTINUED

For each relevant subgroup of rural and urban Indian communities, what are the social networks referenced for latrine use behavior?

recommend the design of an intervention to encourage latrine uptake and use. During the second phase, we also gather necessary baseline data to be used to compare how control and treatment areas fare following the introduction of an intervention. After the intervention, we will gather follow-up data to assess how behavior, beliefs, and/or personal relationships have shifted because of the intervention. Some of the data from this last phase will be gathered in person, and some gathered via phones.

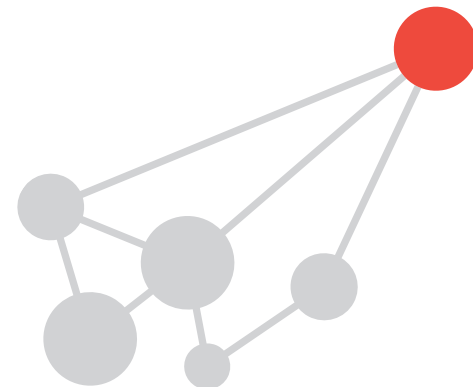
In the project's first phase, we aimed to answer our first central question: For each relevant subgroup of rural and urban Indian communities, what are the social networks

relevant to latrine use behavior? Pulling together information on respondents' network within a variety of localities (rural, urban, and intermediary areas) in Bihar and Tamil Nadu enabled us to map out which network characteristics facilitate information and influence flow. In addition to gathering network information, we also assessed socioeconomic status, health levels, preferences, beliefs, and a mix of other ancillary information. For example, we gathered data about factual beliefs about latrines, the consequences of latrine use, the perceived externalities of open defecation, and the perception of other network members use. These supplemental data enable us to build a more holistic picture of what shapes individuals' behavior.

These social network and ancillary data also positioned us for the second phase of our project, in which we conduct a social norms analysis. As mentioned earlier, while open defecation may not be a norm, there may be social norms that either indirectly support open defecation or make it harder to create a new norm of latrine use. Prior to gathering our network survey data, there was only anecdotal evidence, grey literature reports, and a few peer-reviewed articles to suggest which surrounding norms would be relevant. Our network data serves the important role of identifying the potential reference network about social norms that indirectly affect latrine use in rural and urban India,

thus making a valuable contribution to our subsequent social norms survey.

Social expectations are not simply expectations of "everyone" or generic "others" but of a group or network of people someone refers to in order to figure out what social rules apply to a particular situation. Our network data also reveals which particular reference networks are most important to defecation and toilet construction choices. For example, the behavior and opinions of friends or religious figures may be more important to one's sanitation decisions than family members and members of the government. Ultimately, when intervening on open defecation, understanding which reference network matter most to behavior will make subsequent interventions efficient and cost-effective.



STUDY DESIGN

We collected the first wave of data from September – October 2017 following a pilot in July. We developed the sampling strategy described here to be able to re-interview and add new individuals for the subsequent rounds of surveys.

We stratified our sample by state (Tamil Nadu and Bihar), socio-cultural regions (3 in each state as determined by the Indian census), and type of settlement (Gram Panchayat or GP, Town Panchayat or TP, and Municipal Corporation or MC). Each stratum, or primary sampling unit (PSU), will ultimately have a treatment and a control group so as to allow for a randomized control trial (RCT), which amounts to 2 MC PSUs, 2 GP PSUs and 6 TP PSUs (3 wards from each of treatment and control TP). The sampling strategy is presented in Figure 1. Within each PSU, individuals were sampled randomly from a

list of eligible respondents (aged 16 to 65), compiled specifically for the purposes of the study. The listing was conducted in the weeks prior to wave 1 to minimize failure to follow up due to high labor migration.

This survey was not meant to be representative at country or state level. Our study can, nevertheless, be generalized to understand conditions in Gram Panchayats, Town Panchayats, and registered slums for Tamil Nadu and Bihar.

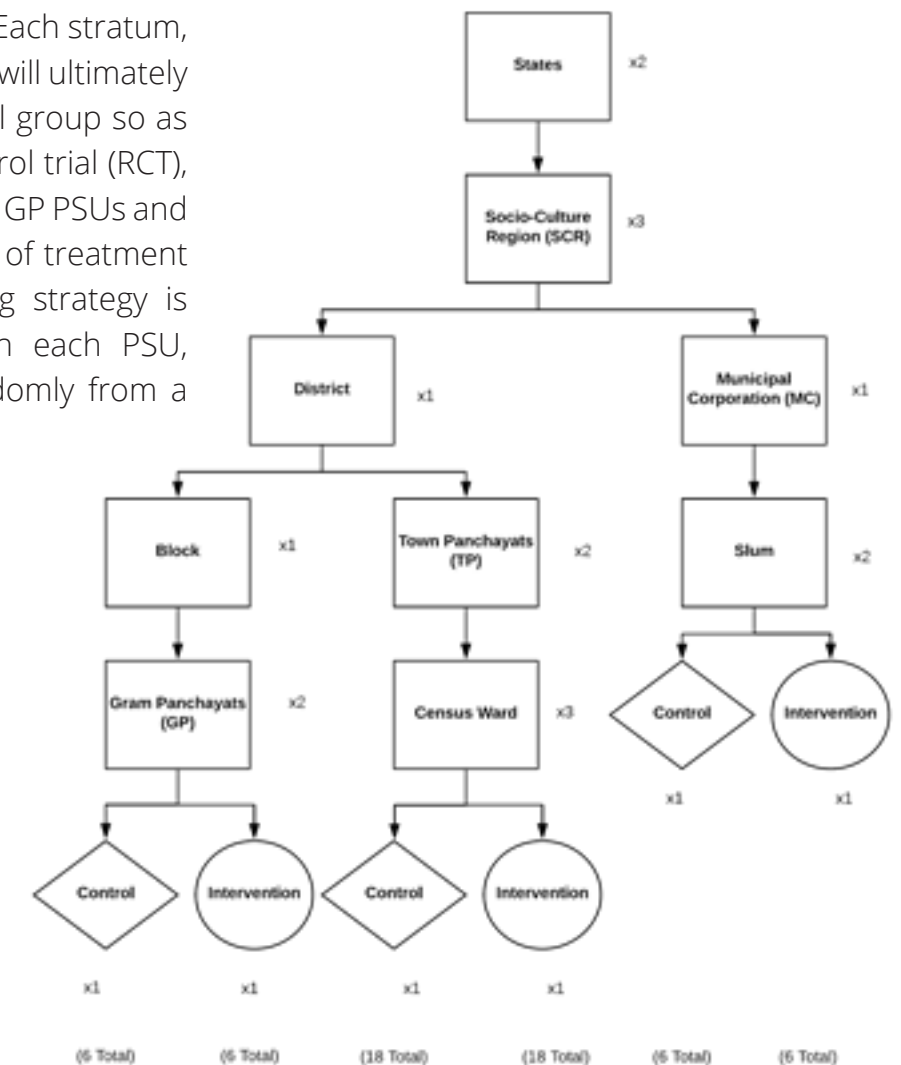
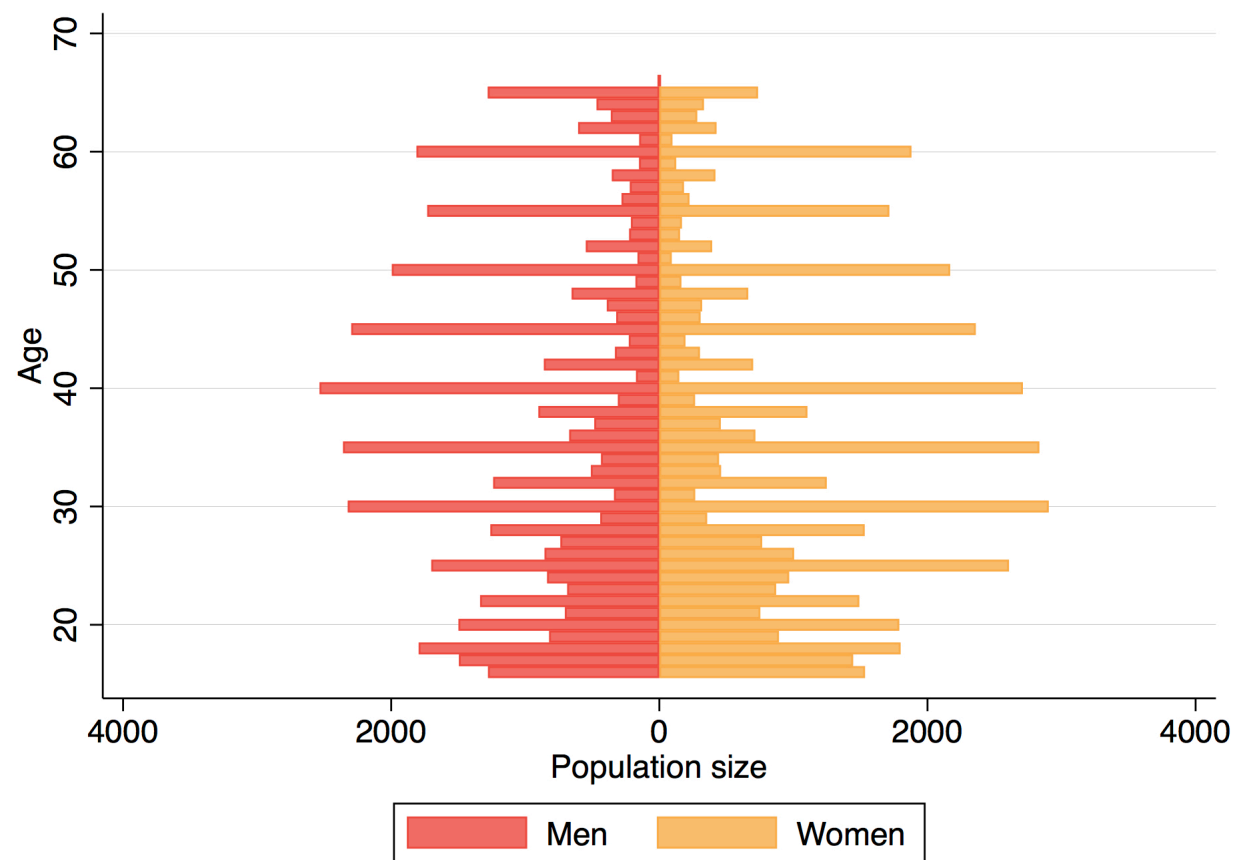


Figure 1: Sampling strategy for Network Survey in Bihar and Tamil Nadu, 2017

Figure 2: Population pyramid from the listing from both states, Network Survey 2017. Left panel: men, right panel: women. Length of the bar corresponds to the number of people in each age-sex group.



The survey consisted of the following sections:

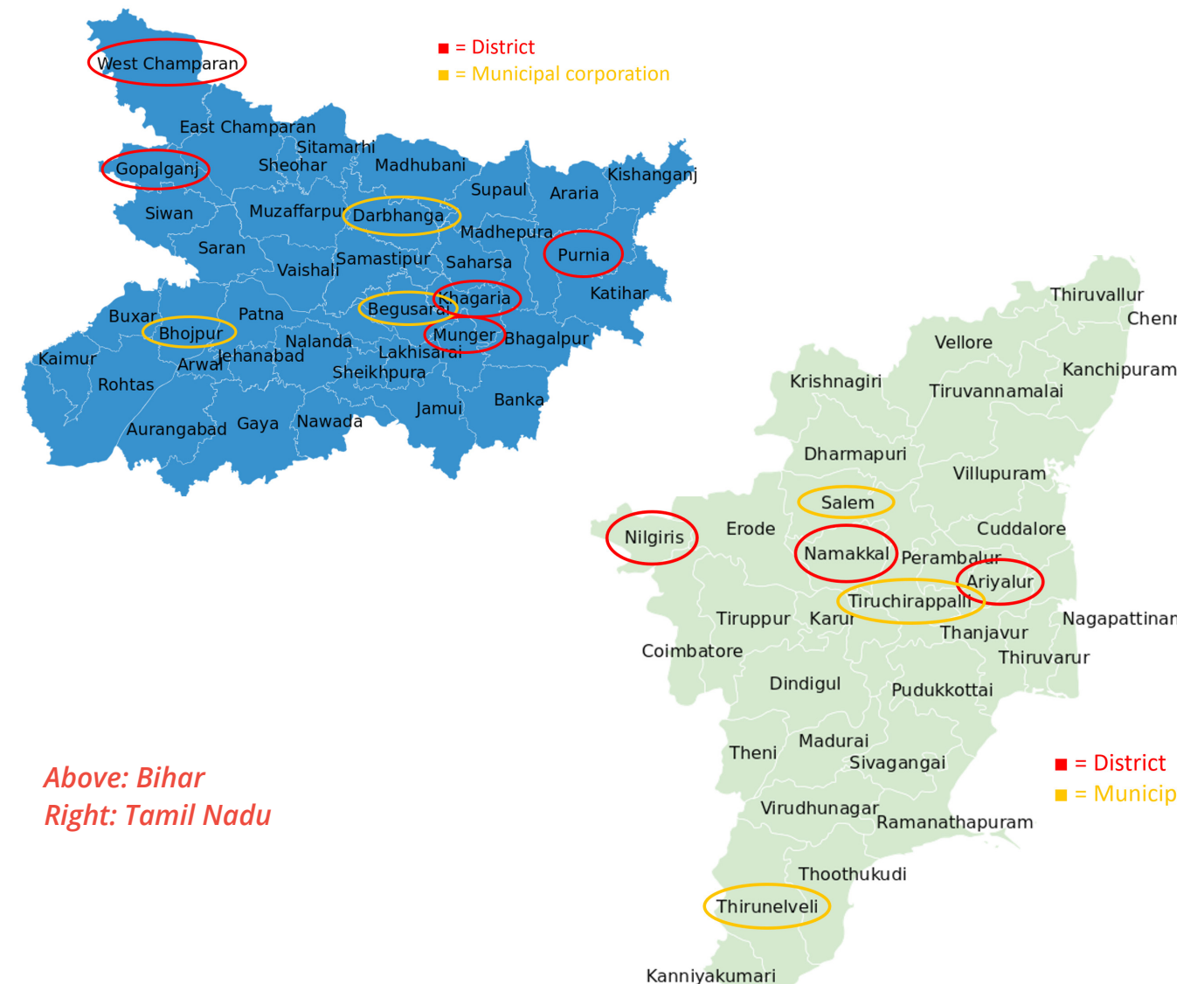
1. Basic socioeconomic characteristics, including demographics, economic status, and caste
2. Household information, including ages, genders, health status, and migration history of household members
3. Egocentric network data about individuals with whom respondents had conversations

about toilet construction and use, support networks, and networks of respect. We also determine the main socioeconomic and demographic characteristics of the alters (individuals in the social networks with whom respondents interact)

4. Toilet ownership and use information and beliefs about the advantages and disadvantages of open defecation and latrine use

There exists a significant amount of age rounding in the populations, most likely due to the imprecise recording of year of birth. Overall, the listing files contain 89,337 individual records for 33,937 households with 2.6 eligible individuals per household. Women slightly outnumber men (51.25% vs. 48.75%). The average age among eligible individuals is 36.2 years old. During the listing exercise, 14.26% of the structures were declared uninhabited.

Our quality checks uncovered several problems with the sampling strategy. Some individuals were more likely than others to be sampled during the interview. Additionally, certain records were reported imprecisely or incorrectly (such as double counting or misspelling names). These shortcomings will be accounted for in the subsequent analyses using reweighting. This did not affect the preparation of round 2 of the survey.



Above: Bihar
Right: Tamil Nadu

STUDY POPULATION

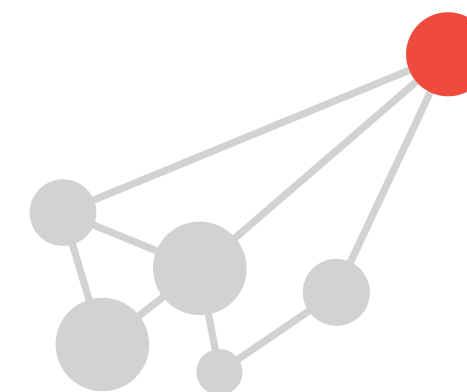
STUDY POPULATION CONTINUED

Table 1 Socio demographic and sanitation characteristics of the study population in Bihar and Tamil Nadu, Social Networks Survey 2017

%	Bihar (n=1702)	Tamil Nadu (n=1668)	%	Bihar (n=1702)	Tamil Nadu (n=1668)
Age (mean, sd)	35-14	39-14	Household		
Female respondent	55	47	Has Electricity	89	99
Literate	56	79	Cemented	47	56
Years of education			Semi cemented	33	37
None	44	21	Non-cemented	20	7
0 to 5 years	11	16	Drinking water		
6 to 12 years	36	49	Piped water	0.2	39
>12 years	9	15	Public tap	0.8	57
Religion			Tube well	94	2
Hindu	74	85	Other	5	2
Islam	26	8	Sanitation		
Christianity	0.1	7	Daily open defecation		
Ethnicity			Adult male respondent	43	33
Bihari	99	-	Adult female respondent	43	30
Bengali	0.4	-	Children 5-0	58	37
Tamil	-	94	Individual latrine ownership	44	57
Telugu	-	2.9	Nutrition		
Malayali	-	1.4	Household is food secure	85	90
Social class					
General	12	40			
SC	23	39			
ST	1	1.5			
OBC	50	17			
Refused/Don't know	14	2			

This survey reached a population between 16-65 years of age sampled equally from the GP, MC and TP from Bihar (n=1702) and Tamil Nadu (n=1668). Women comprised of 55% of the respondents from Bihar and 47% in Tamil Nadu.

Bihar: Forty-four percent of the study population had no formal education and only 9% completed more than 12 years of schooling. The study population was Bihari (99%) and mostly Hindu (74%), with a Muslim minority (26%). Half of the population was from Other Backward castes (50%) with some Scheduled (23%) and General class (12%). These respondents mostly lived in mostly 'Cemented' houses (47%) with electricity (89%). Most of them drew their drinking water from tube wells (94%) and slightly less than half of the adult men (43%) and women (43%) reported defecating in the open daily.



Tamil Nadu: The population from Tamil Nadu is more educated with only 21% with no formal education. Almost half of the population had between 6-12 years of formal education (49%) and 15% had more than 12 years of education. Most of them were Tamil (94%) and were predominantly Hindu (85%), though there were some Muslims (8%) and Christians (7%). These respondents were mostly from General class (40%) and Scheduled castes (39%). Most lived in 'Cemented' houses (56%), most of which had electricity (99%). They got their drinking water from piped water (39%) or public taps (57%). Fewer men (33%) and women (30%) reported practicing open defecation. These respondents did not suffer from shortage of food in the past one month and had a low prevalence of diarrheal disease in the past 7 days.

LATRINE TYPE, OWNERSHIP & USAGE

Bihar: A high proportion of households reported not owning a latrine (46%), most of which were in rural areas. Just over half of our respondents from Bihar had access to a private latrine (53%) but relatively fewer had access to community latrines (12%). Of those with latrines, most were individually owned (44%). Over half of the latrines were reported to have septic tanks (56%); 26% had single and 10% had twin soak pit latrines. Sewer connected latrines were rare in our sample from Bihar (2.2%).

A slight majority were built inside the home (51%), with some attached to the home (23%), near the home (15%), or at some distance away from the home (10%) (Figure 3). Most of these latrines were functional with flushes and intact water seals. We found that 31% of these latrines were built with government support which included labor or financial costs. We found about a third of these latrines were built less than 3 years ago, reflecting the time when Swachh Bharat Mission would be active. More than half of these latrines (53%) received government support.

Community latrine access is low in Bihar (12%). Urban (25%) and peri urban areas (8%) had some community latrine while rural areas had almost none (2%).

Tamil Nadu: A high proportion of respondents in our sample reported not owning a latrine (41%). A larger proportion had access to a private latrine (60%) on a regular basis. In Tamil Nadu, the majority reported having septic tanks while 21% of the latrines had a sewer connection. 15% of the respondents reported owning single soak pit latrines while very few reported having twin pit latrines (1.2%).

The majority of these latrines were functional and showed signs of use. Thirty-three percent were reportedly built less than three years ago. Among these latrines, about a third of these latrines were reported to be built with some government support (32%). These latrines were either built inside the house (29%), attached to the house (39%) or near the house (29%) possibly indicating that distance was minimized for convenience reasons.

Community latrine access was higher in Tamil Nadu (50%), mostly in the urban and peri urban areas with lower coverage in rural areas.

To validate reported latrine ownership and/or characteristics, field workers observed latrines and checked for discrepancies. We found that the proportion of ownership, functional and nonfunctional soak pits, septic tanks, and sewer connections that respondents reported were highly correlated what our surveyors observed.

Table 2

Latrine ownership and characteristics in Bihar and Tamil Nadu, Social Networks Survey 2017

%	BIHAR	TAMIL NADU
Latrine Ownership		
None	46	41
Sole owner	44	56
Shared	11	3.7
Has access to private latrine	53	60
Has access to community latrine	12	50
Latrines built with any govt. support ²	31	20
Latrine type¹		
	N=945	N=1060
Single soak pit	26	15
Twin soak pit	10	1.2
Soak pit (# unknown)	3.6	0.9
Septic ³	56	60
Sewer	2.2	21
Others	0.7	1.4
DK	1.3	0.2
Time since construction¹		
	1.3	0.2
<2 years	35	33
5-3 years	8.1	17
>5 years	48	36
Don't know	9.6	14
Latrine characteristics⁴		
	N=847	N=771
Cement floor	90	82
Intact water seal	95	45
Pour flush	97	46
Visible signs of use	95	83

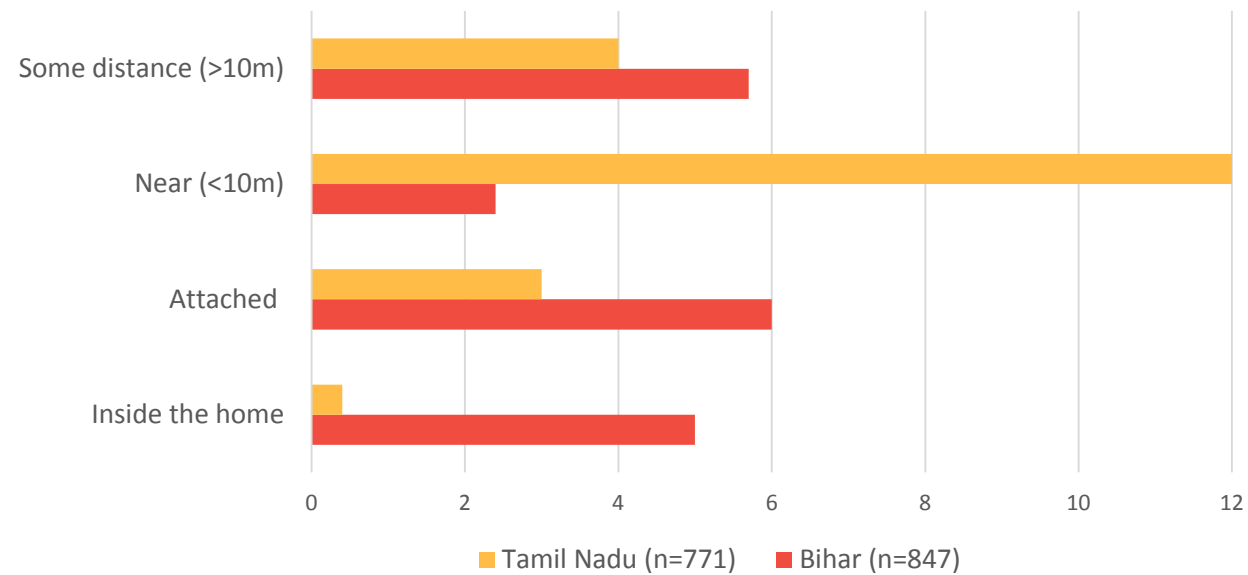
¹ Among households who own or have access to a private latrine

² Among those who owned latrine, this proportion received government support to dig pits or build superstructure or meet financial costs

³ Self-reported and can locally refer to a latrine with an enclosed underground tank

⁴ Observed by the field surveyor

Figure 3: Location of the latrine in Bihar and Tamil Nadu, Networks Survey 2017



Fewer latrines are built inside the home in Tamil Nadu compared to Bihar. Norms governing the location of a latrine are further assessed in the upcoming norms survey.

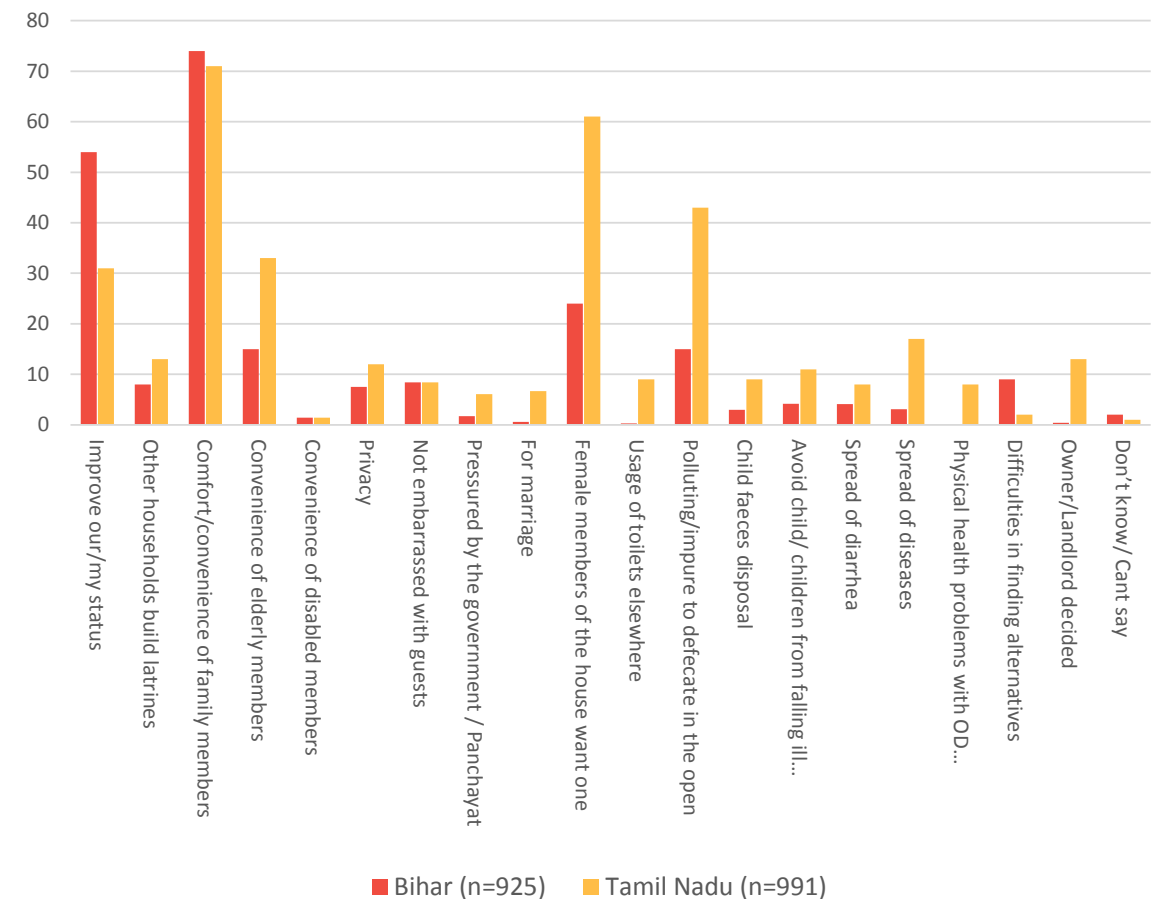
Comfort for family members was the key reason mentioned [for having a latrine] in both states

REASONS WHY HOUSEHOLDS BUILT A LATRINE

To understand why households built a latrine, we asked open ended questions, which we later categorized, about why the household built their latrine (Figure 4). These responses were not prompted. Comfort for family members were the key reason mentioned in both states (74% Bihar, 71% TN). Respondents also mentioned the preferences of women in their household (61% Bihar, 24% TN) and elderly members (15% Bihar, 33% TN). The

next most prominent reason mentioned was that having a latrine would increase their status (54% Bihar, 31% TN). Notably, disease prevention was also mentioned as a reason for building a latrine (12% in Bihar and 36% in TN). Few households in Tamil Nadu mentioned marriage, convenience of guest, child feces disposal, usage of toilets elsewhere and encouragement by government officials.

Figure 4: Comparison of reasons behind constructing the latrine in Bihar and Tamil Nadu, Network Survey 2017



Beliefs about why other people defecate in the open

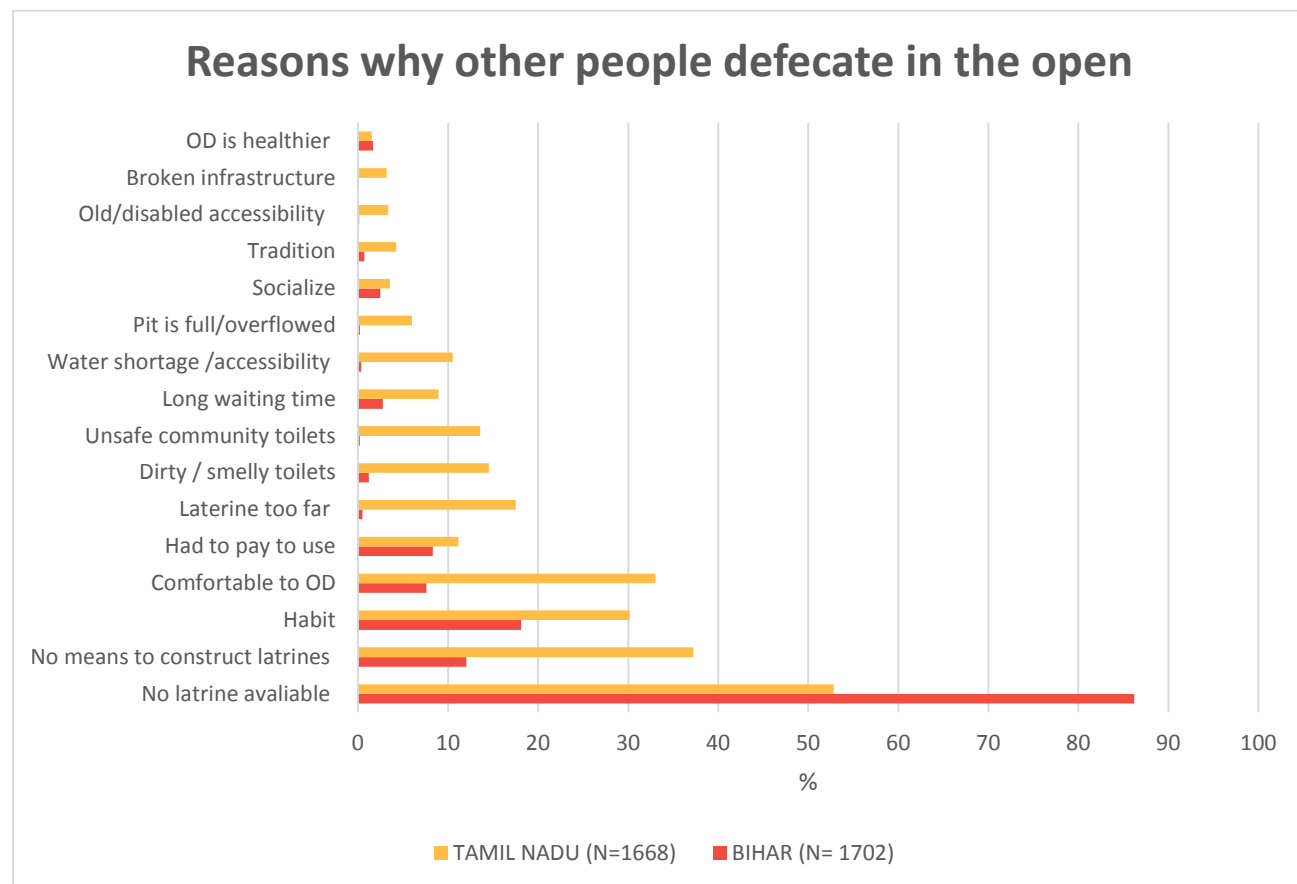
We asked open-ended questions about why other people defecated in the open to elicit respondents' beliefs about what drives the behavior. The surveyors were instructed to not prompt the answer and only record the reason the respondents mentioned. The distribution of prominent reasons in both Bihar and Tamil Nadu is shown in Figure 5.

In both our sites, lack of access to latrine (86% Bihar, 53% TN) and lack of means (12%

Bihar, 37% TN) of constructing the latrines was mentioned as the main reasons for why they thought other people defecated in the open. Next, reasons such as habit (18% Bihar, 33% TN) and comfort (8% Bihar, 33% TN) were mentioned.

The general trend is consistent in the two states: practical reasons such as accessibility and convenience are the dominant justifications for why people defecate in the open. Notably, health related reasons and social and family pressure were rarely

Figure 5: Reasons mentioned regarding why other people defecate in the open in Bihar and Tamil Nadu, Networks Survey 2017



mentioned. This could be because social or health reasons are not perceived as important, or they are not the most salient reasons when obvious material constraints limit one's toilet ownership and use. It may be the case that once material access is available, that social and health reasons become more prominent. Other reasons involving the problems with existing latrines, such as it being too far, too dirty, too smelly, or too unsafe were raised as concerns in Tamil Nadu but not in Bihar. Moreover, we found that social and family pressure (e.g. that it may be humiliating to use community toilets or share a latrine with household members) were rarely mentioned as perceived reasons why other people chose to defecate in the open. These reasons, should they actually drive behavior, may be better measured through qualitative methods that emphasize the social constraints of using latrines.

Factors associated with latrine usage in Bihar and Tamil Nadu

We collected data on several factors such as latrine ownership, age, and sex, which have been found to impact latrine use in India (Coffey et al., 2014; Routray et al., 2015). Young children commonly defecate in the open in South Asia (Majorin et al., 2014). Men have been found more likely to defecate in the open as compared to women (Coffey et al., 2014). We assessed the proportion of household members reporting use of the latrines, conditional on

their latrine ownership. Then, we stratified the households by latrine ownership and assessed the association of age and gender with the probability of open defecation by household members.

Latrine ownership

We found that nearly all of respondents who owned a toilet reported regularly using them (95%). The usage rate was even higher (97%) among those who owned a functional toilet. Ninety two percent of those who reported defecating in the open did not have access to a private latrine (95% in Bihar and 87% in Tamil Nadu). This contrasts with reports from 2014, in which respondents did not report using toilets despite owning them (Coffey et al. 2014, Clasen 2014). Our results indicate a possible shift in latrine usage or, more simply, a more accurate assessment of latrine usage. Our study indicates that the main reason behind open defecation is lack of latrine ownership. This reasoning is consistent with the finding that, when respondents were asked why they defecated in the open, the primary reasons were 1) not having access to a latrine (Bihar 93%, 60% TN) and 2) not having the means to construct a latrine (Bihar 12%, 42% TN). These explanations were also the two most commonly supplied by respondents when asked about why other people defecate in the open. We plotted the local polynomial regression estimates of the probability of the respondents and their household members defecating in the open

despite owning a latrine across age (Figure 7). The large difference in open defecation rates across ages is explained by latrine ownership in both states.

Our results, however, should not however be treated as stating a causal relationship or having a policy implication at this stage of the study. In fact, there are multiple possible

explanations for these observed findings such as the effectiveness of behavioral change campaigns at the state level, the selectivity of toilet ownership among individuals who are more likely to use toilets among others. Further research is needed to explain the discrepancy of our findings with prior research.

Figure 6: Association of latrine ownership and use in Bihar and Tamil Nadu, Network Survey 2017

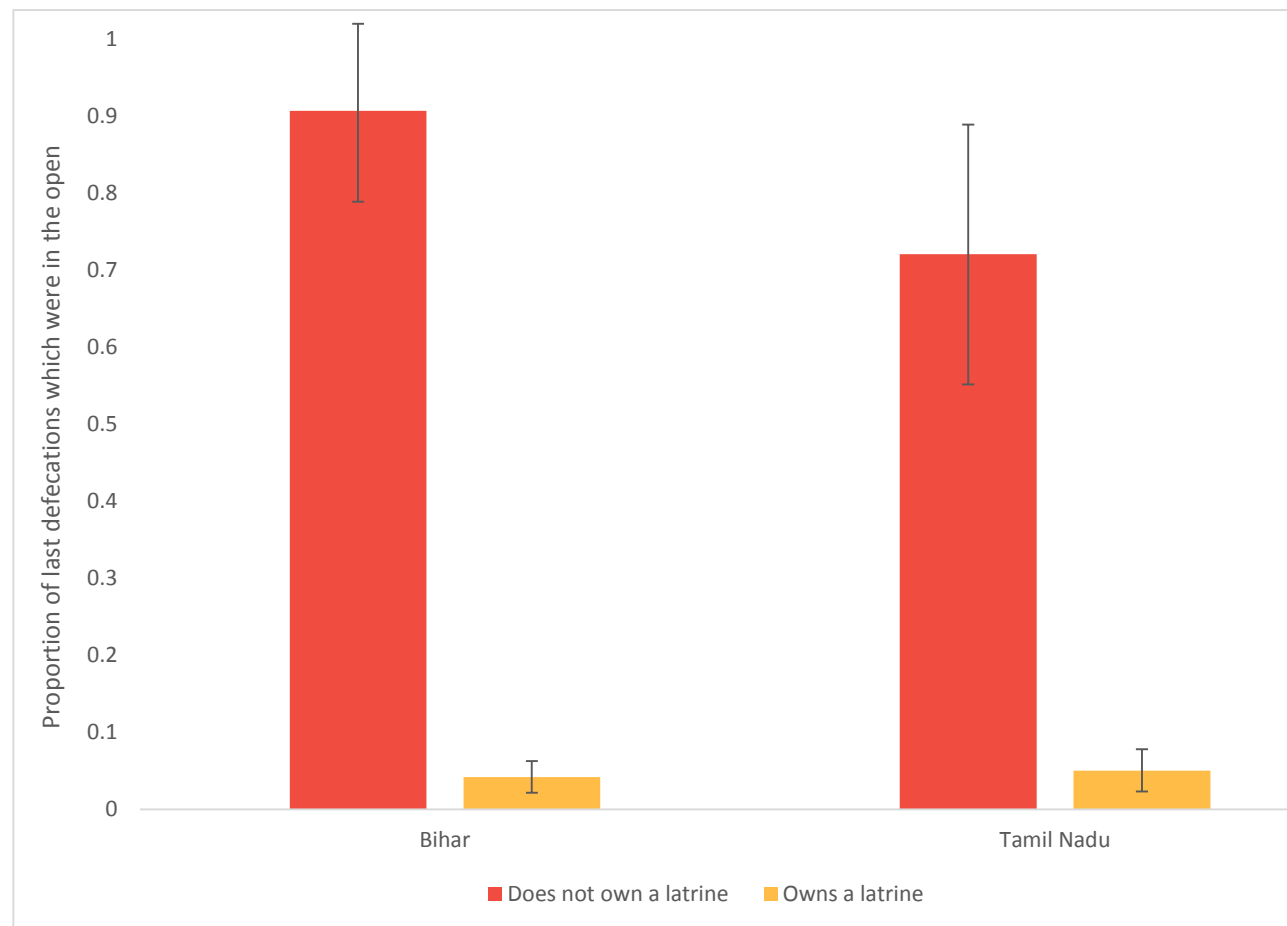
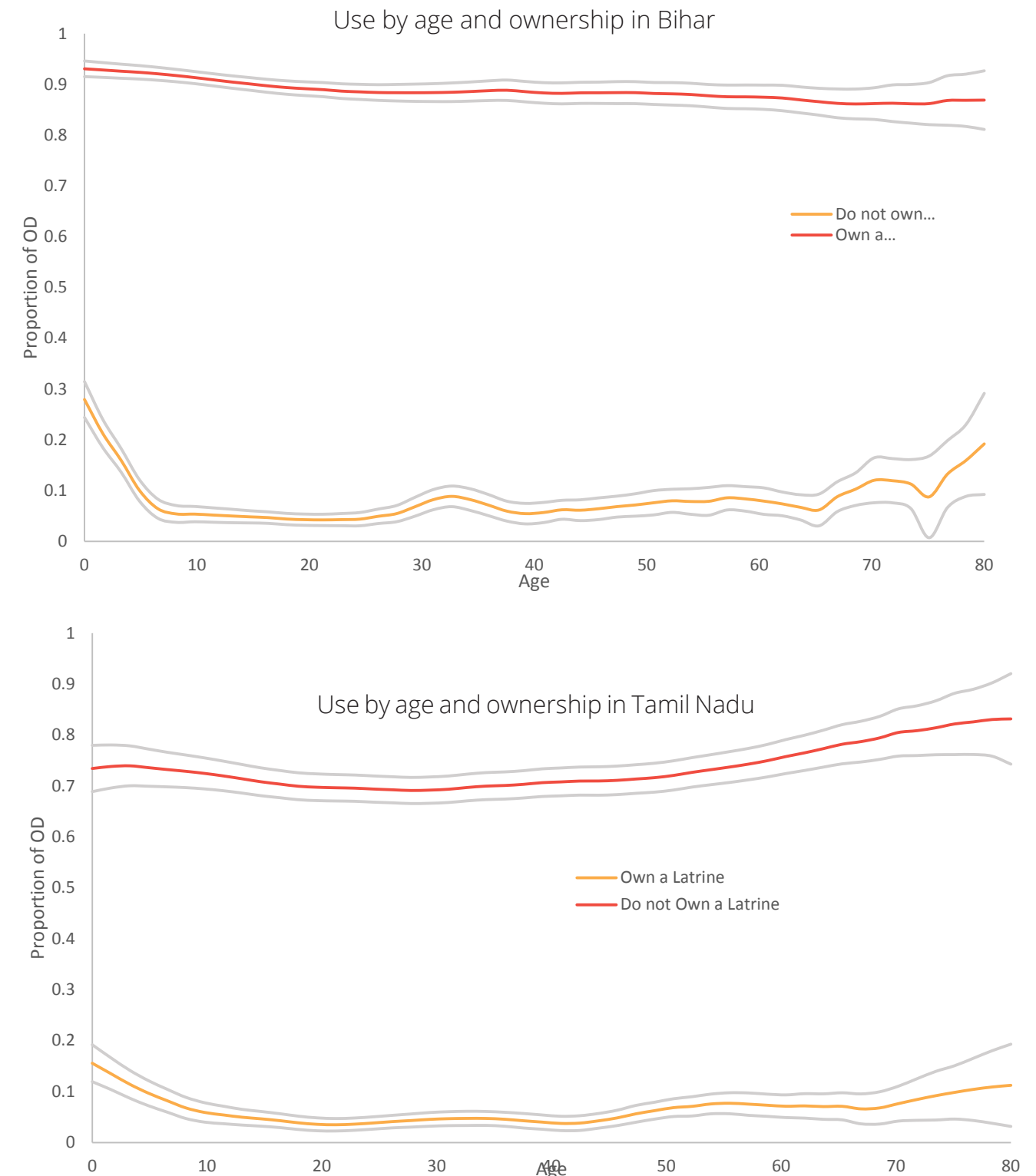


Figure 7: Patterns of latrine use according to age by States, Network Survey 2017



Sex and age

We assessed the patterns of open defecation across age and sex in our study population using local polynomial regression estimates of the probability of the respondents and their household members to defecate in the open despite owning a latrine.

We found that latrine usage among men and women are similar across all types of PSUs in both states. Among latrine owners, open defecation is common in young children who generally defecate freely until they learn how to use a latrine around 5 or 6 years of age. Reported open defecation among latrine owners is low in both states. In rural areas of Bihar, we noted that young men between the age of 30-35 years were defecating in the open more (14%), despite owning a latrine compared to men 20-25 years old (5%). This mild spike in open defecation may occur during their time away from home for work, especially in the fields.

Those older than 60 in Bihar and 50 in Tamil Nadu are reported to have slightly higher open defecation rates despite owning latrines. We observed wide confidence intervals around these estimates due to relatively lower numbers. However, we emphasize that older people's open defecation rates remained below 20% for both sexes if they owned a latrine.

We find no significant difference between male and female latrine usage (Figures 8 and 9). However, despite owning a latrine, older adults and younger children defecate outside more, as has been found in previous research (Majorin et al., 2014; Coffey et al., 2014)

We found that latrine usage among men and women are similar across all types of PSUs in both states

Figure 8: Patterns of open defecation among male and female latrine owners in Bihar, Network survey, 2017

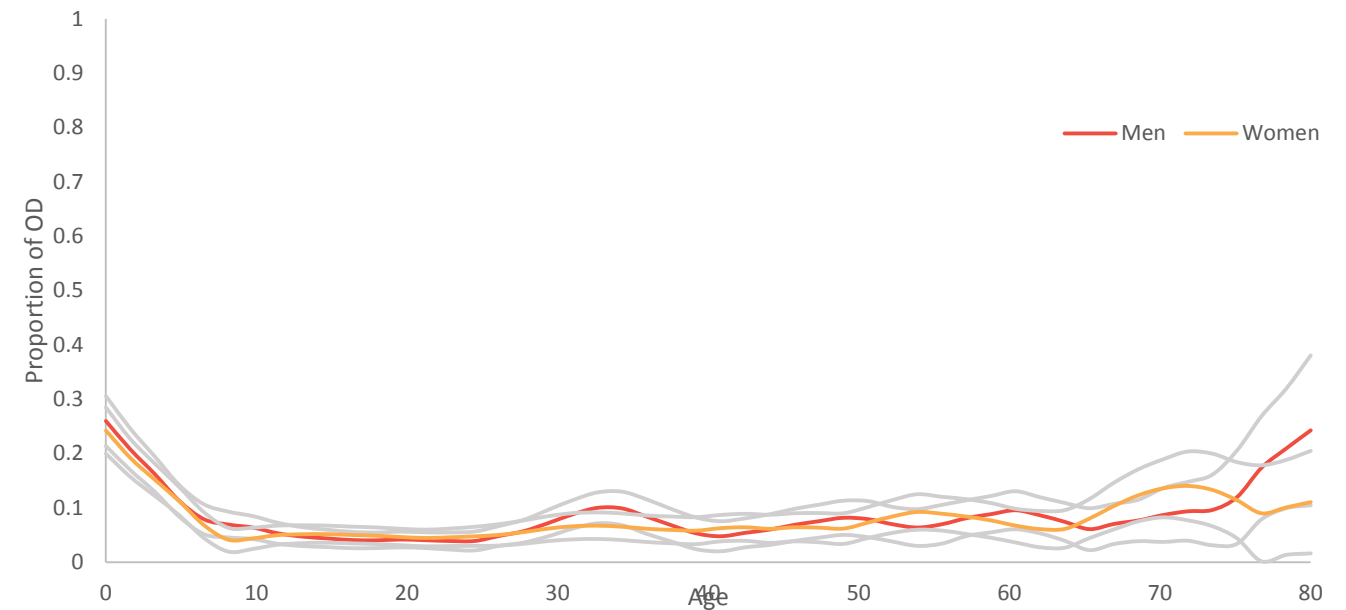
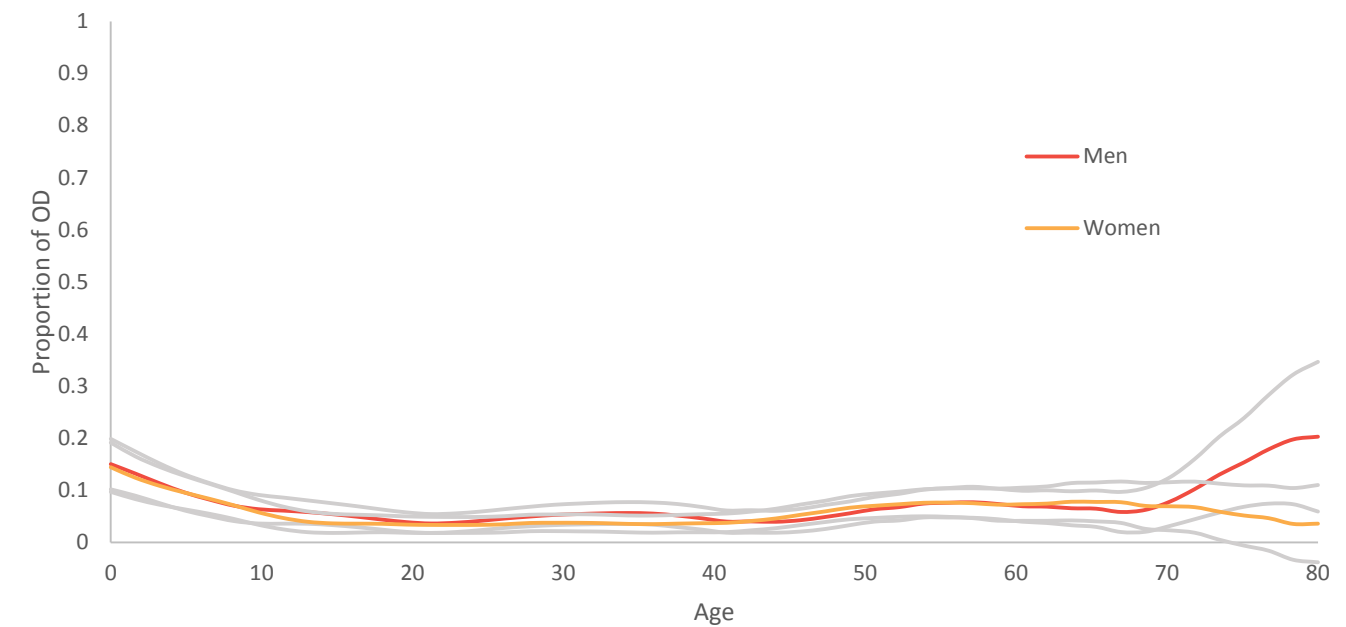


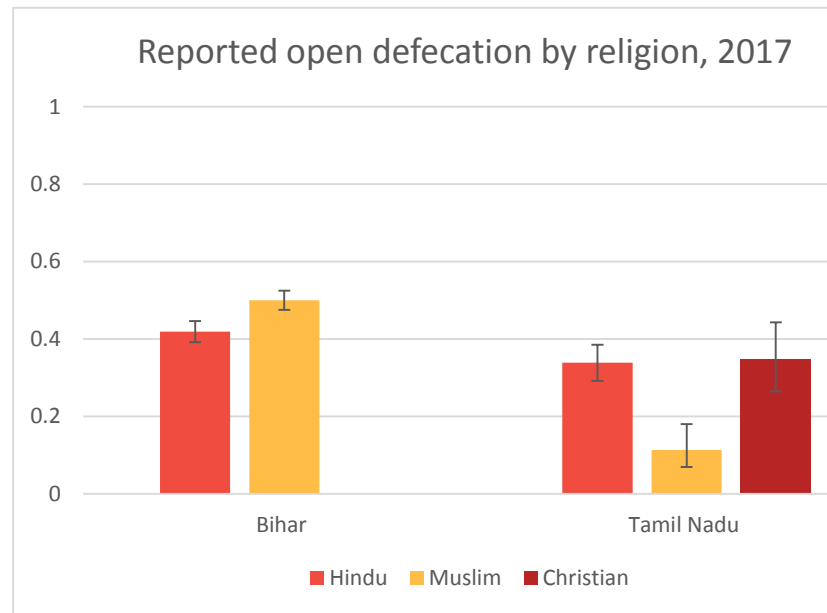
Figure 9: Patterns of open defecation among male and female latrine owners in Tamil Nadu, Network survey, 2017



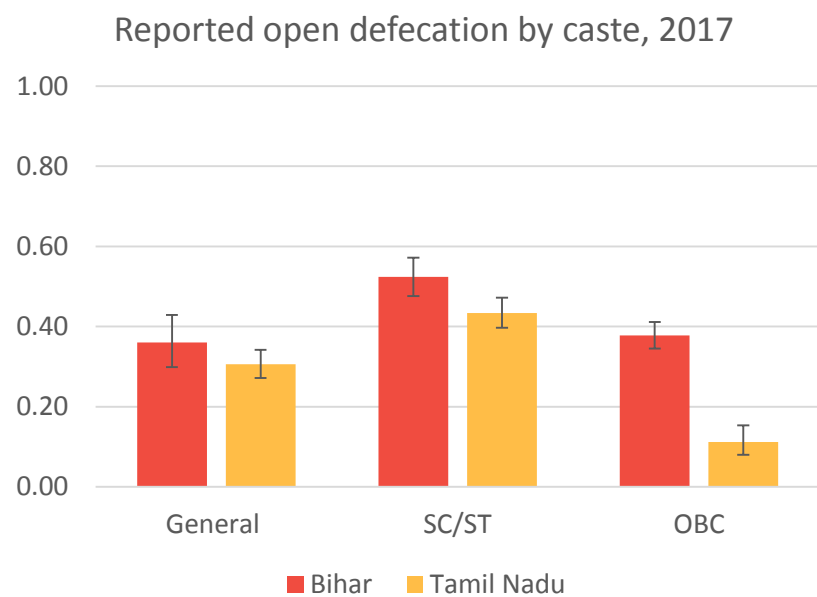
RELIGION & CASTE

Previous work has found rural Muslims are more likely to have and use toilets compared to rural Hindus (Geruso & Spears, 2015; Coffey et al., 2017). We assessed differences in latrine use by religion in our study population. In Bihar, Hindu respondents had a lower proportion of reported open defecation compared to Muslims. However, in Tamil Nadu, Muslims were significantly less likely to defecate in the open compared to Hindu or Christian respondents (Figure 10).

Figure 10: Proportion reporting open defecation by religion and caste, Bihar and Tamil Nadu, Networks Survey 2017



We assess the relationship between household latrine ownership and subgroups based on religion and caste in adjusted regression models. Since less than 8% of the individuals defecate outside despite having access to a household toilet, we modeled household ownership of toilets instead of whether the individual defecates in the open. We adjusted for education, household characteristics, wealth indicators (possession



of motorcycles, fridge), proportion of women and children in the household. The socio-religious variables were grouped as follows: Hindu-upper caste (Thorat & Newman, 2007); Hindu-SC; Hindu-ST and OBC; Muslims and Others (which includes Christians and the few who did not know or refused to answer). We modelled socio-religious groups with household latrine ownership in the first analysis. In the adjusted model we included education, wealth indicators and household composition characteristics.

In both states, compared to Hindu-Upper caste, Hindu-SC and Muslims were significantly less likely to own a latrine. These associations were robust to the inclusion of wealth, education and household characteristics in the adjusted models. In addition, Hindu-ST/OBC were less likely to own a toilet in Bihar (Table 3). While sector-wise separate regressions, which split the sample into rural, urban, and peri-urban sections of Bihar and Tamil Nadu observed the same directional effect of Muslims using toilets less, the effect was non-significant in these smaller samples (Appendix 2).

Table 3 Association of latrine ownership and socio religious characteristics in Bihar and Tamil Nadu, Network Survey, 2017

Estimates (SEs)	Bihar, Unadjusted OR	Bihar, Adjusted OR	Tamil Nadu Unadjusted OR	Tamil Nadu, Adjusted OR
<i>Ref. Hindu-Upper caste</i>				
Hindu-SC	0.04*** (0.02)	0.11*** (0.06)	0.30*** (0.06)	0.42*** (0.10)
Hindu-ST/OBC	0.16*** (0.05)	0.31** (0.13)	1.66 (0.48)	1.83* (0.56)
Muslim	0.06*** (0.03)	0.20** (0.12)	0.37* (0.15)	0.45** (0.13)
Others	0.05*** (0.02)	0.16*** (0.08)	1.39 (0.41)	1.43 (0.46)
N	1702.00	1701.00	1668.00	1668.00
Pseudo R ²	0.20	0.35	0.09	0.26

Models are adjusted for wealth indicators, education and household composition
*p<0.05, **p<0.01, *** p<0.001

SOCIAL NETWORK & LATRINE USE

We collected data on social networks to better understand the spread of information about latrine use. All the information was reported by the respondents (the egos) and pointed to individuals with whom the respondents were likely to have contacts (the alters). Individuals were asked about the following types of contacts:

1. Who would you contact in the event of various crises, such as crop failure or a flood?
2. Who do you respect the most in your community?
3. Who did you have conversations with about toilet use and open defecation?
4. Who would you ask for help if you needed to build a latrine?
5. Who would you ask for help if you needed to clean or repair a latrine?

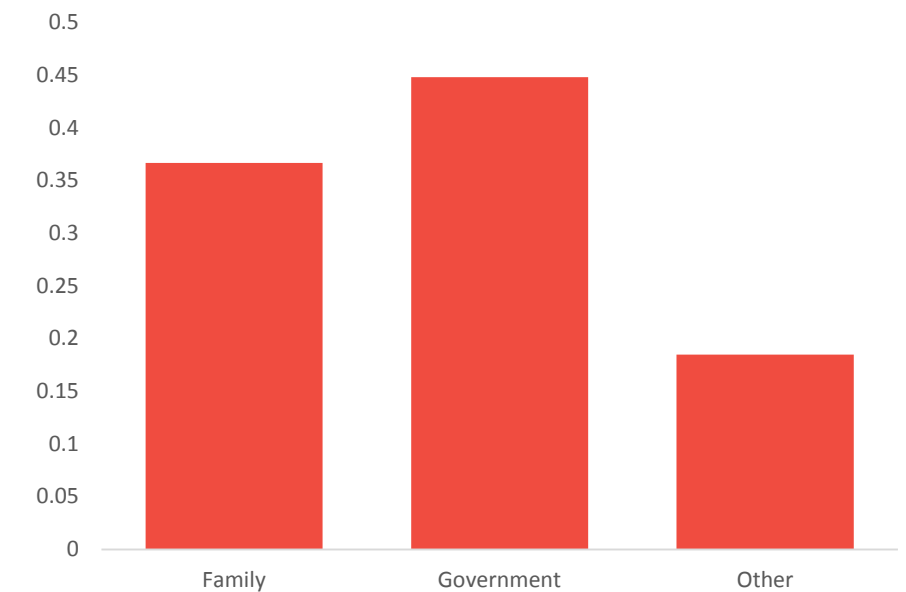
These questions, formally known as “name generators,” allow us to see a broad variety of relationships that are prevalent in the surveyed communities. Overall, information about 10,870 alters has been collected. This information was not, however, evenly distributed across name generators. Question 1 generated 6039 names with an average of 2.1 names per respondent. Question 2 generated 6488 names with an average of 2.3 names per respondent. More

specific questions about toilet use generated a much smaller number of names, which means that despite government programs, conversations about toilet use and open defecation are not as prevalent as one might expect. Question 3 generated only 2195 names with an average of .8 names per respondent. The modal response frequency is zero, which means that the plurality of the respondents have not discussed toilet use in the past and do not have an intention to talk about it with anyone. Of the respondents who do not have a toilet, on average .72 names were given in response to Question 4. This generated 2160 names. Of the respondents who did have a toilet, Question 5 resulted in 2456 names with an average of .84 names per respondent.

For each alter generated by the respondent, participants were asked “How do you know this person?”. This question generated 660 unique responses. We reduced these items through qualitative coding to 23 frequent response types, all with at least 80 instances (for a list of response types and their frequencies, see Appendix 1). We then further reduced these 23 response types to 3 broad categories of Family, Government, and Other. Not only did people have differentially dense networks depending on the type of question, the composition of alters also differed greatly.

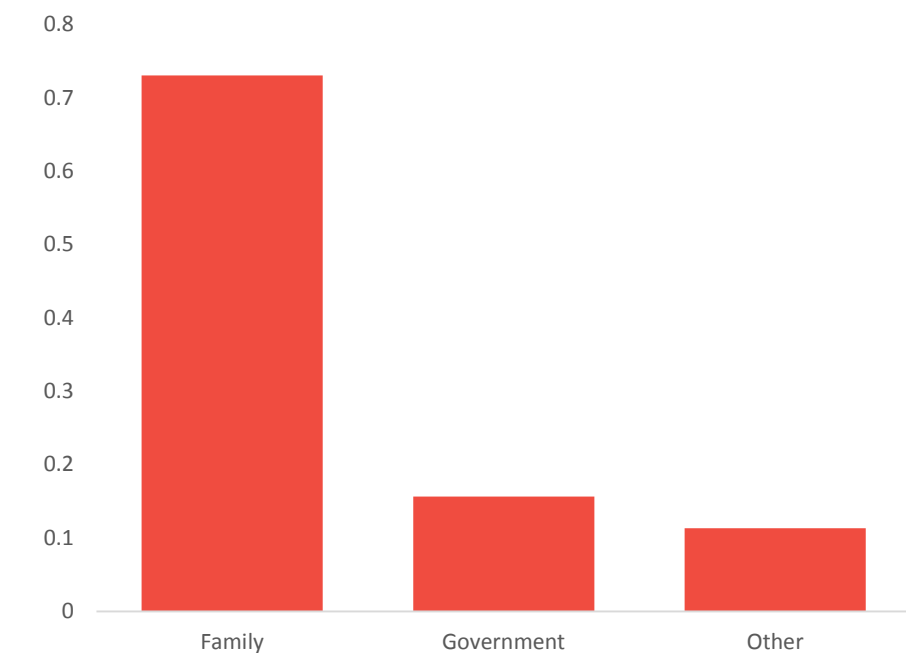
In response to various crises, people were more likely to turn to government officials, with family being a close second source of support (Figure 11).

Figure 11: The distribution of alters by type of relationship for network question 1 (contacts in the event of crises), Network Survey, 2017



Question 2 generated a drastically different pattern of responses. Individuals are predominantly more likely to respect members of their families (see Figure 12).

Figure 12: The distribution of alters by type of relationship for network question 2 (who do you respect the most in your community), Network Survey, 2017



An interesting pattern emerges in questions about open defecation and toilet use. Individuals are somewhat more likely to have these conversations with government officials, but when it comes to actually building or repairing a toilet, the family plays a much larger role (see Figures 13, 14, and 15).

Figure 13: The distribution of alters by type of relationship for network question 3 (conversations about open defecation and latrine use), Network Survey, 2017

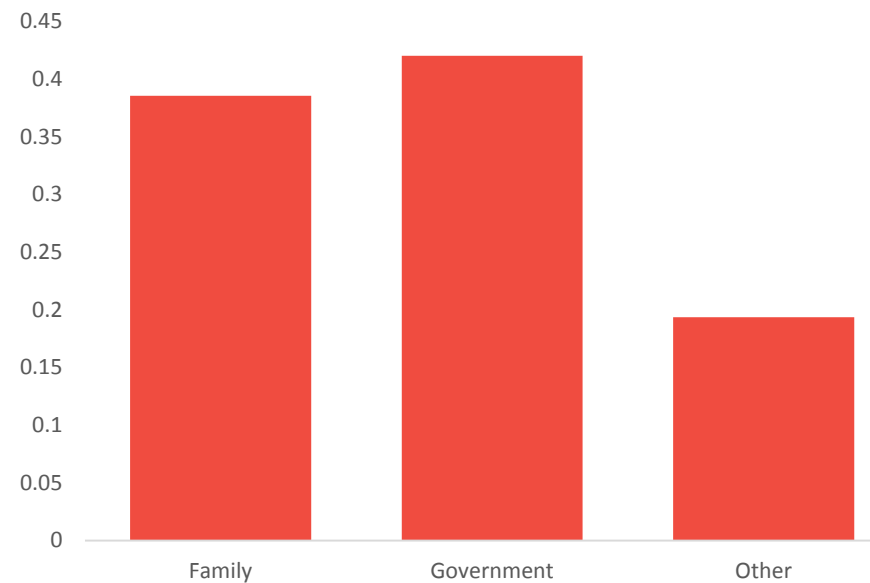


Figure 14: The distribution of alters by type of relationship for network question 4 (conversations about building a toilet), Network Survey, 2017

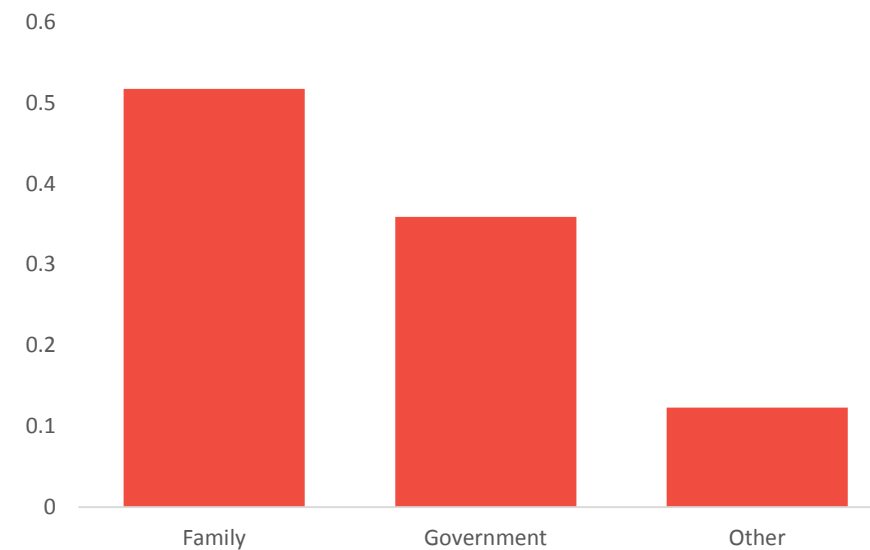
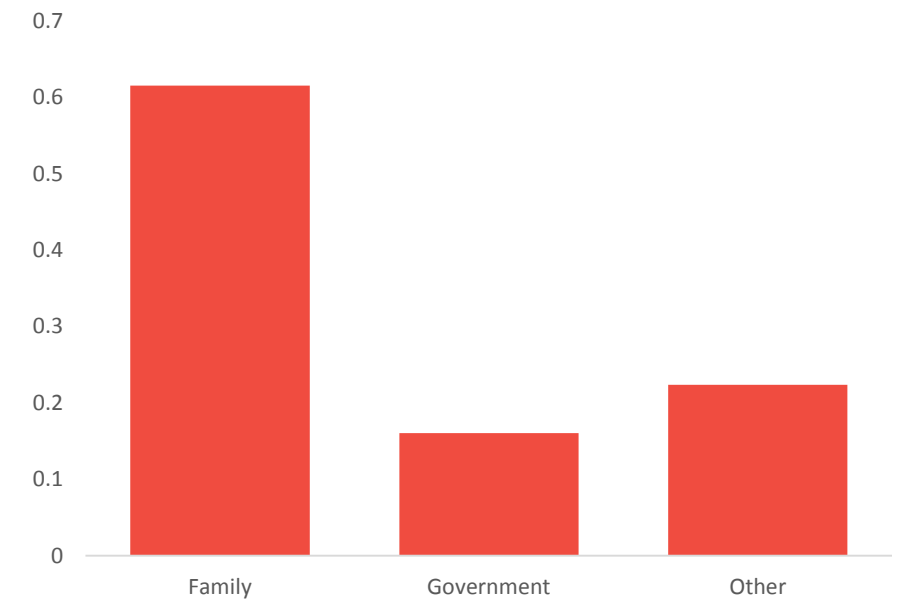


Figure 15: The distribution of alters by type of relationship for network question 5 (conversations about cleaning and repairing a toilet), Network Survey, 2017



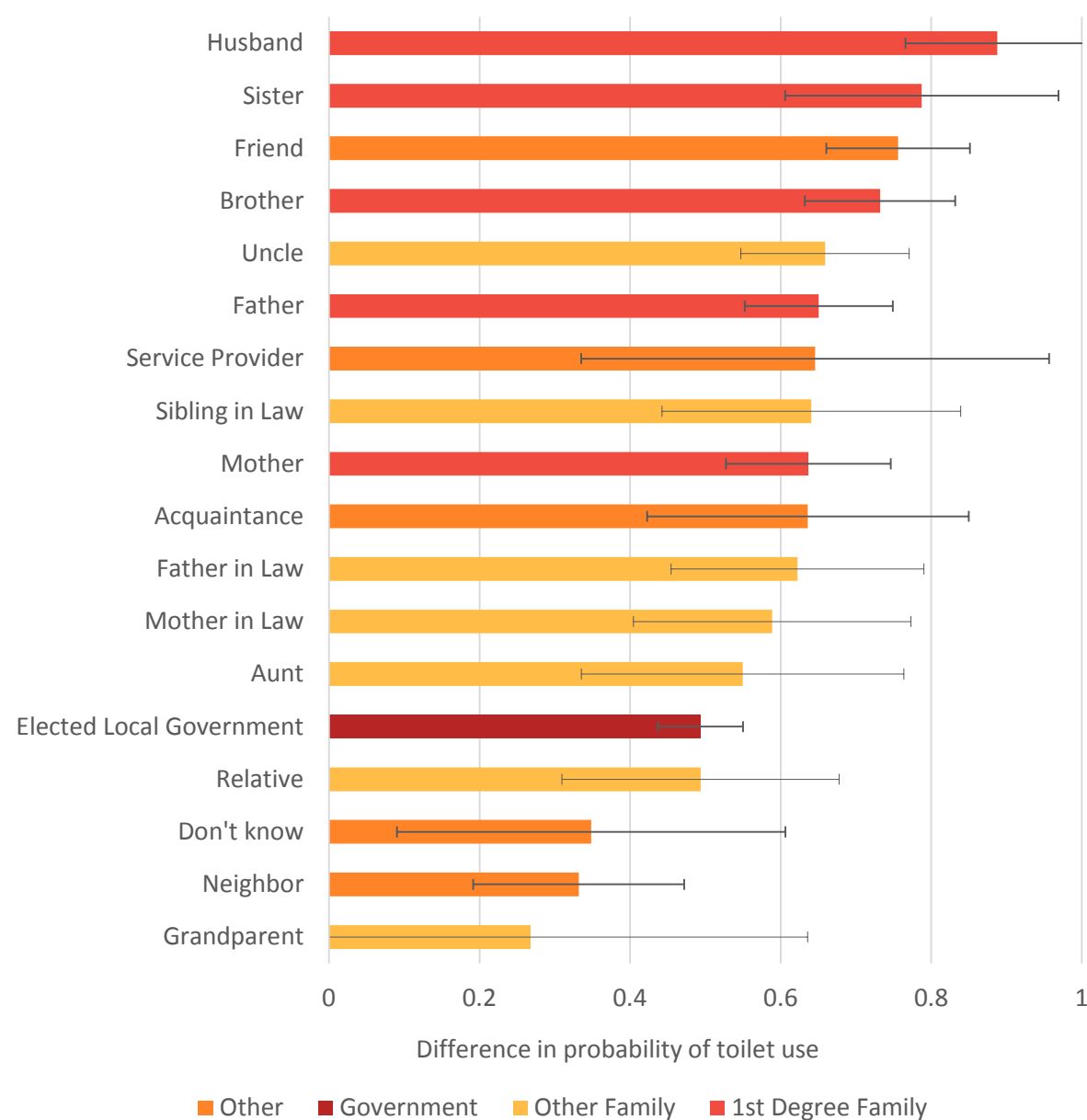
The average age of an alter is 46, and this age is consistent for all name generators (although missing values are more likely with non-family members). The sample of alters is predominantly male (with only 26.7% of alters reported as female). This pattern is similar for both male and female respondents. In terms of residence, 43.97% of the alters live in the same household with the respondent, and 36.85% of the alters live in the same neighborhood as the respondent. The majority of social interactions happen on a daily basis (61.21%), and only 14.27% of alters are contacted less than once a month. The social class composition of the alters is rather even, with 1/3 of the alters belonging to each of the General, SC, and OBC classes.

Previous work suggests that beliefs about what other people do often influence our behavior (Bicchieri, 2016). Cross-sectional

studies about latrine use show that people’s beliefs about others’ latrine use correlate with their own use (Odagiri et al., 2017; Haider et al., 2016). Such correlations do not necessarily imply that one causes the other. One may very well expect members of one’s network to defecate in the open, but this belief may not have causal relevance in one’s decision to do the same. Such findings may be indicative of a trivial correlation; without a causal analysis, this will not be possible to test. Even in the presence of social influence, not all people have the same level of influence. In order to provide some insight into what types alters may influence toilet use, for each alter we asked respondents “Does [NAME] usually defecate in the open or use a latrine?” These data inform which survey questions to ask in a follow up study to test whether or not there is indeed a causal effect of social

influence. Using these responses, we also assessed the difference in probability of toilet use between respondents with an alter who used a toilet versus respondents with an alter who did not use a toilet, for each class of alter.

Figure 16: Difference in the probability of toilet use between respondents with alters who use a toilet versus those that do not, by alter type, Network Survey, 2017



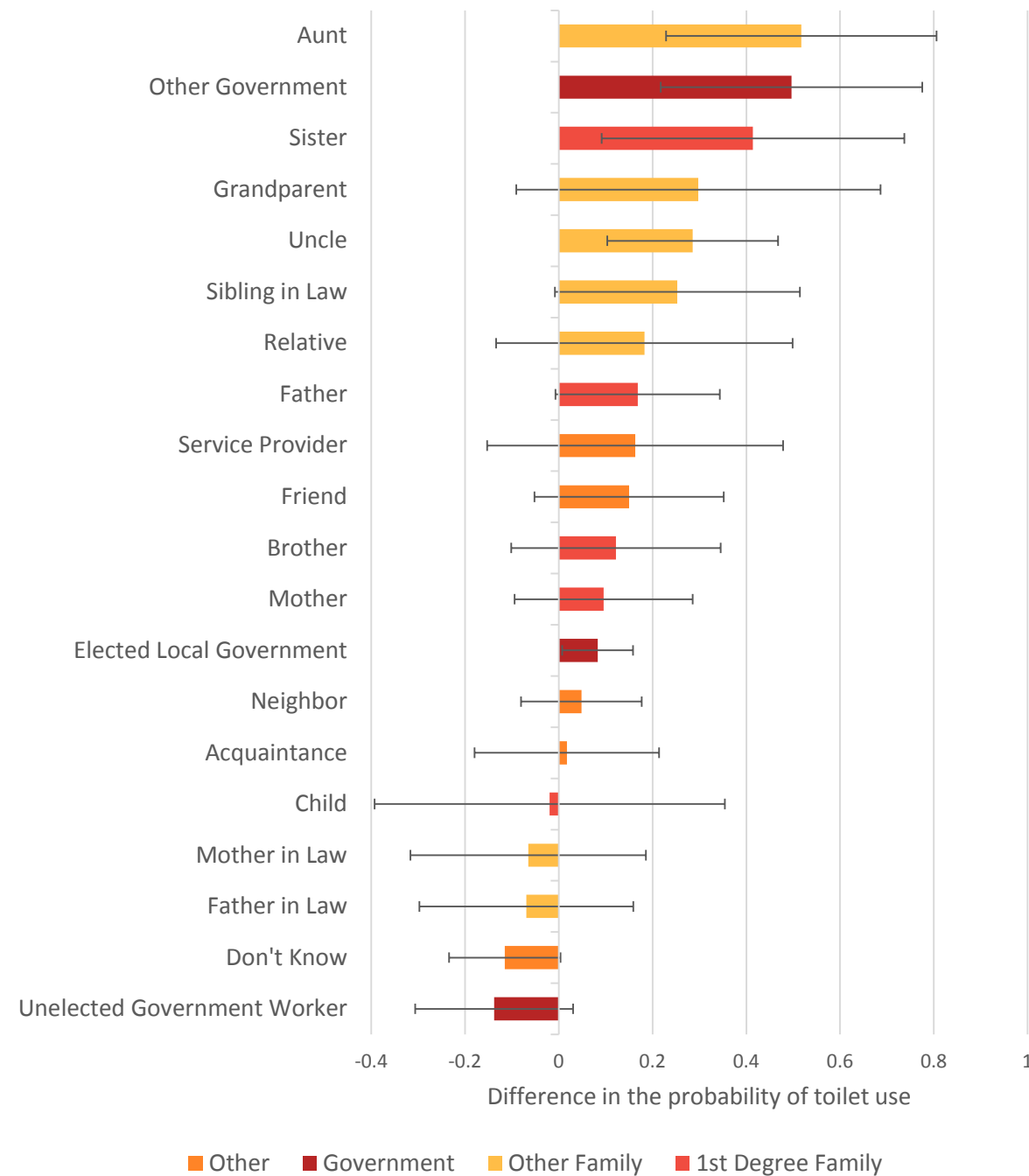
Larger differences in probabilities indicate that toilet use of that particular type of alter is predictive of (but does not necessarily influence) the respondent's toilet use. We excluded respondent-alter dyads who lived in the same household from our analysis, as we found their toilet use would be too confounded with mutual ownership to be meaningful.

In Figure 16, we can see that toilet use among close family members is particularly highly correlated with respondent's own use, even if they don't live with the respondent.¹ We observe the general trend that the behavior of close family members is more highly correlated with the behavior of respondents than more distant relatives, including in-laws. We also see that the use of friends is highly correlated with respondents' own use. However, the latrine use of neighbors is noticeably less correlated with respondents' behavior than friends and close family. A word of caution: we are discussing correlations in these data that may have different reasons and do not necessarily highlight a causal relationship. These exploratory findings are explored further in our follow-up research where we test for causality.

Past work has also suggested that we are also influenced by what we think other people believe we ought to do (Bicchieri, 2016). This has also been found cross-sectionally in the latrine use context, where people's beliefs about what others think one ought to do are correlated with their own latrine use (Odagiri et al., 2017; Haider et al., 2016). But again, not everyone is expected to have a similar level of social influence. To explore whose belief about what one ought to do influences behavior, we asked respondents, for each alter, "Does [NAME] think that it is wrong for people to defecate in the open?" We thus investigated the influence of alters' belief that it is wrong to defecate in the open on respondent's usage. We did this by measuring the difference in probability of toilet use between respondents with an alter who thought it was wrong to defecate in the open, versus respondents with an alter who did not think it was wrong to defecate in the open, for each type of alter. A large difference indicates that the class of alters' beliefs about whether it is wrong to openly defecate is correlated with the respondent's toilet use, consistent with the respondent being potentially influenced by the beliefs of that class of alter.

¹ As mentioned earlier, each category of alters listed in Figure 16 did not live in the same household as the respondent. For example, the "husbands" listed at the top of the graph would be living outside of the household (possibly because they were engaged in migrant work at the time).

Figure 17: Difference in the probability of toilet use between respondents with alters who thought OD was wrong, versus alters who did not believe OD was wrong, by alter type, Network Survey, 2017



Here we see smaller effects than in the previous analysis, indicating alters' toilet use is more highly correlated with respondent's toilet use than alters' belief about whether open defecation is wrong. This observation is consistent with previous experimental laboratory work, which has shown that what other people do has a larger effect on behavior than what other people think one ought to do (Bicchieri & Xiao 2009), as well as cross sectional work on latrine use, which has shown that others latrine use is more predictive than others beliefs about whether one ought to use a latrine (Haider et al., 2016). As these latter effects are both smaller and more noisy, we are more cautious in our conclusions. As stated before, these present data are only correlational, and causation should not be inferred unless, as we do in our second phase of this project, we effectively manipulate expectations to assess their causal effect. However, we do observe some relevant trends. Here we again see family as the most influential group. However, unlike in the previous analysis where close family showed to be a stronger influence, here we see a more general mix of familial relation types. No other broad categories stand out as particularly influential, including a lack of influence from the beliefs of friends and neighbors. Here again we see suggestive results that family members may be the most influential class of social network member, and they may therefore be particularly

important vectors for social intervention. One of the largest effects we observe in this analysis is for Other Government alters. The Other Government category was a catch-all, primarily constituted with former local government officials and the family members of government officials. It is possible that these members of the community are held in particularly high esteem, and therefore hold particularly influential opinions.

We also ran a similar analysis looking into the effect alter gender may have on the correlation between alter and respondent toilet use. We assessed the difference in probability of toilet use between respondents with an alter who used a toilet versus respondents with an alter who did not use a toilet, for male versus female alters.

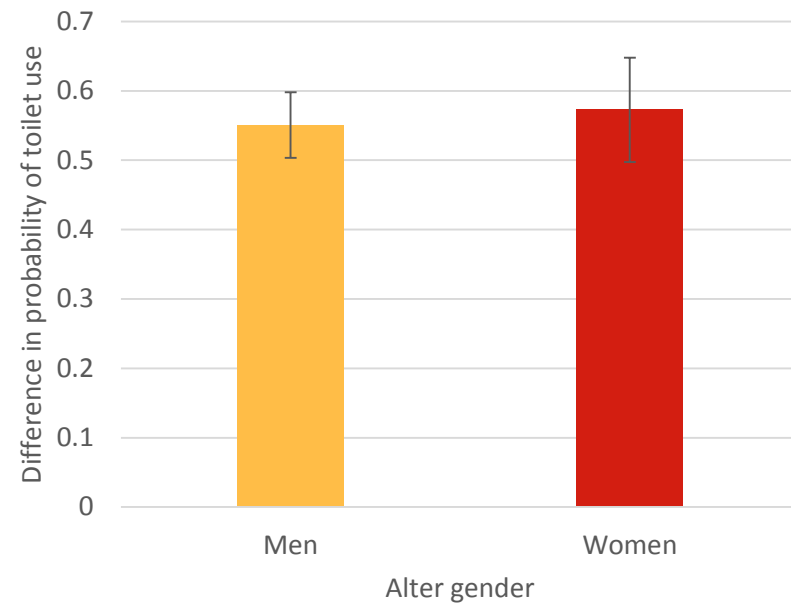
Here we observe no meaningful effect of alter gender on the correlation between alter toilet use and respondent toilet use. This suggests that neither sex's behavior is more influential than the other on their network's behavior

Toilet use among close family members is particularly highly correlated with respondent's own use, even if they don't live with the respondent

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Here we observe no meaningful effect of alter gender on the correlation between alter toilet use and respondent toilet use. This suggests that neither sex's behavior is more influential than the other on their network's behavior.

Figure 18: Difference in the probability of toilet use between respondents with alters who use a toilet versus those that do not, by alter gender, Network Survey, 2017



While the correspondence between alter and respondent use is high across ages, it is particularly pronounced between respondents and young alters. This is consistent with young people being particularly influential trendsetters in their networks, with others imitating their behavior.

Figure 19: The proportion of individuals who use a latrine by the age of alters and whether they use a latrine (red line) or do not (green line), Network Survey, 2017

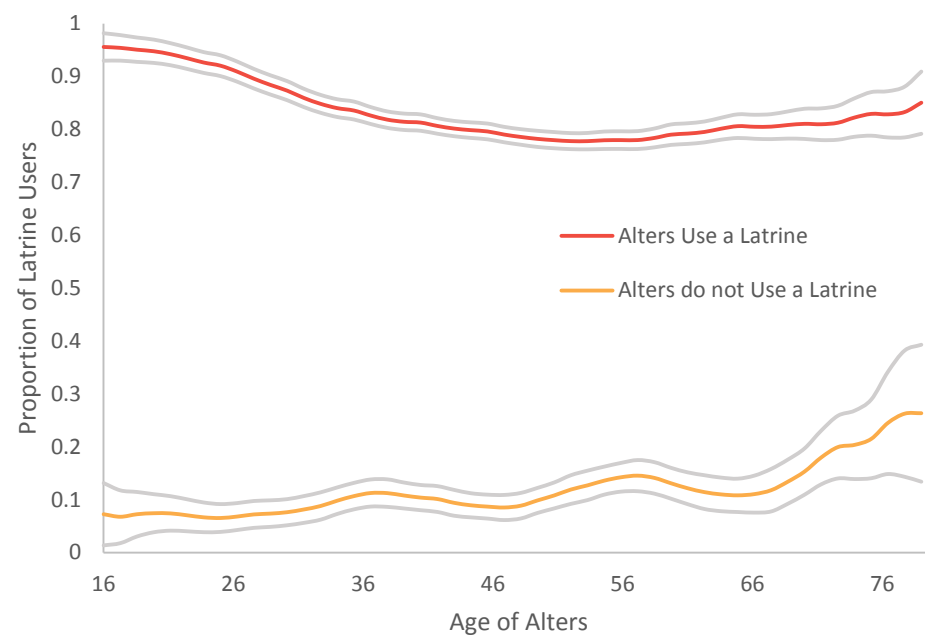
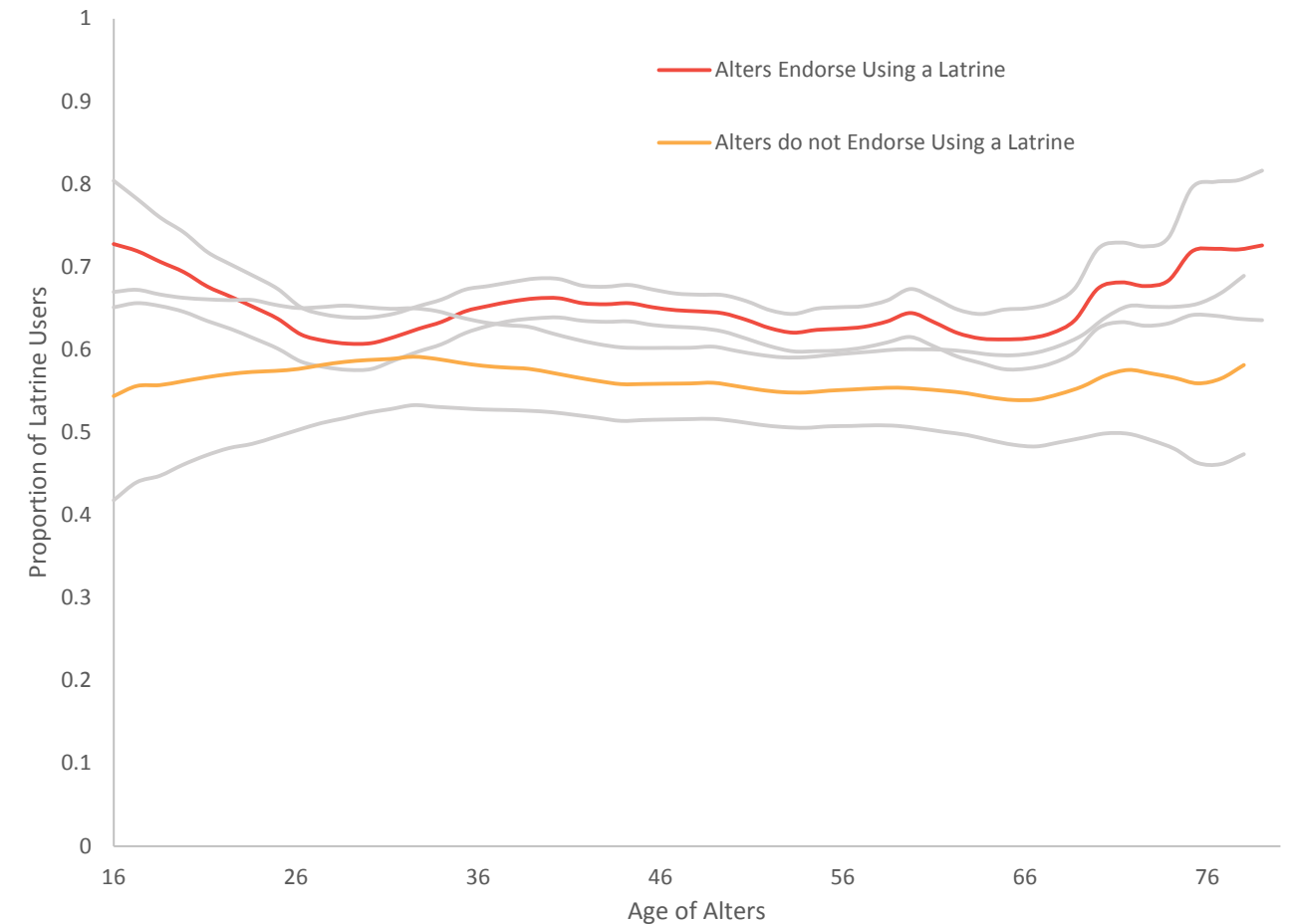


Figure 20: The proportion of individuals who use a latrine by the age of alters and whether they endorse using a latrine (red line) or do not (green line), Network Survey, 2017



We do not observe the same predictive pattern of respondents' latrine use in terms of alters' beliefs about whether open defecation is wrong. Alters' beliefs that open defecation is wrong by age (see Figure 20) do not substantially predict respondents' likelihood of using a toilet at any particular age of alter.

CONCLUSION

Overall, the first stage of the project provided us with information previously unavailable in the literature. Unlike in earlier pre-Swachh Bharat surveys, our sample shows high levels of latrine use among latrine owners. The high correspondence between ownership and use hints at the importance of interventions targeting the construction of latrines, including those focused on supply-side issues. We also do not observe any sex differences in latrine usage, which could be an indirect sign of the effectiveness of recent interventions. For example, the Swachh Bharat Abhiyan has incorporated more behavioral change initiatives into its approach, while previous national campaigns have taken a more exclusively supply-side driven approach. Additionally, there are many non-governmental initiatives being undertaken, but they are poorly documented. Though we conducted a systematic review of the literature to try and figure out which intervention designs work best, there may be some that are making an impact but are not well-tracked (Ashraf et al., 2018).

Unlike gender, economic status is highly correlated with latrine ownership and use. Richer and more educated families are more likely to have and use latrines. Additionally, individuals belonging to scheduled castes are less likely to own a latrine even after controlling for observed economic factors. These observations might be a result of exposure to different samples than previous research but can also signify a particular social position of dalits in the Indian society. Round 2 of the survey and further data analysis will shed additional light on this observation.

Combining findings about social networks and norms in Indian communities, we aim to design interventions to increase latrine usage that will be evaluated through a randomized controlled trial in Bihar and Tamil Nadu.

We further analyzed how the social network structure of the respondents is associated with latrine use. Individuals are marginally more likely to interact with government officials when asking for help in case of short-term distress. However, they show a greater respect for members of their own families and are more likely to rely on their help when constructing or repairing their latrines. Respondent behavior is also more strongly associated with the behavior of their close relatives and friends. The correlation with geographic neighbors' behavior was far smaller. We then compared the effects of alters' behavior with the effects of alters' endorsement of open defecation, and discovered that the latter have a much smaller association with respondent's behavior than the former.

As this initial network phase of the project is necessarily exploratory, none of these findings should be interpreted as explicit policy recommendations. Using these findings to develop the second wave of our project, we aim to transform these results into actionable programming advice. While many of the traditionally observed social correlates of latrine use were not observed in our survey, social structure was still an important predictor of behavior, and we believe examining the nature of social norms in Indian communities is an important step towards understanding the reasons behind the persistence of open defecation in India. Combining findings about social networks and norms in Indian communities, we aim to design interventions to increase latrine usage that will be evaluated through a randomized controlled trial in Bihar and Tamil Nadu.

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APPENDIX 1

RESPONSE TYPE	BROAD CATEGORY	FREQUENCY
Husband	Family	1122
Father	Family	851
Mother	Family	812
Brother	Family	476
Father in Law	Family	439
Wife	Family	373
Child	Family	360
Mother in Law	Family	337
Uncle	Family	295
Sibling in Law	Family	238
Relative	Family	187
Aunt	Family	165
Sister	Family	112
Grandparent	Family	96
Elected Local Government	Government	2312
Unelected Gov. Worker	Government	552
Other Government	Government	155
Acquaintance	Other	530
Don't know	Other	449
Friend	Other	400
Neighbor	Other	389
Service Provider	Other	139
Landlord	Other	81

APPENDIX 2

Logistic regressions of latrine ownership on caste membership

OR Estimates (SEs)	Bihar Unadjusted	Bihar, adjusted for wealth, education and household composition	Tamil Nadu Unadjusted	Tamil Nadu, adjusted for wealth, education, and household composition
<i>Ref. Hindu-Upper caste</i>				
Hindu-SC	0.041*** (0.02)	0.105*** (0.06)	0.298*** (0.07)	0.424*** (0.10)
Hindu-ST/OBC	0.157*** (0.05)	0.306** (0.13)	1.66 (0.48)	1.83 (0.56)
Muslim	0.060*** (0.03)	0.202** (0.12)	0.365* (0.15)	0.453** (0.13)
Others	0.050*** (0.02)	0.164*** (0.08)	1.39 (0.41)	1.43 (0.46)
<i>Ref. Cemented and not dilapidated</i>				
Cemented-dilapidated or semi-cemented-not dilapidated		0.501*** (0.07)		0.350*** (0.06)
Semicemented-dilapidated or not cemented		0.376*** (0.09)		0.126*** (0.04)
Has a motorcycle		1.26 (0.28)		1.13 (0.18)
Has a color TV		2.368*** (0.52)		
Has a fridge				2.072*** (0.32)
Uses internet		1.42 (0.26)		1.865*** (0.32)
Has a separate room that is used as a kitchen?		1.968** (0.42)		2.479*** (0.62)
Proportion of female members		1.04 (0.51)		0.85 (0.32)
Has an older member (above 65 years)		0.787* (0.09)		1.12 (0.17)

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OR Estimates (SEs)	Bihar Unadjusted	Bihar, adjusted for wealth, education and household composition	Tamil Nadu Unadjusted	Tamil Nadu, adjusted for wealth, education, and household composition
<i>Ref. No kids</i>				
One kid in the household		0.731* (0.13)		0.91 (0.14)
Two or more kids in the household		0.75 (0.13)		1.16 (0.33)
<i>Ref. no higher secondary or above</i>				
One higher secondary or above		2.386*** (0.39)		1.25 (0.18)
Two or more higher secondary or above		3.979*** (0.96)		1.566* (0.29)
PSU Type dummies	Yes	Yes	Yes	Yes
District dummies	Yes	Yes	Yes	Yes
N	1702.00	1701.00	1668.00	1668.00
Pseudo R ²	0.20	0.35	0.09	0.26

ACKNOWLEDGEMENTS.....

We wish to thank Bill and Melinda Gates foundation for their generous support (Grant No. OPP1157257). We received valuable feedback from the participants in the 2018 Milestone Workshop in Delhi, India. We also would like to acknowledge the assistance of Kantar Public and their surveyors in data collection. We benefited throughout the preparation process from the generous comments of Doug Paletta, and we thank Sez Giulian for her work in the design and typesetting of this report. Finally, we thank the participants themselves for their time.

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PHASE 1 PROJECT REPORT

Social Norms and Sanitation in India

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