

**Evaluating information and communication strategies to promote latrine use and improve child health: Design and baseline findings from a community randomised trial in Bhadrak, Orissa.**

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## ABSTRACT

**Objective:** To present the study design and baseline findings of a randomised controlled intervention to decrease child morbidity and mortality associated with diarrhoea by increasing the demand for and use of individual household latrines in the state of Orissa, India.

**Design:** Cluster-randomised controlled trial with repeated measures on households. The sample included 40 representative villages from a sampling frame of 1112 villages in the district of Bhadrak. Under random assignment, 20 villages received an information, education, and communication (IEC) campaign and the remaining villages served as controls. Data collection from approximately 25 households per village was secured through the use of local enumerators trained by our research staff. Across the 40 villages, 1086 households (treatment = 534, control = 552) were surveyed; the same set of households will be surveyed post-intervention.

**Setting:** Chandbali and Tihidi blocks, Bhadrak district, Orissa India, 2005.

**Participants:** Respondents who self-identified as the primary care giver of a child below the age of 5 years provided data for the household survey. Key informants (*i.e.*, village elders, teachers) provided information on village infrastructure and characteristics.

**Results:** Baseline findings suggest that randomisation successfully distributed potential confounders across experimental conditions; some differences across condition are identified and these will be controlled for analytically in the impact analyses.

**Conclusions:** The Orissa evaluation will provide important information on the effectiveness of IEC campaign efforts to alter the demand and promote household and community sanitation and hygiene practices.

Inadequate water and sanitation infrastructure coupled with unsafe hygiene behaviours are collectively responsible for high diarrhoea incidence, especially in children.[1-3] The most recent data available suggest that Orissa has one of the highest infant mortality rates (IMR) as well as diarrhoea prevalence among major Indian states with an IMR of 81 per 1000, under-five mortality of 104 per 1000, and diarrhoea prevalence of 28 % for children under-3 years.[4]

A growing body of evidence suggests that programs that offer safe, potable drinking water, increase safe water handling and personal hygiene behaviours, and improve sanitation practices can reduce diarrhoea morbidity and improve the health and well-being of people living in developing countries. For example, Luby *et al.*[5] show that efforts to raise awareness of the association between hand and water contamination and poor health outcomes result in significantly less diarrhoea (50% – 65%) compared to persons living in control neighbourhoods.[5] Similar findings have been reported from programs in peri-urban[6] and rural[7] settings. A recent meta-analysis by Fewtrell *et al.*[8] found that five types of interventions (hygiene education, water supply improvements, water quality improvements, sanitation, and multiple interventions) reduce the prevalence of diarrhoea in children under six, with relative risk estimates ranging from 0.63 to 0.75.[8] Their review indicates that a broad range of water and sanitation interventions can reduce the prevalence and associated morbidity of diarrhoea in children. Fewtrell and colleagues concluded that there is still need for additional studies on the impact of increased sanitation interventions.[8]

### **A Shift from Supply-Driven to Demand-Driven Development**

Despite decades of donor and government financed infrastructure to improve water and sanitation conditions, many rural households in developing countries lack adequate coverage. Some have concluded that ownership and investment (*i.e.*, demand) by the local population is needed if a program is to be sustainable. This sustainability factor has long been overlooked in development because supply-driven interventions have tended to measure success in terms of program outputs (*e.g.*, latrines built), rather than in terms of project impact (*e.g.*, reduction in open defecation).[9]

Accordingly, reform efforts in water and sanitation policy have attempted to remedy coverage and sustainability problems by promoting bottom-up, demand-driven programs. Unlike the previous generation of development projects, demand-driven efforts are based on the assumption that the keys to increasing program coverage include effective behaviour change strategies to increase program adoption and community empowerment efforts to increase sustainability. These campaigns have been effectively employed in developing countries[10-12] and offer economic advantage in increasing coverage of government sponsored public health initiatives to economically and geographically marginalised sectors of the population.[13] Kar[9], for example, describes a community-led total sanitation effort in Bangladesh that employed children as change agents and used recognised diffusions principles[14-16] to increase coverage and acceptance of key program goals. Quick[10] reports on water treatment efforts in three African nations; these efforts included individual behaviour change and community mobilisation and resulted in meaningful improvements in safe water handling practices.

Demand-driven programs recognise that health behaviours are driven by value expectancy.[17] They include components designed to influence household demand by altering the structure of costs and benefits from the perspective of the end user. If local stakeholders and community members do not recognise the benefits of improving basic water safety and hygiene, if they do not perceive themselves as capable of executing the intended behaviour, or if they view costs and barriers as too high, they will be less likely to embrace program activities. Accordingly, these efforts use focus group interviews to help ensure that program objectives are perceived as desirable and are sensitive to local customs, mores, and traditions; they use baseline data collection to identify gaps in knowledge, attitudes, and practices that present opportunities for change; monitoring and evaluation efforts provide feedback to local stakeholders, giving them buy-in and responsibility for the achievement of development goals.

### **The Government of India's Total Sanitation Campaign**

The Government of India developed the Total Sanitation Campaign (TSC) in response to studies indicating that obtaining a private latrine was associated with an individual's attitudes regarding the value of ownership.[18] The TSC was developed to be a demand-responsive, 'community led' and

‘people centred’ reform program that would be implemented by state governments such as the Government of Orissa (GoO). This approach has an empowerment focus that acknowledges the importance of individuals and communities in selecting and achieving goals. The strategy addresses all sections of the rural population, includes a wide range of community partners, and provides economic incentives to meet program and community needs. Current program efforts emphasise the development of information, education, and communication (IEC) activities to impact attitudes and knowledge relating sanitation, safe water, and hygiene to health. According to the logic of the program, increasing awareness of the connection among these health-related factors will lead to increased demand for sanitary facilities.

GoO has a particular interest in the potential for TSC efforts to encourage the uptake of individual household latrines (IHL) and to reduce open defecation practices.[19, 20] It is believed that the success of the TSC and the increase in IHL coverage will lead to substantial reductions in the infant mortality rate related to diarrhoea. To help it plan, the government piloted an IEC campaign in the 20 rural villages in the district of Bhadrak that was derived from the Bangladeshi model for social mobilisation (described in Kar[9]). Trained facilitators and local community-based organisations engaged the village population in an intensive and focused program of participatory activities, which included at its core faecal count (*i.e.*, calculating the volume of faecal material accumulated in a village), defecation mapping (*i.e.*, understanding the spatial distribution of faeces), and a ‘walk of shame’ (*i.e.*, a community walk to identify current conditions). These strategies are designed to heighten community knowledge and attitudes towards the state of community hygiene and sanitation; addition elements currently being developed will provide the mechanisms for improving community conditions, health, and ultimately the quality of life. The intensive IEC was followed by regular mobilisation visits; periodic monitoring; and ramping up the supply of toilet construction materials, expertise and masonry.

### **Goals of the Current Study**

This paper describes the evaluation design and baseline findings of this randomised intervention to assess the impact of the GoO’s pilot IEC campaign under the TSC program. Results will be presented that support randomisation procedures and describe current behaviours and attitudes related to water

safety and sanitation practices. The design for this campaign will overcome a number of limitations from previous studies by using a cluster-randomised design with pre- and post-intervention assessment surveys to measure the impacts of behavioural and primary health outcomes.

## **METHODS**

### **Overview of the Study Design**

We applied a cluster-randomised design to assess the impact of the IEC on IHL coverage in the state of Orissa. In this experimental framework, villages rather than individuals are randomly assigned to treatment and control conditions, while the individuals within the villages remain the primary unit of observation. This is considered to be the best experimental design available whenever the evaluator wants to assess a program that operates at the group level, manipulates the social or physical environment, or cannot be delivered to individuals.[21, 22] As we are interested in whether IEC impacts individual behaviour, the primary analyses for this study will evaluate a repeated-measures cohort model using a difference-in-difference estimator. Our evaluation will measure two primary outcomes: (a) uptake of IHL in response to the IEC intervention; and (b) change in reported rate of diarrhoea. The study protocol was approved by several authorities including the Institutional Review Board at RTI International, an external technical oversight group comprised of leading public health agencies (*e.g.*, U.S. Centers for Disease Control and Prevention, the World Bank, UNICEF, Indian Council of Medical Research) and a local steering committee from the Office of the Secretary of Rural Development in Orissa. Throughout the design stage of this study, the evaluation team worked closely with GoO as well as the IEC campaign implementation team to ensure consistency and coherence across all aspects of the study, including integrity of the design and measurement.

### **Sample Selection**

Within the state of Orissa, the district of Bhadrak served as our study area for three reasons: (1) Bhadrak still has a sufficiently large number of blocks and villages without TSC interventions; (2) the use and maintenance of latrines in the area remains unsatisfactory despite adequate water availability; and (3)

the GoO indicated that no special water, sanitation or hygiene programs would be implemented in ‘control’ villages during the study period.

Within Bhadrak, we established a sampling frame of 1112 villages, excluding those with less than 70 or more than 500 households to ensure that included villages would be similarly rural and would provide enough households with at least one child under the age of five. We also considered measures to reduce the potential of spillover effects. For example, we grouped the villages by panchayat<sup>2</sup> and selected one village per panchayat. Next, we spatially mapped all villages in the sampling frame and removed from the selection process contiguous villages. Finally, we selected villages that were accessible via roadways and avoided areas where political issues could affect survey implementation.

### **Sample Size Estimation**

Sample size calculations indicated that 40 villages with 25 eligible households per village would provide sufficient statistical power (*i.e.*, 80% or greater) to identify meaningful differences between treatment and control villages on the primary outcome, prevalence of diarrhoea among children younger than five years. We assumed a base rate of 25% and an anticipated program effect of 0.30. Moderate attrition was considered and a design effect (DEFF) of 2.0 was introduced to account for variance inflation.

### **Data Collection**

*Instrument Design.* We developed the household survey instrument in three stages. First, we developed a preliminary household survey instrument based on existing survey instruments[4, 23-26], literature reviews of various WSH studies, and inputs from local advisors. Second, we finalised the household and community questionnaires through focus group discussions with selected individuals, key informants, and households. Third, we pre-tested the household, questionnaire in the field to identify any problems with the content, length, and flow of the instrument. We developed the community questionnaire based on the household questionnaire and information gathered during previous field trips.

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<sup>2</sup> Panchayats are groups of about 3-6 villages that are linked administratively and interact frequently.

Village-level information is collected on WSH related projects, other community-based projects, land use, socioeconomics, and village institutions in the community questionnaire.

For the purposes of interpretation, knowledge scales have been created to assess respondents' understanding of the causes, symptoms, and danger signs of diarrhoea. For dangers signs of diarrhoea, an open ended question asked respondents to report all know indicators; respondents provided between zero and three danger signs. A similar approach was employed to assess knowledge of symptoms of diarrhoea (range = 0 – 6). For causes of diarrhoea, respondents were queried (agree or disagree) on a set of 12 potential causes. Of the 12 items, eight items represents valid causes of diarrhoea and the remaining four items were distracters. The scale score for causes of diarrhoea was calculated by summing the number of valid causes correctly identified and subtracting one point per distracter item endorsed (range = 0 – 8).

*Survey Implementation.* We worked with an international survey organisation, with substantial local experience and presence, to recruit and train approximately 30 local enumerators, supervisors, and water quality personnel, all of them with at least a bachelor's degree and fluent in the local language. The survey was implemented by three teams of six members; each team consisted of 5 enumerators and a supervisor. One field executive supervised all three teams. A listing and mapping team identified all the eligible households (< 5 year old children) within the 40 villages prior to the survey. From each village, enumerators randomly selected 28 households from the sampling frame generated by the mapping and listing process. At each household, enumerators were instructed to interview the primary care giver for children under 5 years whenever possible. This was done to ensure the most accurate information on child health and child sanitation and hygiene practices. Survey teams sent completed questionnaires to trained editors who scrutinised questionnaires prior to data entry. Validity and accuracy were maintained through spot checks, range checks, consistency checks, and skip pattern checks.

## **RESULTS**

### **Household Survey**

A total of 1086 households were surveyed, 534 from the treatment villages and 552 from the control villages. As Table 1 indicates, treatment and control conditions are similar in terms of most

demographic characteristics. Following our intention to interview the primary care-givers of young children, the majority of respondents were female (94%). The religious affiliation of the majority of households was Hindu (97%) and slightly more than half of the respondents report that they live below the poverty line (58%). Household rates of diarrhoea in the past two weeks were similar in treatment and control villages for both children and adults. More households in the control condition than in the treatment condition reported currently having a latrine, and this difference was statistically significant ( $p = 0.03$ ).

#### TABLE 1 ABOUT HERE

Table 2 provides attitude and knowledge variables for villages in the treatment and control condition. Survey items assessed perceptions of cleanliness and safety, attitudes about future improvements, interest in building private latrines, as well as knowledge relating to diarrhoea. No significant differences between households in treatment and control villages are evident. Across treatment and control villages an average of 40% of respondents endorsed a statement indicating the village was ‘very dirty.’ Similar levels of satisfaction with the current sanitation situation were reported in both treatment and control villages, with 67% of respondents ‘completely dissatisfied’ with current practices. Knowledge related items assessing key symptoms of diarrhoea, treatment of diarrhoea, and causes of diarrhoea reveal no systematic differences between households in the two intervention conditions.

#### TABLE 2 ABOUT HERE

Table 3 compares base rates of key hygiene practices and community involvement across study conditions. Significant differences between treatment and control villages are evident for defecation practices. As Table 3 indicates, households in control villages report less open defecation and a greater proportion of IHL usage than households in treatment villages. Water safety, garbage disposal, waste water disposal, and handwashing practices of both children and adults are similar in treatment and control village. Community participation rates are similar across experimental conditions, with slightly more than

one-third of household (36%) participating in a Gram Sabha (village council) meeting. Community participation measures reflect that involvement in public sanitation efforts (*e.g.*, helped sweep streets) are generally low and similar in treatment and control villages.

TABLE 3 ABOUT HERE

### **Community Survey**

In each village, we identified a key informant (*e.g.*, village elders, local government officials, school principals and teachers, or health workers) who would be knowledgeable about the conditions of interest and unbiased in their responses. Overall, 88% of the respondents were male and had a mean age of 45 years. Villages averaged 915 people living in 189 households. Other community level indicators indicate similarity between treatment and control villages with regard to number of under 5 children, average house and farmland values, water consumption, water quality problems, awareness of TSC, assistance under public schemes or programs, and village services.

TABLE 4 ABOUT HERE

## **DISCUSSION**

This Orissa intervention is designed to provide a rigorous answer regarding the effectiveness of a demand-driven sanitation and water sector reform effort. The framework of the design includes cluster randomisation and overcomes a number of limitations identified by Fewtrell<sup>18</sup> as well as our own review of the extant literature. These limitations include: (a) accounting for baseline diarrhoea rates and pre-intervention behaviours, (b) the inclusion of control groups, (c) explicit examination and control for confounders, and (d) detailed reporting and presentation of results.

The results of the baseline survey suggest that on the whole, randomisation was successful in distributing many of the potential confounding factors that may influence the impact analysis. Respondent are similar across treatment and control villages in terms of household demographics, as well as knowledge, attitudes, and practices related to hygiene and sanitation. Our findings also reveal two

important differences across conditions: in control villages we see greater current availability and use of IHLs and less open defecation. This difference in one of the primary outcome variables supports the use of a repeated measures methodology with a difference-in-difference estimator of program effects.[27]

The results of the baseline survey also identify current attitudes and practices regarding hygiene and sanitation. For example, costs of IHL seem to be the major constraint to uptake of this intervention. Most households that defecate openly report they have no other defecation option and that the biggest constraint to using an IHL is expense. Additionally, when households that say they want to build an IHL are asked why they have not done so, most say cost. However, it may be the case that households are overestimating the true monetary costs of IHLs. Our data indicate that households with an IHL overestimate the true costs by as much as Rs. 4000. And yet, even with accurate information many people still would be unlikely to build a private latrine without financial assistance as they believe the government has a responsibility to provide sanitation facilities to households, or at least help subsidise the costs of these facilities.

While cost appears to be a major factor, discussions with key informants also suggests that cheap private latrines can be more of a burden to a household, and can have greater negative health consequences, than alternative practices. Although most households that report owning a latrine have built a permanent structure, ventilation within an IHL is rare. We have not yet analysed this correlation in the study area. Given the prevalence of poor quality toilets and the fact that usage rates by men and children are low, it is possible that households have a negative perception of IHL because of the proliferation of poor quality toilets in their villages. This type of negative perception can decrease demand within the population and usage rates if poor quality latrines are built. Thus, IEC activities aimed at correcting negative perceptions and endorsing the individual-level and community-level benefits of IHLs should be considered a priority.

Another important target for IEC activity will be to alter individuals' perception of the need for community improvements in sanitation and hygiene. Currently, the need for this change in the community is endorsed by a very small percentage of the population (7%), despite the fact that the majority of

households are dissatisfied with their current sanitation situation and would like to make changes. For most households, the ‘current situation’ means open defecation (91%). Many of these households say they want to build an IHL (88%). However, attitudes and beliefs about IHL do not always match up with this stated demand and actions, indicating that without further motivation (*i.e.*, the IEC campaign) or incentives, IHL uptake will not be this high. Given the magnitude of the impact of poor water and sanitation, this finding may reflect a poor understanding of the relationship between water and sanitation, on the one hand, and the health and welfare of the population on the other. IEC efforts emphasising this association may be a key factor in increasing interest and community participation in village reform and sanitation efforts.

The results of the baseline survey provide a window into the current attitudes and practices that will influence the success of the demand-driven IEC intervention. This information is currently being fed back to program developers to tailor program activities to the needs and concerns of the program participants. Conforming IEC activities to the information afforded by the baseline survey endorses the demand-driven and participatory orientation of the program and acknowledges validity of the attitudes and practices of the end-users over and above the beliefs of policy-makers. In so doing, it increases likelihood of program uptake and long-term sustainability of project goals.

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**Table 1. Demographic Characteristics of Respondents and Households in Treatment and Control Villages**

| Variable                       | Overall (mean)<br>N=1086 | Treatment Village<br>N=534 | Control Village<br>N=552 | p-value* |
|--------------------------------|--------------------------|----------------------------|--------------------------|----------|
| Respondent information         |                          |                            |                          |          |
| Female                         | 93.55%                   | 93.26%                     | 93.84%                   | 0.870    |
| Age                            | 29.39                    | 29.25                      | 29.52                    | 0.661    |
| Household information          |                          |                            |                          |          |
| Religion                       |                          |                            |                          |          |
| Hindu                          | 96.87%                   | 96.25%                     | 97.46%                   | 0.616    |
| Muslim                         | 2.30%                    | 3.56%                      | 1.09%                    | 0.372    |
| No Religion                    | 0.55%                    | 0.19%                      | 0.91%                    | 0.166    |
| Government assigned caste      |                          |                            |                          |          |
| Open / general                 | 39.96%                   | 35.77%                     | 44.02%                   | 0.293    |
| Scheduled Castes (SC)          | 26.98%                   | 27.72%                     | 26.27%                   | 0.796    |
| Other Backward Classes (OBC)   | 26.43%                   | 29.03%                     | 23.91%                   | 0.387    |
| Scheduled Tribes (ST)          | 1.10%                    | 1.50%                      | 0.72%                    | 0.243    |
| Below poverty line             | 58.20%                   | 56.18%                     | 60.14%                   | 0.462    |
| Currently have IHL             | 9.39%                    | 5.99%                      | 12.68%                   | 0.030    |
| Diarrhoea rate in past 2 weeks |                          |                            |                          |          |
| Adults                         | 10.99%                   | 10.75%                     | 11.23%                   | 0.710    |
| Children under 5               | 30.81%                   | 32.40%                     | 29.24%                   | 0.401    |

\*Statistical tests assessed the difference between treatment conditions, measured among households nested within villages

**Table 2. Knowledge and Attitudes Regarding Health and Hygiene**

| Variable   | Overall<br>(mean)<br>N=1086 | Treatment<br>Village<br>N=534 | Control<br>Village<br>N=552 | p-value* |
|--|-----------------------------|-------------------------------|-----------------------------|----------|
| <b>Village cleanliness</b>                                   |                             |                               |                             |          |
| Village is very clean  | 2.30%                       | 1.87%                         | 2.72%                       | 0.554    |
| Village is clean   | 6.63%                       | 5.62%                         | 7.61%                       | 0.365    |
| Village is somewhat dirty/clean                              | 35.27%                      | 32.58%                        | 37.86%                      | 0.336    |
| Village is dirty   | 15.47%                      | 15.36%                        | 15.58%                      | 0.950    |
| Village is very dirty  | 39.87%                      | 44.01%                        | 35.87%                      | 0.129    |
| <b>Satisfaction with sanitation</b>                          |                             |                               |                             |          |
| Completely dissatisfied                                      | 66.57%                      | 72.28%                        | 61.05%                      | 0.011    |
| Somewhat dissatisfied  | 15.93%                      | 15.17%                        | 16.67%                      | 0.555    |
| Satisfied  | 17.22%                      | 12.17%                        | 22.10%                      | 0.01     |
| <b>Most important community improvement in next 10 years</b> |                             |                               |                             |          |
| New roads  | 58.66%                      | 62.92%                        | 54.53%                      | 0.282    |
| Household water supply                                       | 9.48%                       | 6.93%                         | 11.96%                      | 0.149    |
| Sanitation & hygiene improvements                            | 6.72%                       | 5.43%                         | 7.97%                       | 0.264    |
| Women do not have privacy during defecation                  | 32.14%                      | 33.52%                        | 30.80%                      | 0.805    |
| <b>Women are not safe during defecation</b>                  |                             |                               |                             |          |
| During the day   | 34.25%                      | 33.71%                        | 34.78%                      | 0.364    |
| At night   | 30.02%                      | 29.96%                        | 30.07%                      | 0.522    |
| <b>Diarrhoea knowledge**</b>                                 |                             |                               |                             |          |
| Symptoms of diarrhoea (range 0 - 6)                          | 2.19                        | 2.18                          | 2.21                        | 0.546    |
| Causes of diarrhoea (range 0 - 8)                            | 6.26                        | 6.28                          | 6.24                        | 0.729    |
| Danger signs of diarrhoea (range 0 - 3)                      | 0.42                        | 0.40                          | 0.44                        | 0.366    |
| <b>Treatment of diarrhoea</b>                                |                             |                               |                             |          |
| Give oral rehydration salts/solution (ORS)                   | 89.69%                      | 90.07%                        | 89.31%                      | 0.602    |
| Breast-fed during diarrhoea                                  | 58.47%                      | 58.05%                        | 58.88%                      | 0.782    |
| <b>Building a private latrine</b>                            |                             |                               |                             |          |
| % who would like to  | 77.99%                      | 82.58%                        | 73.55%                      | 0.183    |
| % who say it is cost prohibitive                             | 66.76%                      | 69.10%                        | 64.49%                      | 0.934    |
| <b>Responsible for improving sanitation</b>                  |                             |                               |                             |          |
| Family   | 59.48%                      | 57.87%                        | 61.05%                      | 0.568    |
| Government   | 32.60%                      | 32.21%                        | 32.97%                      | 0.894    |
| <b>Who should bear burden of cost</b>                        |                             |                               |                             |          |
| Family   | 28.45%                      | 24.72%                        | 32.07%                      | 0.124    |
| Government   | 52.49%                      | 53.37%                        | 51.63%                      | 0.706    |
| % households willing to cost share                           | 47.51%                      | 44.94%                        | 50.00%                      | 0.341    |

\*Statistical tests assessed the difference between treatment conditions, measured among households nested within villages.

\*\*Diarrhoea knowledge scales were constructed by asking respondents to agree or disagree with items related to each domain.

**Table 3. Key household variables in treatment and control villages**

| Variable                           | Overall (mean)<br>N=1086 | Treatment<br>Village N=534 | Control Village<br>N=552 | p-value* |
|------------------------------------|--------------------------|----------------------------|--------------------------|----------|
| <b>Waste Safety Practices</b>      |                          |                            |                          |          |
| Use pots to store water            | 53.13%                   | 56.18%                     | 50.18%                   | 0.414    |
| Use buckets/vessels to store water | 71.64%                   | 68.91%                     | 74.28%                   | 0.435    |
| Boil or treat drinking water       | 11.23%                   | 9.36%                      | 13.04%                   | 0.192    |
| <b>Defecation Practices</b>        |                          |                            |                          |          |
| % who defecate in open             | 91.16%                   | 94.76%                     | 87.68%                   | 0.011    |
| % who use an IHL                   | 9.39%                    | 5.99%                      | 12.68%                   | 0.030    |
| <b>Garbage disposal</b>            |                          |                            |                          |          |
| Dump garbage outside of house      | 68.32%                   | 67.60%                     | 69.02%                   | 0.794    |
| Uses compost in field or yard      | 25.05%                   | 27.72%                     | 22.46%                   | 0.199    |
| <b>Wastewater disposal</b>         |                          |                            |                          |          |
| Throws in backyard                 | 47.05%                   | 46.07%                     | 48.01%                   | 0.705    |
| Flows outside the house            | 23.39%                   | 24.16%                     | 22.64%                   | 0.660    |
| <b>Adult handwashing practices</b> |                          |                            |                          |          |
| Report of 5 critical times**       | 2.92                     | 2.98                       | 2.86                     | 0.578    |
| <b>Child handwashing practices</b> |                          |                            |                          |          |
| Reported of 2 critical times**     | 1.43                     | 1.42                       | 1.43                     | 0.709    |
| <b>Community Participation</b>     |                          |                            |                          |          |
| Attended a Gram Sabha meeting      | 36.19%                   | 34.46%                     | 37.86%                   | 0.540    |
| Helped sweep streets               | 7.92%                    | 8.99%                      | 6.88%                    | 0.395    |
| Helped clean water sources         | 8.66%                    | 9.93%                      | 7.43%                    | 0.474    |
| Helped clean drains                | 7.73%                    | 8.80%                      | 6.70%                    | 0.351    |

\*Statistical tests assessed the difference between treatment conditions, measured among households nested within villages

\*\*Respondents indicated whether they typically wash hands prior to, or following, certain events (*i.e.*, after defecating, before preparing food)

**Table 4. Key community-level variables in treatment and control villages**

| Variable  | Overall<br>(mean)<br>N=40 | Treatment<br>Village<br>N=20 | Control<br>Village<br>N=20 | p-value |
|---|---------------------------|------------------------------|----------------------------|---------|
| Mean # households per village   | 189                       | 166                          | 211                        | 0.119   |
| Number of children under 5 in the sample  | 38                        | 39                           | 38                         | 0.607   |
| Percent of households below the poverty line  | 57.52%                    | 59.17%                       | 56.07%                     | 0.793   |
| Average daily wage rates  |                           |                              |                            |         |
| During dry season (Rs.)   | 42                        | 43                           | 41                         | 0.547   |
| During rainy season (Rs.)   | 46                        | 48                           | 45                         | 0.544   |
| Value of arable/farm land (Rs.)   | 43,248                    | 50,622                       | 35,875                     | 0.335   |
| Average house value (Rs.)   | 31,740                    | 29,880                       | 33,600                     | 0.599   |
| Water consumption (liters per capita per day [lpcd])                                  |                           |                              |                            |         |
| 1-10 lpcd   | 10.00%                    | 5.00%                        | 15.00%                     | 0.297   |
| 11-20 lpcd  | 15.00%                    | 10.00%                       | 20.00%                     | 0.377   |
| 21-30 lpcd  | 5.00%                     | 5.00%                        | 5.00%                      | 1.000   |
| 31-40 lpcd  | 2.50%                     | 5.00%                        | 0.00%                      | 0.317*  |
| Over 40 lpcd  | 67.50%                    | 75.00%                       | 60.00%                     | 0.312   |
| Water quality problems  |                           |                              |                            |         |
| Nitrate   | 2.63%                     | 5.26%                        | 0.00%                      | 0.317*  |
| Salinity  | 58.97%                    | 57.89%                       | 60.00%                     | 0.894   |
| Iron  | 47.37%                    | 38.89%                       | 55.00%                     | 0.321   |
| Bacteriological contamination   | 5.26%                     | 5.26%                        | 5.26%                      | 1.000   |
| Other harmful minerals (naturally present)  | 2.70%                     | 5.56%                        | 0.00%                      | 0.304*  |
| Community has levied charges for water use  | 2.70%                     | 5.56%                        | 0.00%                      | 0.304*  |
| Have a village water and sanitation committee (VWSC) / paithana committee             | 5.00%                     | 10.00%                       | 0.00%                      | 0.152*  |
| Aware of TSC  | 12.50%                    | 10.00%                       | 15.00%                     | 0.676   |
| Whether households in the village that receive assistance from the following programs |                           |                              |                            |         |
| Integrated Rural Development (IRDP)   | 27.50%                    | 25.00%                       | 30.00%                     | 0.723   |
| National Rural Employment Program (NREP)  | 5.00%                     | 5.00%                        | 5.00%                      | 1.000   |
| Training Rural Youth for Self Employment (TRYSEM)                                     | 7.50%                     | 5.00%                        | 10.00%                     | 0.550   |
| Employment Guarantee Scheme (EGS)   | 15.00%                    | 20.00%                       | 10.00%                     | 0.377   |
| Development of Women and Children of Rural Areas (DWACRA)                             | 7.50%                     | 5.00%                        | 10.00%                     | 0.550   |
| Indira Awas Yojana (IAY)  | 70.00%                    | 60.00%                       | 80.00%                     | 0.168   |
| Sanjay Gandhi Niradhar Yojana (SGNY)  | 2.50%                     | 5.00%                        | 0.00%                      | 0.317*  |
| Housing under other government scheme   | 30.00%                    | 20.00%                       | 40.00%                     | 0.168   |
| Ganga Kalyana-Irrigation Borewell Scheme  | 5.00%                     | 0.00%                        | 10.00%                     | 0.152*  |
| Sector reform programme (water supply)/Swajaldhara                                    | 5.00%                     | 0.00%                        | 10.00%                     | 0.152*  |
| Mills/small scale industries (M/SSI)  | 2.50%                     | 0.00%                        | 5.00%                      | 0.317*  |
| Credit cooperative society (CCS)  | 40.00%                    | 40.00%                       | 40.00%                     | 1.000   |
| Agricultural cooperative society (ACS)  | 45.00%                    | 40.00%                       | 50.00%                     | 0.525   |
| Fishermen's cooperative society (FCS)   | 12.50%                    | 5.00%                        | 20.00%                     | 0.159   |
| Milk cooperative society (MCS)  | 7.50%                     | 5.00%                        | 10.00%                     | 0.550   |
| Literacy program  | 27.50%                    | 30.00%                       | 25.00%                     | 0.723   |

| Variable                | Overall<br>(mean)<br>N=40 | Treatment<br>Village<br>N=20 | Control<br>Village<br>N=20 | p-value |
|-------------------------|---------------------------|------------------------------|----------------------------|---------|
| Health program          | 7.50%                     | 10.00%                       | 5.00%                      | 0.550   |
| Family planning program | 60.00%                    | 60.00%                       | 60.00%                     | 1.000   |
| Village Services        |                           |                              |                            |         |
| No drainage facilities  | 92.50%                    | 90.00%                       | 95.00%                     | 0.550   |
| Electricity             | 57.50%                    | 60.00%                       | 55.00%                     | 0.749   |
| Receive NGO assistance  | 2.50%                     | 5.00%                        | 0.00%                      | 0.317*  |
| Have a health centre    | 5.00%                     | 5.00%                        | 5.00%                      | 1.000   |

\*Results based on the Wilcoxon rank-sum test, which is also known as the Mann-Whitney two-sample statistic.