Baseline report TW14/1010

Promoting latrine use in rural India using the Risks, Attitudes, Norms, Abilities and Self-regulation (RANAS) approach to systematic behaviour change

Prepared by: Max Friedrich (Eawag), Arundati Muralidharan (WaterAid India), Tejaswi Balasundaram (WaterAid India), Hans-Joachim Mosler (Eawag)

Submission date: 2nd August 2018

Outline of the main report

List of tables

Acknowledgements

We would like to thank 3ie for funding, technical review and support throughout the study. We wold like to thank all participants of the study.

Executive Summary

The Swachh Bharat Mission (SBM) has given impetus to sanitation in the country more than ever before, with the explicit agenda to make India open defecation (OD) free by 2nd of October 2019. While the Mission has been very successful in boosting latrine coverage, actual latrine use (LU) remains low in many areas of the country. The aim of this study was to develop and rigorously evaluate low-cost and scalable behaviour change interventions to promote latrine use in rural India. “What works and why?” best summarizes the evaluation questions of this impact assessment.

This cases study was conducted among 2328 households in Raichur district, Karnataka. We used the risks, attitudes, norms, abilities and self-regulation (RANAS) approach to gain a systematic understanding of the drivers and barriers steering latrine use and to select population-tailored interventions. Interventions will be evaluated using a cluster-randomized controlled trial (cRCT) with 120 clusters. The primary outcomes of the study are as follows:

1. Change over time in the relative number of adult household members who use the latrine for defecation,
2. Change over time in behavioural factors related to latrine use,
3. Change over time in the relative number of households with children whose faeces are safely disposed.

Baseline date were collected through standardized, quantitative face-to-face interviews with one key respondent per household and through spot-check observations of the household latrine. Both tools were intensively pre-tested to assure valid and reliable measures.

The findings of this study revealed that latrine use was closely linked to the mind sets and beliefs of participants. The psycho-social factors, which the RANAS model postulates to steer sanitation behaviours, explained latrine use well in the study population. The following behavioural factors were identified to be most relevant:

- Positive attitudes towards open defecation (negative correlation),
- Perception of others’ behaviour (positive correlation),
- Perception that latrine use was right whereas open defecation was wrong (personal norm, positive correlation),
- Respondent’s awareness of his or her goal to use the latrine (action control, positive correlation).

Additional factors included the perceived ease and ability to use the latrine, negative attitudes towards latrine use, such as costs and negative emotions, and forgetting to use the latrine despite good intentions.

In order to effectively change behaviour towards latrine use, the interventions have to target these behavioural factors. Thus, the interventions designed during Phase 1 of this project were revised accordingly. The overall structure of the interventions was maintained.

Preparatory analyses for the impact assessment were performed and revealed a balanced allocation of villages to intervention or control group with regard to baseline values of all outcomes and socio-demographics. Power analysis using baseline data revealed that the trial is adequately powered to detect minimal effects of 10% change in latrine use.

1. Introduction

1.1. Context and rationale for evaluation

The Swachh Bharat Mission (SBM) has given impetus to sanitation in the country more than ever before, with the explicit agenda to make India open defecation free by 2nd of October 2019. While the overwhelming focus of the Mission has been to construct toilets, much of the research and ground level experiences suggests that building of toilets alone is insufficient to end open defecation (Ram et al., 2016). Understanding people's motivations to use or not use toilets is equally critical. The Ministry of Drinking Water and Sanitation, the nodal ministry for SBM, is cognizant of the role of behaviour change for latrine use, and is keen to have approaches that can enable sustained use of toilets.

Raichur, compared to other districts, is lagging behind in toilet construction in lieu of the pace of construction in other districts (MDWS, 2018a). A measure of success of SBM (as stated by MDWS officials themselves) is of ODF GPs and districts. In Raichur, SBM data reveals low toilet coverage, as does the census data this study collected.

Given this scenario, we anticipate intensified efforts to increase latrine coverage during this project implementation period. SBM's clear-cut agenda at the national, state and district levels has poses several challenges related to behaviour change interventions: 1) the current paucity of evidence that behaviour change interventions complement latrine construction efforts and result in behaviour change; 2) the scalability of such behaviour change interventions, especially if they are resource intensive; 3) questions about how behaviour change interventions are different from the mass media campaigns on SBM.

According to the literature reviewed, determinants of latrine use in rural India include both contextual and psychological drivers and barriers (Ram et al., 2016). However, the relative importance of these determinants and barriers is unclear. Identifying which determinants are most relevant requires a systematic quantitative approach. Further, many determinants that have been proven to be strong drivers of other health behaviours have not been fully investigated in this context. These drivers are summarised in the risks, attitudes, norms, abilities and self-regulation (RANAS) model (Mosler, 2012). In this study, we used the RANAS model to determine the most relevant behavioural factors of latrine use in Raichur and, based on these findings, develop and rigorously evaluate behaviour change interventions

1.2. Objectives of the evaluation

The baseline study had the following objectives:

- Measure latrine ownership and use in a representative sample of the study population,
- Measure and determine the behavioural factors, which steer latrine use in the study population,
- Finalize the intervention design by complementing the qualitative evidence collected during Phase 1 of this project with the quantitative evidence collected during this baseline survey.

Latrine ownership and latrine use were measured through self-reports, reports and spot-check observations during census and baseline survey. The data on latrine use constitute the pre-intervention measurement of the main outcome variables of this impact evaluation.

Together with the post-intervention measurement to be done at endline, these data will be used to compute change scores in the relative number of adult household members who use the latrine for defecation and safe disposal of child faeces. In addition, the data on latrine use will served to allocate villages to control or intervention condition through a pair-matched design.

In line with the RANAS approach, this project's theory of change postulates that latrine use is changed by changing the relevant behavioural factors steering latrine use. Potential behavioural factors of latrine use were systematically surveyed during the baseline survey. Through linear regression analysis, the behaviour-steering factors were identified. Based on these findings, we evaluated whether the existing intervention, designed during phase 1 of this project, actually targeted the most relevant behaviour steering factors of latrine use and revised the campaign accordingly. In addition, the behavioural factors measured at baseline will serve as the pre-intervention measurement to compute change scores in behavioural factors. Using change scores in behaviour and behavioural factors in a mediation model will allow us to validate the theory of change of the intervention and determine through which change in mindset the intervention changed behaviour.

The findings from this study are of particular relevance to the Swachh Bharat Mission, which at its current stage, is increasingly concerned with issues around sustainability of toilets and usage. Behaviour change strategies under the Swachh Bharat Mission largely use IEC and large mass media campaigns to trigger change, with a greater emphasis on latrine construction than on sustained use by all family members. This study will provide valuable insights into how a behaviour change intervention can be effectively implemented at scale.

1.3. Scope of the Evaluation

Raichur is a district in northern Karnataka, located between the Krishna and Tungabhadra rivers in the north and south respectively. Raichur has five talukas (blocks): Raichur, Manvi, Devadurga, Sindhanur, and Lingasugur. As per the 2011 census, Raichur has a population of 1,924,773. Raichur is one of Karnataka's most challenging districts in terms of development indicators.

With mounting pressure from the central government to make India open defecation free in the next year and half, latrine construction has been slow in Raichur. Notably, Karnataka has a Congress led government, with the Congress in power in Raichur district as well. With SBM, a BJP led initiative, progress has been slower as compared to other districts and states that have a BJP government. The upcoming elections will likely have implications for speeding up latrine construction.

We agree that the Total Sanitation Campaign and the Nirmal Bharat Abhiyan have resulted in toilet construction to some extent before SBM. Discussions with non-governmental stakeholders in Karnataka suggests that the while the Congress government has led and supported sanitation campaigns, given the currently political scenario with BJP, there may reluctance to push a "BJP agenda". This is a political move, not one based on concern over an issue (in this case OD). There is no hard data to support this, and as the reviewer points out – this is an assumption based on dialogues with non-governmental stakeholders who are engaged in policy advocacy on SBM/WASH.

Further, through this study, we will learn about the status of latrine construction, how many constructed latrines are functional, and how many are regularly used by a household and all its members. Such insights may be at odds with the government's claims of open defecation

free communities and can influence the government's openness to accepting the study results and recommendations.

For this study, 120 villages were randomly selected. Inclusion criteria for villages were as follows:

- Latrine coverage was greater than 30%. This guaranteed that latrine access was not limited to early adopters but that a representative number of households had latrines,
- Villages had less than 533 households and at least 30 HHs with toilets according to government data,
- Village had one Anganwadi Centre. Strategy 4 of the proposed intervention will be implemented through a parents meeting at Anganwadi Centres,
- Groundwater level was deeper than 30 ft. below ground. This made groundwater contamination through leach pits very unlikely,
- In case a selected village was closer than 5 km from an already enrolled village, it was replaced by another randomly selected village to avoid spill over between control and intervention villages. Only one village per GP was selected.
- The initially envisaged criteria that village toilet coverage should be at most 80% was dropped, due to lack in sufficient number of eligible villages.

To identify eligible respondents, a census survey, measuring socio-economic characteristics of households and latrine ownership, was conducted. Out of households which had a functional latrine, defined as having a pan, pit, and not being permanently obstructed or clogged, 20 households were randomly selected in each participating village. For each household, one main respondent and one substitute in case of unavailability of the first respondent were randomly selected. Respondents and substitutes were at least 18 years old.

2. Evaluation questions and hypotheses

"What works and why?" best summarizes the evaluation questions of this impact assessment.

WHAT WORKS: The principal aim of this impact assessment is to quantify to which extent the intervention increased latrine use of beneficiaries.

WHY: The second aim of this impact assessment is to quantify the mechanisms of action of the tested interventions. The risks, attitudes, norms, abilities and self-regulation (RANAS) model postulates that interventions have to change the behavioural factor which steer the behaviour and that changes in behavioural factors lead to behaviour change. Using mediation models, we will be able to determine which of the factors were mainly changed by the intervention, and how those changes resulted on behaviour change.

The following specific hypothesis will be tested:

- Hypothesis 1: In intervention households, increases in latrine use are statistically significantly higher than in control households.
- Hypothesis 2: Changes in behavioural factors postulated in the RANAS model mediate changes in latrine use.
- Hypothesis 3: In intervention households, improvement in safe disposal of child faeces is statistically significantly higher than in control households.

3. Identified outcomes and key indicators

Key outcomes of the impact assessment are described in Table 1.

Table 1: Key outcomes.

Outcome	Description	Hypothesis	Level	Data Source
Latrine use (behavioral outcome)	Change over time in the relative number of adult household members who use the latrine for defecation	Related to Hypothesis 1	Household	BL and EL survey
Behavioral factors	Change over time in behavioral factors (described in the RANAS model) related to latrine use	Related to Hypothesis 2	Individual	BL and EL survey
Safe disposal of child feces (behavioral outcome)	Change over time in the relative number of households with children whose feces are safely disposed'	Related to Hypothesis 3	Household	BL and EL survey

4. Research Design

4.1. Evaluation design and timeline

The baseline survey is one of two panel surveys to be conducted in this study and constitutes the pre-intervention measurement of the study outcomes (see previous section). The evaluation design is illustrated in Figure 1.

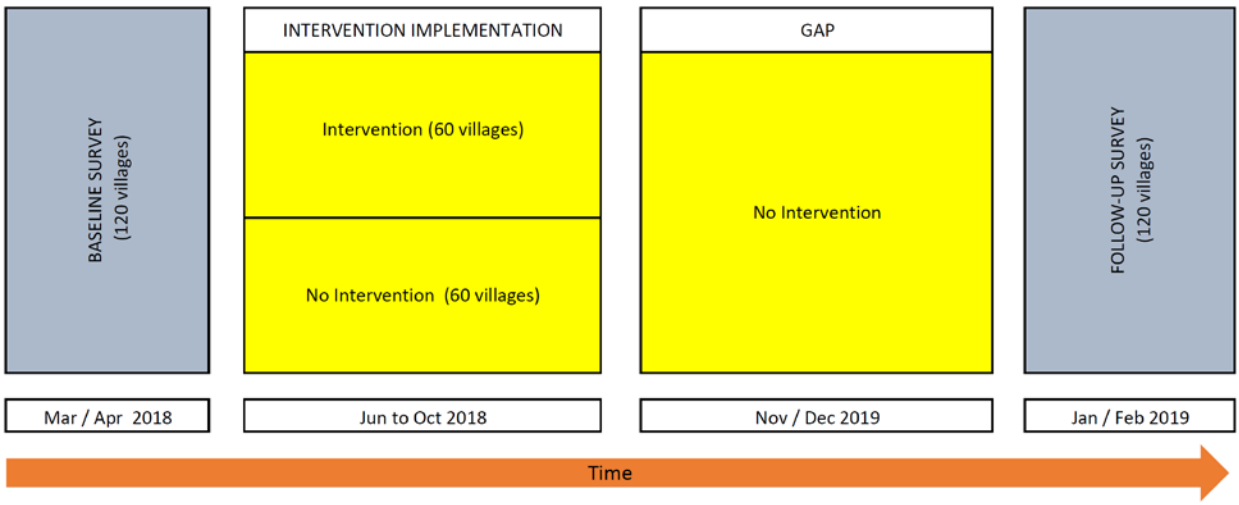


Figure 1: Study design.

The sample size was calculated for Outcome 1, the change over time in the relative number of adult household members who use the latrine for defecation, considering the following assumptions:

- Minimal detectable effect size: 10%; Justification: Values no greater than 10% have been suggested by Research Institute of Compassionate Economics (RICE).
- Expected baseline levels for primary outcome: 50%; Justification: The formative study yielded 50% latrine use across all adult household members.
- Expected effect size or minimum detectable effect: 10%; Justification: Values no greater than 10% have been suggested by RICE.
- Level of alpha: 0.05; Justification: This is the standard value. Increasing the value would make sense if missing an intervention effect would have adverse consequences (e.g. not detecting a potentially harmful side effect). However, the aim of the impact assessment is to demonstrate that the proposed intervention works. Increasing alpha is thus not appropriate.
- Level of beta: 0.8; Justification: Statistical power greater than .8 is generally recommended in social science experiments.
- Intra-cluster correlation coefficient: .25; Justification: Frequently use in epidemiological trials testing impact of sanitation intervention.
- Expected take-up rates: 95%; Justification: During the pilot, nearly all households agreed to participate in the intervention. The interventions will be implemented under intensive monitoring and relatively controlled conditions. Resources for revisiting households that had not been reached during the first household visit are available.
- Expected attrition: We expect a maximum drop-out of 25% in the initial baseline sample. Although a smaller drop-out is likely, 25% are assumed as worst-case scenario, as there is no way to rectify larger attrition that assume once the trial has started.

The sample size was calculated for a one-tailed test, since the hypothesis is that the intervention will increase latrine use. Until present, no intervention designed using the RANAS approach has led to negative changes in the target behaviour.

This yielded a sample size of 2400 households across 120 villages.

4.2. Sampling

Villages were selected according to the following procedure:

- Compile a list of all villages in Raichur district which match the inclusion criteria,
- To each village, allocate a random number between 0 and 1 using the RAND() function in Microsoft Excel,
- Allocate ranks within the villages of each GP based on the random number,
- Select villages ranked 1,
- Sort the file by the random number and select the first 120 villages for the trial and following four villages for qualitative data collection.

According to SBM data (MDWS, 2018a), 250 villages out of, in total, 1071 villages in Raichur district were eligible for inclusion in the study.

Households were selected using a similar procedure:

- Select all households with a functioning latrine according to census data,
- To each households, allocate a random number between 0 and 1 using the RAND() function in Microsoft Excel,
- Sort the households by the random number and select the first 20 households for the trial,

- Select the next 10 households as back-up households, in case of locked households or refusals.

In the census survey, 32172 households were listed. Out of these 21% (6868 households) had a functioning latrine and were eligible for the study[1]. The final sample includes data from 2328 households, which corresponds to 34% of eligible households.

Within households, participants were selected as follows:

- Select all household members aged 18 or above,
- To each household member, allocate a random number between 0 and 1 using the RAND function in Microsoft Excel,
- Within each households, sort the members by the random number and select the first member to be the key respondent for interviews,
- The next household member in the random sequence was selected as back up.

No qualitative data were collected.

4.3. Data collection

We used two tools to collect data: First, a structured, quantitative face-to-face questionnaire and, second, structured, quantitative spot-check observations of the household latrine. The questionnaire was administered by trained enumerators in the local language Kannada. The key objective of the questionnaire was to measure reported latrine use of all households members, self-reported latrine use of the key respondent and the behavioural factors potentially steering latrine use of the key respondent. The key objective of the spot-check observations was to obtain a more objective measure of latrine use. The observations were performed after the interview in the end of the household visit. The questionnaire was intensively pre-tested, both qualitatively and quantitatively. To compare the study sample to the national population, we used data from the National Annual Rural Sanitation Survey (MDWS 2018b).

4.4. Implementation

In order to carry out census in 124 villages covering about 32000 HHs, a total of 43 field team members including three field executives, eight supervisors to monitor 32 enumerators in eight teams were selected for rollout. This entire field team was closely supported and monitored by the field manager and the project director of the data collection agency.

For the baseline data collection, initially, a similar team structure was adopted but with a team strength of 29 including five teams each comprising of one supervisor and 4 enumerators reporting to the respective field monitor who in turn reported to the field manager.

Once the model code of conduct came into force earlier than expected, two more field teams (each team having one supervisor and four enumerators) were trained and roped in so as to ensure timely completion of data collection. Therefore, in total, there were 39 members mobilised for baseline survey.

[1] The inclusion criteria of latrine coverage of at least 30% referred to government data, which was used to select villages. Actual latrine coverage, as revealed by the census survey, was substantially lower leading to the average latrine coverage of 21%.

The survey team underwent a one-week intensive theoretical and practical training. Enumerators were introduced to the project objectives, structure and to the basic concepts of the RANAS approach. Each questionnaire section was explained, then rehearsed as a role play on front of the team and, finally, team member practice the interview in mock-interviews with each other. During two days, team members conducted partially accompanied interviews in the morning and attended de-briefing sessions in the afternoon. The data collected during these days was discarded.

A solid monitoring plan was devised through a carefully planned team structure and a responsive system for constant monitoring and quality control. Every team comprised of one supervisor and four enumerators. The supervisor was tasked with accompaniments and back-checks to check for quality of surveys being conducted in addition to the task of ensuring that the targeted number of calls are met for the day. For Census, random back-checks were carried out by the supervisors in 10% of the calls for the day whereas for Baseline, no back-checks were carried out but instead accompaniments were made periodically by the supervisors, field monitors, field manager and WaterAid. In order to ensure that the enumerators accomplished their targets for the day, a micro level plan was developed with details of the selected and back up HHs along with their addresses, phone number, caste, surnames and availability. This helped the interviewers plan their time for the day and schedule calls as per targets. The performance of the enumerators was supervised using a checklist of key pointers of protocol adherence during the BL interviews. Besides, the tool being complex, was made much easier to navigate through by use of hints and instructions to Interviewers wherever needed. Based on observations made during the accompaniments, the enumerators were debriefed right after the calls in order to facilitate improvement in their performance in the subsequent interviews.

With periodic data reviews and feedback sharing, the field teams were re-oriented on the correct interview methods, commonly occurring errors and missed out items and in turn help improve data quality. Monitoring visits throughout the period of data collection were carried out by both Nielsen and WaterAid.

Once data is derived from the CAPI platform, both the field manager and data manager checked for the actual count of records against the extraction count, data consistency based on the consistency checks provided by core team, shared erroneous records/data with core team and subsequently the field team for suspected anomalies and ensured validation of core indicators as per set procedures. The data from the field was then converted into SPSS data format for storage and processing. The variable labels and value labels were assigned for each variable and a codebook produced listing all of the study variables, their values and their labels.

5. Data Analysis

To check for systematic differences between participants of the intervention and control arm, means and standard deviations of all primary and secondary outcomes and important covariates were computed separately for each study arm (Section 7).

To describe the participants of the study, means and standard deviations of socio-economic and demographic characteristics of the full sample population were computed (Section 8). In addition, descriptive statistics of household level and individual measures of sanitation behaviour and of the behavioural factors of latrine use were computed.

To assess inter-correlation of all behavioural measures, a correlation matrix was computed and is presented in Table 7. To account for the not normal distribution of some of the variables, spearman's rho was computed in all correlational analyses. In order to determine the behavioural factors steering latrine use, correlations between self-reported latrine use and behavioural factors were computed (Table 8). Factors correlating stronger than .3 were subsequently included in a linear regression model to determine the most influential factors. The model is presented in Table 9. All model assumption were met and no model bias through influential cases was detected. Finally, correlation between latrine use of the main respondent, on the one hand, and attitude factors and others' behaviour, on the other hand, were examined on item level (Table 10). This additional analysis was necessary to determine which dimensions of these scales were most strongly associate with latrine use and should thus be targeted by the interventions. We did not use qualitative data analysis.

Throughout the data analysis, several measures of latrine use were employed.

1. **Latrine use household** is an aggregate measure of latrine use across all households' members on the day preceding data collection. It ranges from 0 (indicating none of the household members used the latrine) to 1 (indicating all household members used the latrine).
2. **Safe child faeces** quantifies safe disposal of child faeces in the household on the day preceding data collection. It ranges from 0 (indicating that none of the child faeces were safely disposed) to 1 (indicating that none of the child faeces were safely disposed).
3. **Latrine observation index** is an index across spot-check observations of the toilet which were conducted after the interview. It ranges from 0 (indicating that all spot-check items suggest that the latrine is being used) to 1 (indicating that none of the spot-check items suggest that the latrine is being used).
4. **Latrine use main respondent** is an individual measure of latrine use of the randomly selected main respondent. Like the other measures, it ranges from 0 to 1. This measure is used on all analyses with regard to behavioural factors.

6. Registration of pre-analysis plan

The pre-analysis plan can be downloaded under the following link:

http://ridie.3ieimpact.org/index.php?r=search/detailView&id=637

7. Internal validity of the evaluation design

Allocation of villages to the intervention or control arm was done through randomized pair matching. The matching variable was latrine use across all household members, which is the key outcome of this study. First, latrine use of all household members was computed for each village. The two villages being most similar in terms of latrine use were paired. Finally, for each villages a random number was computed using Microsoft Excel's Rand() function. In each pair the village with the higher number was allocated to the control condition and the village with the lower number was allocated to intervention.

Means and standard deviations of all outcomes and important covariates are presented in Table 2. The results show that all investigated variables are evenly distributed across study arms.

Table 2: Means and standard deviations of all outcomes and important covariates.

Variable	Control group (N = 60 Cluster, 1150 participants)		Intervention group (N = 60 clusters, 1178 participants)		Test of equality of means	
	Mean	SD	Mean	SD	t	p
Female respondent (%)	52%	50%	51%	50%	.433	.665
Age of respondent (years)	38,60	13,72	37,61	14,07	1724	.085
HH size (members)	5,07	2,59	4,87	2,38	1961	.050
HHs which own a house (%)	99%	12%	99%	10%	-.827	.408
HHs which own agricultural land (%)	81%	40%	79%	41%	1237	.216
Size of land owned (acres)	4,72	7,59	4,57	9,71	.401	.688
HHs which have ration card (%)	94%	25%	93%	26%	.741	.459
Highest level of education in the HH (years)	9,60	4,81	9,70	4,76	-.512	.608
HH which belong to SC/ST (%)	43%	50%	46%	50%	-1481	.139
Latrine use household	0,792	0,355	0,788	0,357	.216	.829
Safe child faeces	0,110	0,293	0,102	0,269	.337	.737
Latrine observation index	0,714	0,264	0,688	0,277	2335	.020
Handwashing facility	0,503	0,500	0,415	0,493	4251	.000
Latrine use main respondent	0,772	0,347	0,797	0,330	-1787	.074
Habit OD	0,265	0,290	0,225	0,276	3387	.001
Habit LU	0,725	0,294	0,743	0,282	-1503	.133
Intention LU	0,774	0,253	0,772	0,254	.142	.887

Note: Two-tailed independent samples t-test was performed to test equality of means.

7.1. Other competing interventions

The Swachh Bharat Mission is underway with toilet construction activities ongoing in the state and district. In four study villages, WASH related activities are being carried out as part of WAI's WASH Project in the district. These interventions include WASH infrastructure strengthening and awareness generation activities in the public institutions like schools, anganwadi centres and health centres in addition to households. Wall paintings, wall writings, rallies and campaigns by school children, formation and strengthening of systems to ensure operation and maintenance of WASH infrastructure at public institutions through school cabinets and school development and monitoring committees in the schools, self-help groups and village health sanitation and nutrition committees in the villages, water-men, front-line workers and gram panchayat members.

7.2. Incentives

The intervention consists of public meetings (Strategies 1 & 4), and direct personal communication (Strategies 2 & 3). For the latter there is no risk of self-selection as

households will be approached directly based on the contact details noted during census. However, it is possible that attrition will be systematic, for example, if households with specific characteristics will be absent from the villages during the intervention implementation. For the first, it is possible that individuals who attend the meetings and those who do not differ systematically. However, allocation to interventions happened on cluster level. As a consequence, all members of intervention villages will be considered intervention participants, irrespective of their actual attendance of the meeting. This will yield a conservative measure of intervention effects.

7.3. Spillover

We only selected villages, which were at least 5 km away from any other study villages. In addition, only one village per Gram Panchayat was included in the study to avoid spill over though local leaders. Through these two measures, we do not expect spillover from the treatment to the control. However, contamination of the control cannot be categorically ruled out. If not on a daily basis, villagers from control and intervention villages might meet at market days of when visit neighbouring villages.

7.4. Behavioural responses to the evaluation

We do not expect control participants to compare themselves with intervention participants. First control participants will not know that there is an intervention and that they are part of the control. Second, they will meet few intervention participants if any, see Section 7.3, and will be unlikely to compare their own performance with intervention participants' performance. Consequently, we do not expect John Henry effect to be a major origin of bias.

Both, individuals of control and intervention, are aware that they are part of a study. In addition, sanitation activities under SBM are intensive in Raichur district, thus also control participants will be exposed to activities promoting sanitation. Therefore, reactivity, for example in the form of over-reporting of latrine use, is probably similar in both study arms and we do not expect Hawthorne effect to be a major source of bias.

There were only 5 households in which the respondent refused to participate in the baseline. Consequently, characteristics of refusing respondents were not computed.

7.5. Implications for ex-post power calculation

The sample size calculation, using input parameters determined from the baseline sample, are presented in Table 3. Three scenarios are considered:

- Scenario 1 Sample size calculation as per pre-analysis plan,
- Scenario 2: Updated sample size calculation assuming that all 120 villages are included in the trial,
- Scenario 3: Updated sample size calculation assuming that only the 110 villages where less than 98% of participants use latrine are included in the trial.

The table shows that in all three scenario the required minimal sample size is smaller than the available sample. This indicates that, for all scenarios, the trial will be sufficiently powered to detect the assumed minimal effect size of 10% change in latrine use.

Table 3: Sample size calculation considering results from the baseline survey.

Step	Input parameters and result (bold).	Scenario 1	Scenario 2	Scenario 3
1. Compute desired sample size at endline assuming randomisation on individual level				
	Minimum detectable effect size:	0.1	0.1	0.1
	Mean latrine use at baseline	0.5	0.790	0.771
	SD of Mean latrine use at baseline	0.4	0.356	0.366
	Alpha probability:	0.05	0.05	0.05
	Power:	0.8	0.8	0.8
	Number of groups:	2	2	2
	Sample size for 1-sided independent sample t-test	**398**	**319**	**334**
2. Compute actual sample size required to achieve effective sample size presented above				
	Average cluster size at endline	15	15	15
	Intra-cluster correlation coefficient:	0.25	0.202	0.174
	Sample size	**1791**	**1221**	**1148**
	Number of villages assuming above average cluster size	**119**	**81**	**77**
3. Compute sample size at baseline to achieve desired sample size at endline				
	Expected max. attrition:	25%	25%	25%
	Expected uptake:	95%	95%	95%
	Minimum cluster size at baseline	**20**	**20**	**20**
	Minimum sample size at baseline	**2351**	**1603**	**1506**
	Number of clusters at baseline	**119**	**81**	**77**
4. Compute rounded sample size for baseline survey				
	Cluster size	**20**	**20**	**20**
	Sample size	**2400**	**1640**	**1560**
	Number of clusters	**120**	**82**	**78**

Note: Scenario 1: Sample size calculation as per pre-analysis plan; Scenario 2: Updated sample size calculation assuming that all 120 villages are included in the trial; Scenario 3: Updated sample size calculation assuming that only the 110 villages, where less than 98% of participants use latrine, are included in the trial.

8. Findings

8.1. Description of the quantitative sample

Descriptive statistics of socio-economic and demographic characteristics of the sample population are presented in Table 4 and descriptive statistics of household level and individual level measures of sanitation behaviour are presented in Table 5. Latrine use across all household members and latrine use of the main respondent are similarly high at roughly 80%. The latrine observations corroborate these results. In contrast, safe disposal of child faeces amounts to merely 10%. The table further shows that both habit and intention for latrine use, computed as the average across all individuals, are relatively high, while habit for open defecation is relatively low. Roughly, half of the households had a handwashing facility with soap and water next to the latrine.

Table 4: Socio-economic and demographic characteristics of the sample population.

	Mean	SD	Minimum	Maximum
Female respondent (%)	52	50		
Age of respondent (years)	38.10	13.90	18	75
HH size (members)	4.97	2.49	1	36
HHs which own a house (%)	99	11		
HHs which own agricultural land (%)	80	40		
Size of land owned (acres)	4.64	8.72	0	99
HHs which have ration card (%)	93	25		
Highest level of education in the HH (years)	9.65	4.78	0	25
HH which belong to SC/ST (%)	45	50		

Note: N=2328.

Table 5: Descriptive statistics of household and individual level measures of sanitation behaviour.

Behavioural measure	Mean	Standard Deviation	Minimum	Maximum
Latrine use household	0.790	0.356	0.00	1.00
Safe disposal of child faeces	0.106	0.281	0.00	1.00
Latrine observation index	0.701	0.271	0.00	1.00
Handwashing facility	0.458	0.498	0.00	1.00
Latrine use main respondent	0.785	0.339	0.00	1.00
Habit OD	0.245	0.284	0.00	1.00
Habit LU	0.734	0.288	0.00	1.00
Intention LU	0.773	0.253	0.00	1.00

Note: N = 2328, N (safe disposal of child faeces) = 487.

On average latrines had been constructed 2.5 years ago (SD = 3.3). Single pits were present in 95% of households, while two per cent of households had double pits and 3 per cent of households reported to have septic tanks. Only three per cent of households had experienced the pit to fill up in the past.

Descriptive statistics of behavioural factors are presented in Table 6. All factors were asked with regard to latrine use of the main respondent. Within the risk factor block, respondents' knowledge on the causes of diarrhoea and ways to prevent it was relatively high. Also, participants perceived diarrhoea to have serious consequences. In contrast, participants did not express to feel at high risk to contract diarrhoea if defecating in the open. In the attitude factor block, attitudes towards latrine use were rather positive, meaning that participants' evaluation of latrine use with regard to personal advantages and disadvantages was rather positive. In contrast, attitudes towards open defecation were rather negative. This means that, in general, respondents perceived latrine use to be rather beneficial than having negative consequences while the opposite was true for open defecation. Within the norm factor block, respondents perceived others to often use the latrine for defecation. This is consistent with the behavioural measure discussed above. Furthermore, respondents perceived others to approve using the latrine for defecation. Finally, respondents' individual moral perception of what is right or wrong was clearly in favour of latrine use (personal norm). How-to-do knowledge, in the ability factor block, was at a medium level. On average, respondents correctly answered half of the knowledge questions. Confidence in being able to use the latrine at all (confidence in performance), to use it continuously (confidence in continuation) and to start using it again after practicing open defecation for some time (confidence in recovery) were similarly high. In the self-regulation block, low scores in action planning indicate that, on average, participants did not have a clear idea of how to create an enabling environment for using the latrine. The reason for this is probably that not only the respondents who actually maintained the latrine were interviewed. In contrast, respondents were randomly selected and included all household members. Action control, the awareness of one's goal to use the latrine, was relatively high. Few respondent, reported to forget using the latrine or other hindrances, while many could mention clear strategies to overcome barriers, such as water shortage or the latrine being used by somebody else. With regard to

water access, households needed approximately 2 hours per week to collect water for latrine use. They perceived it rather easy at the time of interview and, prospectively, medium difficult during the hot season.

Table 6: Descriptive statistics of behavioural factors.

Factor block	Behavioural factor	Mean	SD	Minimum	Maximum
Risks	Health Knowledge	0.717	0.1245	0.00	1.00
	Vulnerability	0.410	0.327	0.00	1.00
	Severity	0.765	0.142	0.00	1.00
Attitudes	Attitudes LU positive	0.744	0.196	0.00	1.00
	Attitudes LU negative	0.143	0.164	0.00	0.86
	Attitudes OD positive	0.186	0.222	0.00	0.94
	Attitudes OD negative	0.642	0.181	0.04	1.00
Norms	Others behaviour	0.623	0.165	0.00	0.97
	Personal norm	0.731	0.226	0.00	1.00
	Others' (dis)approval	0.653	0.211	0.00	1.00
Abilities	How-to-do knowledge	0.537	0.101	0.00	0.90
	Confidence in performance	0.768	0.222	0.00	1.00
	Confidence in continuation	0.652	0.215	0.00	1.00
	Confidence in recovery	0.715	0.257	0.00	1.00
Self-regulation	Action Planning	0.381	0.186	0.00	1.00
	Action Control	0.687	0.258	0.00	1.00
	Hindrance	0.241	0.428	0.00	1.00
	Coping planning	0.817	0.334	0.00	1.00
	Forgetting	0.099	0.299	0.00	1.00
	Commitment	0.720	0.228	0.00	1.00
Context: Water access	Time for water collection (hours / week)	1.838	2.173	0.00	8.10
	Difficulty water collection now	0.238	0.341	0.00	1.00
	Difficulty water collection during hot season	0.599	0.402	0.00	1.00

Note: N (RANAS factors) = 1891, N (water access) = 2328.

8.2. Comparison of survey sample with national population

We used data from the National Annual Rural Sanitation Survey (MDWS, 2018b) to compare our study sample to national data at household level. Across all villages, which were included in this census survey, 21% of all households had access to a private household

latrine. In the national survey, the corresponding share of households with latrine was 69%. In our study sample, surveyed at baseline, latrine use of all members of households with a functioning latrine amounted to 79%, while the NARSS survey yielded 70%. Huge differences with regard to save disposal of chid faeces were observed. In the study sample, safe handling of child faeces was at 10% across all households, while the national figure amounted to 72%. With regard to demographic characteristics, the average household size in our sample amounted to 4.9 HH members and was slightly higher than the average of 4.1 members, reported in the NARSS survey.

8.3. Cross-tabulations, correlation and regression analysis using quantitative data

Correlations for behavioural measures are presented in Table 7. Within the household level measures, we see high correlation between reported latrine use of the households and the latrine observation index. This suggests that in households where participants reported high latrine use, latrine observations was the same. Furthermore, there was a medium to strong correlation between signs of use at the latrine, as indicated by the latrine observation index, and presence of a handwashing facility with water and soap.

Within the individual level measures, the correlation matrix indicates high inter-correlations throughout. The strong positive correlation between latrine use and habit for latrine use and the negative correlation between latrine use and habit for open defecation suggest that using the latrine or defecating openly was strongly habit driven. The high correlation between latrine use and intention suggests that, in general, respondents did not intend to change their sanitation behaviour from their current practice.

Table 7: Correlation matrix for behavioural measures.

	2	3	4	5	6	7	8
1 Latrine use household	.135**	.537**	.296**	.579**	-.543**	.608**	.566**
2 Safe child faeces		.111*	0.086	.196**	-.097*	.175**	.195**
3 Latrine observation index			.479**	.410**	-.418**	.434**	.453**
4 Handwashing facility				.288**	-.219**	.253**	.206**
5 Latrine use main respondent					-.651**	.682**	.600**
6 Habit OD						-.648**	-.566**
7 Habit LU							.707**
8 Intention LU							

Note: N = 2328; * Correlation is significant at the 0.05 level (2-tailed), ** Correlation is significant at the 0.01 level (2-tailed).

Table 8 presents correlations of self-reported latrine use of the main respondent with behavioural factors. This correlation table was computed as a preliminary analysis to identify

the behavioural factors most closely related to latrine use in order to include only them in the subsequent linear regression model. Factors with a correlation larger than .3 which, according to Cohen (1992), constitutes a medium effect, will be included in the regression model and are marked in bold.

Table 8: Correlation of self-reported latrine use of the main respondent with individual and households level behavioural factors.

Factor block	Behavioural factors	Spearman's rho
Risks	Health Knowledge	.062**
	Vulnerability	.090**
	Severity	.249**
Attitudes	**Attitudes LU positive**	**.503****
	Attitudes LU negative	**-.418****
	Attitudes OD positive	**-.521****
	Attitudes OD negative	.297**
Norms	**Others behaviour**	**.400****
	Personal norm	**.566****
	Others' (dis)approval	.280**
Abilities	How-to-do knowledge	.078**
	Confidence in performance	**.579****
	Confidence in continuation	**.430****
	Confidence in recovery	**.455****
Self-regulation	Action Planning	.137**
	Action Control	**.530****
	Hindrance	-.152**
	Coping planning	.258**
	Forgetting	**-.426****
	Commitment	**.536****
Context: Water access	Time for water collection (hours / week)	-.184**
	Difficulty water collection now	-.257**
	Difficulty water collection during hot season	-.163**
Context: Household socio-economics	Land ownership	.052*
	House ownership	-.030
	Ration card holder	-.014
	Years of education	.105**
	Scheduled Caste / Tribe	-.174**
	Household size	-.082**
	Gender of respondent	.029

Note: N = 1891; N (household socio-economics) = 2328; * Correlation is significant at the 0.05 level (2-tailed); ** Correlation is significant at the 0.01 level (2-tailed).

Table 9 presents regression weights of behavioural factors on self-reported latrine use of the main respondent. Since all factors were coded from 0 to 1, unstandardized regression weights can be directly compared. Positive attitudes towards open defecation were most strongly related to behaviour. The more positive a respondent evaluated open defecation with regard to the costs and benefits and the more positive the respondent's emotions towards open defecation were, the more likely he/she was to practice OD and to not use the latrine. The second largest regression weight was observed for others' behaviour. The stronger the respondent believed that other people used the latrine, the more the respondent used the latrine him or herself. The third largest regression weight was personal norm, meaning that the perception that latrine use was right whereas open defecation was wrong prompted people to use the latrine. Action control was a further important behavioural factor: The more aware the respondent was of his or her goal to use the latrine the more he/she actually used the latrine. Confidence in performance, the perceived ease and ability to use the latrine, negative attitudes towards latrine use, such as costs and negative emotions, and forgetting to use the latrine despite good intentions included further significant factors.

Table 9: Regression weights of behavioural factors on self-reported latrine use of the main respondent.

Factor block	Behavioural factor	B	Std. Error	t	Sig.
	(Constant)	0.064	0.035	1.811	0.070
Risks	Health Knowledge				
	Vulnerability				
	Severity				
Attitudes	Attitudes LU positive	0.020	0.040	0.510	0.610
	Attitudes LU negative	**0.131**	**0.038**	**3.429**	**0.001**
	Attitudes OD positive	**-0.458**	**0.032**	**-14.373**	**0.000**
	Attitudes OD negative				
Norms	**Others' behaviour**	**0.414**	**0.030**	**13.593**	**0.000**
	Personal norm	**0.258**	**0.040**	**6.438**	**0.000**
	Others' (dis)approval				
Abilities	How-to-do knowledge				
	Confidence in performance	**0.151**	**0.047**	**3.217**	**0.001**
	Confidence in continuation	0.018	0.033	0.557	0.577
	Confidence in recovery	0.018	0.024	0.747	0.455
Self-regulation	Action Planning				
	Action Control	**0.206**	**0.029**	**7.160**	**0.000**
	Hindrance				
	Coping planning				
	Forgetting / Remembering	**-0.115**	**0.016**	**-7.378**	**0.000**
	Commitment	0.070	0.042	1.673	0.094
Context: Water access					
Context: Household socio-economics					

Note: N = 1891; R^2 = .74; blank row indicates that the factor's correlation was smaller than .3 and that the factors was hence not included in the regression mode; all model assumptions (i.e. independence of errors, no multicollinearity, no bias through influential cases, normal distribution of residuals, linearity, and homoscedasticity were fulfilled.

Attitudes towards latrine use and open defecation constitute scales with several dimensions. They thus have to be examined in more detail, in order to determine which dimensions of the scale are most closely related to latrine use. From the perspective of intervention design, it is important to change the balance of positive and negative attitudes towards latrine use to be more positive and towards open defecation to be more negative. Thus, all attitudes are considered. Attitudes correlated with a medium or high correlation with behaviour are formatted bold and should be targeted by the intervention.

Table 10: Correlations of attitudes towards latrine use and open defecation with self-reported latrine use of the main respondent on item level.

Attitude scale	Attitude item	Correlation coefficient
Attitudes LU positive	**Liking LU**	**.606****
	Convenience LU	**.512****
	Being a good example when using the latrine	.268**
	Being proud of using the latrine	**.377****
Attitudes LU negative	**Disgust LU**	**-.437****
	Expenditure of time LU	-.076**
	Spiritual Pollution LU	**-.438****
	Risk of Mosquito bites LU	-.215**
	Feeling cramped in the latrine building	**-.496****
	Feeling lonely in the latrine building	**-.462****
	Smell in the latrine building	**-.334****
Attitudes OD positive	**Liking OD**	**-.570****
	Talking to others during OD	**-.358****
	Convenience OD	**-.493****
	Feeling fresh during OD	**-.451****
Attitudes OD negative	Risk of animal attach OD	.147**
	Physical environmental contamination OD	**.443****
	Disgust OD	**.376****
	Shame OD	**.320****
	Expenditure of time OD	.137**
	Risk of attack by others OD	.039
	Risk of mosquito bites OD	.095**

Note: N = 1891; * Correlation is significant at the 0.05 level (2-tailed); ** Correlation is significant at the 0.01 level (2-tailed).

Similar to attitudes, other's behaviour constituted a scale with several dimensions: Perceived behaviour of others in the village, perceived behaviour of peers (same age and gender), and perceived behaviour of other household members. To determine which perception is the most relevant driver for latrine use, they were separately examined. For perceived behaviour of other villagers in general and peers, correlational analysis revealed a small to medium relationship (Rho = .271, $p < .01$; Rho = .201, $p < .01$). The correlation of other household members with self-reported behaviour of the main respondent was medium to high (Rho = .443, $p < .01$) and should thus be targeted by the intervention.

8.4. Implications

In order to effectively change behaviour, the interventions have to target the most influential behavioural factors, which were identified in the regression model and described in the

previous section. Consequently, the intervention matrix was updated: Behaviour change techniques (BCTs) which targeted behavioural factors not identified to be influential (e.g. confidence in recovery) were removed. BCTs targeting influential behavioural factors, which were not targeted by the existing campaign (e.g. confidence in performance), were added. The updated intervention matrix is presented in Appendix 3.

With regard to implications for the impact evaluation design, the relatively high level of reported latrine use across household members is a concern. When designing the study, we assumed that latrine use amounted to roughly 50%. However, the results indicate values of 79% (see Table 2). Further investigations on village level yielded that, in 9 villages, all members of participating households were reported to use the latrine, and in one village, 99% were reported to do so. We propose to exclude these villages from the further trial, as there is no potential for behaviour change. In further 30 villages, latrine use was above 90%. We propose to keep these villages in the trial, to evaluate the interventions' effect also on these most change resistant participants. This corresponds to Scenario 3 of the updated power calculation, which revealed that the trial would be adequately powered to detect minimal effect sized of 10%.

With regard measuring latrine use, these results suggest that a more objective individual measure of latrine use, for example through structured behavioural observations would be very useful. Latrine spot-check observations were done. However, they only provide household level measure of whether the latrine looks to be used at all or not. Partial use by some and open defecation by other household members cannot be captured.

9. Ethics

In a specific block on good interview practices, enumerators were trained on how to communicate with respondents from the moment of first interaction to the completion of the interview. This session included basic social skill such as greeting and thanking the respondent, taking informed consent in a standardized way, tactfully handling hesitant respondents, creating a positive rapport and private setting for the interview, and basic rules for asking questions. A checklist with dos was compiled as a summary of this briefing. This was also used by supervisors during accompanied interviews and interviewers were debriefed accordingly.

Participants' confidentiality was protected during all stages of the evaluation. During data collection, enumerators were instructed to create a private setting and being alone with the respondent as much as possible. Data were entered on CAPI devices and were only accessible to the enumerators. Once the data were submitted online, they were only accessible to the data managers of the hired data collection agency. After receiving the final data set, identified data were separated from the data set and stored in a separate file.

10. Major challenges and lessons learned

The study has been challenging to implement with several key takeaways for the team as we plan next steps. The use of the SBM data to select villages for inclusion into the study proved an issue as the SBM data tended to overestimate latrine coverage. As a result, certain villages selected for census did not have adequate number of functional latrines for it to be considered for the baseline data collection.

The census tool was a simple tool that was explained in detail to the data collection agency. Supervision and feedback was provided to all census teams during census rollout as well. Despite this, a critical question on the presence of a household latrine was misinterpreted by several interviews and consequently asked incorrectly, resulting in faulty data regarding the number of households with a functional latrine. The data collection agency had to collect census data from a set of 30 new villages, to replace villages were not enough households with latrines were listed. To assist with this, SVYM and WaterAid had to undertake screening of new villages to ensure that at least 30 households in a newly selected village had functional latrines, before passing on this list to the data collection agency to carry out the census.

The baseline questionnaire was quite complex and called for substantial training of all members who were involved in data collection. At the same time, many enumerators' level of skills and commitment to the survey was poor and supervision and logistical planning and support provided by the data collection remained insufficient throughout the survey. To assist with baseline data collection, team members from Eawag and WaterAid worked closely with senior members, supervisors and enumerators from data collection agency. For endline, training substantially more enumerators than actually needed for the survey is a promising strategy. This will enable us to remove enumerators with poor commitment and skills from the team without implications on the timeline.

This study has important limitation. First, data are collected from one district only, thus it remains unclear how representative they are for other districts and regions in India. Second, no causality can be inferred from the baseline survey as it followed completely cross-sectional design. Last, determining the behavioural factors of latrine use is based on self-reports of behaviour and the behavioural factors only. Social desirability may have led to over-reporting in both behaviour and behaviour factors.

11. Conclusion

To conclude, the findings of this study demonstrate that latrine use closely linked to individuals' mind sets and beliefs. The psycho-social factors, which the RANAS model postulates to steer sanitation behaviours, explained latrine use well in the study population of Raichur, Karnataka. The following behavioural factors were identified to be most strongly related to latrine use: First, the more positive a respondent evaluated open defecation with regard to personal costs and benefits and emotions, the less likely he/she was to use the latrine. Second, the stronger the respondent believed that other people used the latrine, the more the respondent used the latrine him or herself. Third, the perception that latrine use was right whereas open defecation was wrong prompted people to use the latrine. Fourth, the more aware the respondent was of his or her goal to use the latrine the more he/she actually used the latrine. The perceived ease and ability to use the latrine, negative attitudes towards latrine use, such as costs and negative emotions, and forgetting to use the latrine despite good intentions were further significant predictors.

This detailed understanding of the target population's mind set allowed to systematically tailor the interventions to the target population. Only the specific interventions that match the mind-set of the target population were selected for the final intervention design. This led to parsimonious and focused interventions, will reduce costs and increase scalability and sustainability of the campaign.

Besides providing data for the intervention design, the baseline survey was the pre-intervention measurement for evaluating the interventions in a cluster-randomized controlled trial. It allowed preliminary analyses and conclusions about the internal validity of the trial. With regard to a balanced allocation of participants to control or intervention group, the approach of pair-matching proved to be successful: Both experimental groups showed similar characteristics with regard to all outcomes and important socio-economic variables. Further, ex-post power analysis using data gained from the baseline survey revealed that the trial is sufficiently powered to detect minimal effects of 10% change in latrine use. This is particularly crucial as baseline values of latrine use were above 70% and considerably higher than expected. Thus, the intervention effects may be constrained by a ceiling effect. While this requires sufficient power of the trial, it also constitutes the valuable opportunity to evaluate the interventions in a sample that includes many change-resistant participants. Demonstrating the effectiveness of the population-tailored and data-driven interventions and design approach in this setting will be a unique contribution to the scientific and practical understanding of prompting latrine use in rural India.

References

COHEN, J. 1992. A power primer. *Psychol Bull,* 112**,** 155-9.

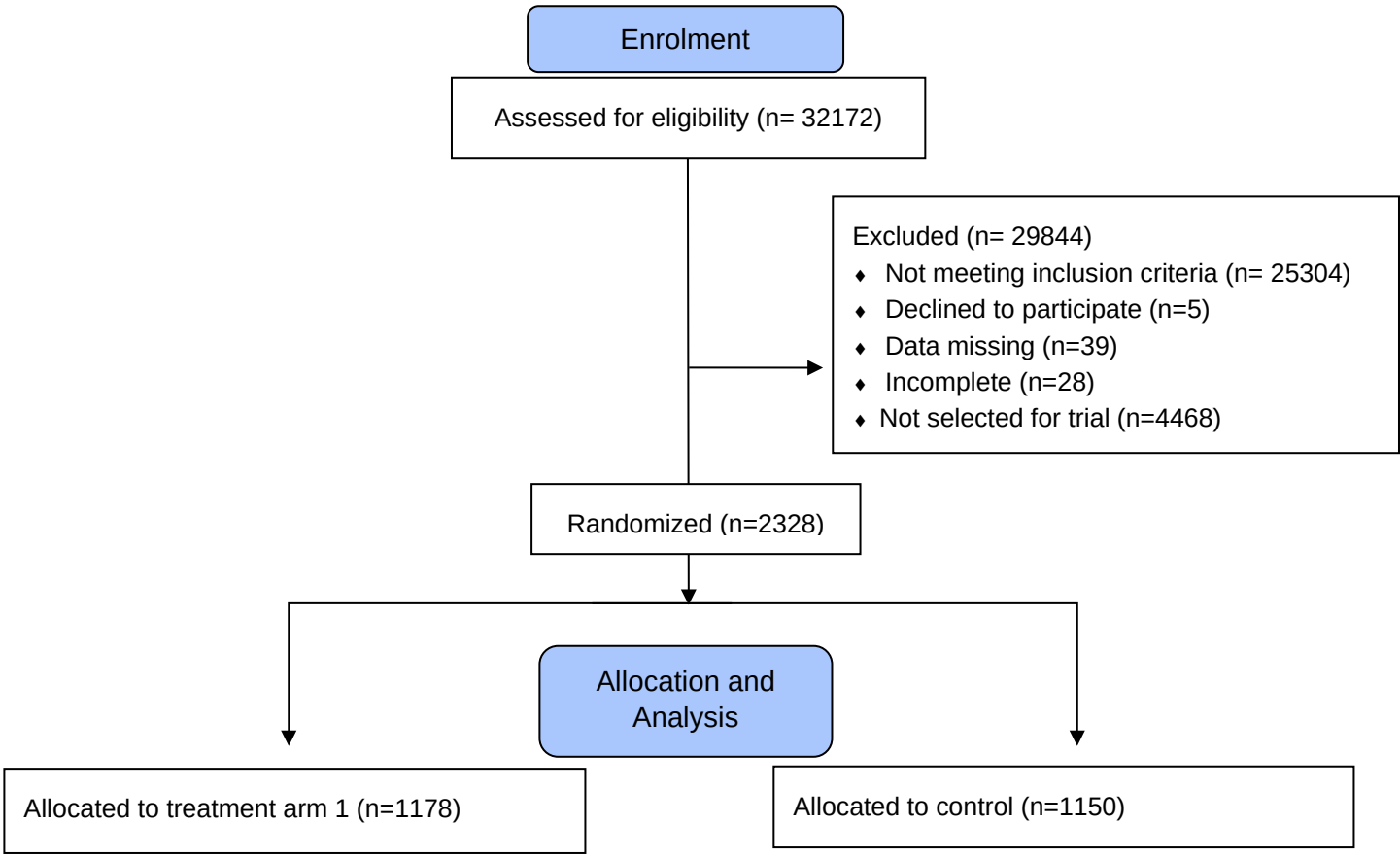
MINISTRY OF DRINKING WATER AND SANITATION (MDWS) 2018a. Status of Declared and Varified ODF villages. Retrieved from http://sbm.gov.in/sbmReport/Report/Physical/SBM_VillageODFMarkStatus.aspx.

MINISTRY OF DRINKING WATER AND SANITATION (MDWS) 2018b. National Annual Rural Sanitation Survey Data 2017-2018. Retrieved from https://mdws.gov.in/publication/national-annual-rural-sanitation-survey-data-2017-2018-provisional-and-un-weighted.

MOSLER, H.-J. 2012. A systematic approach to behavior change interventions for the water and sanitation sector in developing countries: a conceptual model, a review, and a guideline. *International Journal of Environmental Health Research,* 22**,** 431-449.

RAM, P. K., PLATA, Z. & PASI, N. 2016. Latrine Use: Prevalence, Motivators and Interventions. Buffalo, NY: University of Buffalo.

Appendix A: Evaluation design



Appendix B: Updated intervention matrix

Strategy	Communication channel	Target individuals	Behavior change technique (BCT)	Activity	Ranas factor targeted
1	Village meeting	Entire village	BCT 5 Inform about and assess costs and benefits BCT 8 Describe feelings about performing and about consequences of the behaviour	In a street play the following messages are conveyed: (1). LU feels good, is convenient and a reason to be proud of. (2). LU is not disgusting, spiritually polluting, smelling, and does not feel cramped or lonely. (3) OD does feel bad, is inconvenient, not fresh and not social. (4) OD contaminates the environment, is disgusting, shameful, *time-consuming* and entails *high risk of mosquito bites*. In a group discussion, participants collect advantages of latrine use and disadvantages of open defecation. The discussion explicitly focuses on both, instrumental and emotional aspects. All points are documented in written on a poster and through sketches.	Beliefs about costs and benefits, Feelings
			BCT 15 Provide instruction	*Participants are informed how long they can use a single pit of 4 feet depth. Options for pit emptying are presented and fliers with contact and cost information for pit emptying are distributed.*	*How-to-do knowledge (maintenance)*
			BCT 13 Provide a positive group identity	A video interview, which has been recorded in a real ODF villages is screened. Key messages: OD has negative consequences (contaminates environment, disgusting, shameful, time-consuming, mosquito bites) which conflict with important values (cleanliness, self-respect, belonging to the village). Whoever practices OD is responsible for these consequences and violates these values. OD is wrong and LU is right. A good member of the community uses the latrine. In a group discussion, participants discuss these points.	Personal importance

New Delhi
202–203, Rectangle One
D-4, Saket District Centre
New Delhi – 110017, India
3ie@3ieimpact.org
Tel: +91 11 4989 4444

London
c/o LIDC, 36 Gordon Square,
London WC1H 0PD
United Kingdom
3ieuk@3ieimpact.org
Tel: +44 207 958 8351/8350

Washington, DC
1029 Vermont Avenue, NW, Suite 1000
Washington, DC 20005
United States of America
3ieus@3ieimpact.org
Tel: +1 202 629 3939

Strategy	Communication channel	Target individuals	Behavior change technique (BCT)	Activity	Ranas factor targeted
2	Household visit	All family members	BCT 10 Prompt public commitment	Family member commit to consistent latrine use through taking a family photo (also see Strategy 3).	Others' behavior
			BCT 34 Use memory aids and environmental prompts	Stickers are put on the tumbler normally used for anal cleansing. Another sticker is put at the place where the tumblers are stored or refilled before OD.	Remembering
		Male family members	BCT 26 Prompt specific planning	Participant plans when exactly to use the toilet in specifying the activities of their morning/evening routine. This includes identifying the activities he will perform directly before and after toilet use.	Action planning / Control

Strategy	Communication channel	Target individuals	Behavior change technique (BCT)	Activity	Ranas factor targeted
3	Phone	Male family members	BCT 34 Use memory aids and environmental prompts BCT 27 Prompt self-monitoring of behavior	Thank the participants for committing to latrine use. Participant is asked on the phone if he used the latrine.	Remembering/ Action control
			BCT 19 Prompt behavioral practice / BCT 22 Use arguments to bolster self-efficacy	In the same conversation participant is encouraged to use the latrine. "You can do it" "Try it once!" "You achieved XYZ so you will also achieve to use the latrine."	Confidence in performance
	Household visit	Male family members	*BCT 30 Prompt coping with barriers / BCT 32 Prompt to resist social pressure*	*Participant is asked if he has experienced barriers to latrine use and for his ideas how to overcome them. If he does not share barrier plans, the promoter suggests barriers plans from other participants. If participant names social pressure as a barrier he is provided with arguments how to resist.*	*Barrier planning*
			BCT 19 Prompt behavioral practice / BCT 22 Use arguments to bolster self-efficacy	In the same conversation participant is encouraged to use the latrine. "You can do it" "Try it once!" "You achieved XYZ so you will also achieve to use the latrine."	Confidence in performance
		All family members	BCT 10 Prompt public commitment	The family photo (see Strategy 2) is put on the template and stuck on the wall in the entry / veranda of the hose.	Others' behavior

Strategy	Communication channel	Target individuals	Behavior change technique (BCT)	Activity	Ranas factor targeted
4	Parents meeting in Anganwadi center	Lactating mothers, caregivers of children below 5 years.	*BCT 1 Present facts*	*Inform why child feces are likely to be a great danger for children.*	*Health knowledge*
			BCT 3 Inform about and assess personal risk / BCT 8 Describe feelings about performing and about consequences of behavior	*Each participant draws a household map of where the child normally defecates and plays. Transfer of feces from defecation to the playing area is visualized by colors. Discussion focusing on disgust and health consequences.*	*Vulnerability* *Feelings: Disgust*
			BCT 15 Provide instructions / BCT 18 Prompt guided practice	*Using posters, participants are informed on how child feces should be safely handled. Using chalk, Anganwadi teacher draws a toilet pan on the floor and participants practice with their children.*	*How-to-do knowledge / Confidence in performance*
			BCT 3 Inform about and assess personal risk / BCT 8 Describe feelings about performing and about consequences of behavior	*Each participant creates a second household map. This map includes the toilet and stickers showing the mother assisting the child with latrine use or safely disposing child feces. Discussion focusing on happy child and happy/good mother.*	*Feelings: Nurture*
			BCT 36 Prompt to agree on a behavioral contract	*The participants make the following commitment: whenever my child has to defecate, I take it to the toilet and safely dispose the feces. This is graphically documented on the template, the participants sign it and take it home. The old template is symbolically put in a dustbin.*	*Commitment*

Note: Target behavior for Strategy 1 to 3 is latrine use of all households members aged more than 5 years. Behavioral factors refer to this target behavior; Target behavior of Strategy 4 is safe disposal if child feces by caregivers. Behavioral factors for strategy 4 refer to this target behavior. Behavioral factors and BCTs in italic were selected based on qualitative findings. Underlined behavioral factors and BCTs were selected based on the quantitative baseline findings. Behavioral factors and BCTs without specific formatting were selected based on both qualitative and quantitative findings.

Appendix C: Main study outcomes disaggregated by socio-demographics

Variable			Latrine use households	Latrine use main respondent	Safe disposal of child feces
Gender of respondent	Male	M	0,806	0,781	0,074
		SD	0,346	0,340	0,244
	Female	M	0,775	0,789	0,131
		SD	0,365	0,338	0,306
Age Group Of respondent	Below 20 years	M	0,724	0,735	0,127
		SD	0,395	0,389	0,282
	20 to 29 years	M	0,796	0,793	0,112
		SD	0,351	0,330	0,288
	30 to 39 years	M	0,794	0,793	0,072
		SD	0,350	0,336	0,225
	40 to 49 years	M	0,811	0,781	0,108
		SD	0,353	0,340	0,284
	50 to 59 years	M	0,800	0,796	0,149
		SD	0,345	0,324	0,354
	60 to 69 years	M	0,764	0,776	0,108
		SD	0,361	0,345	0,292
	70 to 79 years	M	0,716	0,796	0,250
		SD	0,415	0,332	0,500
Land ownership	No	M	0,803	0,809	0,192
		SD	0,343	0,326	0,375
	Yes	M	0,787	0,779	0,089
		SD	0,359	0,342	0,256
Ration card	No	M	0,853	0,819	0,108
		SD	0,311	0,302	0,274
	Yes	M	0,785	0,782	0,106
		SD	0,359	0,341	0,282
Caste	General category	M	0,891	0,868	0,134
		SD	0,273	0,260	0,308
	Other Backward Classes (OBC)	M	0,828	0,822	0,143
		SD	0,324	0,311	0,329
	Scheduled Caste (SC/Dalit/Harijan)	M	0,712	0,718	0,075
		SD	0,384	0,368	0,213
	Scheduled Tribe (ST/Adivasi)	M	0,700	0,705	0,064
		SD	0,410	0,390	0,228
	Minority	M	0,839	0,811	0,108
		SD	0,322	0,304	0,270
	Others	M	0,934	0,916	0,250
		SD	0,209	0,223	0,500