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# Improving households' attitudes and behaviours to increase toilet use in Bihar, India

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# **Improving households' attitudes and behaviours to increase toilet use (HABIT) in Bihar, India**

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All opinions expressed, and mistakes in the report, if any, remain the responsibility of the authors.

## Summary

In this report, we present the results of the evaluation of the impact of a behavioural intervention in changing attitudes and practices around toilet use in rural Bihar. The broader context of this study is the push by the Swachh Bharat Mission to increase toilet construction and its information campaign to increase toilet use. Effective behavioural interventions to increase toilet use could contribute to increasing the success of the Swachh Bharat Mission.

The intervention tested here was designed to identify barriers to toilet use, and was based on formative research conducted between November 2016 and May 2017. While physical barriers such as poor toilet design or lack of water are important, the focus was on barriers that would be amenable to correction using a behavioural intervention. The study identified barriers that influence the intention to use the toilet, such as misconceptions about the rate at which the pit fills up (thus discouraging use), and aversion to emptying the contents of the pit. Further, even amongst those who may intended to use the toilet, barriers to habit formation included socialisation associated with open defecation and the lack of immediate rewards for toilet use.

Oxford Policy Management, ideas42 and World Vision India designed and developed a behavioural intervention directed at correcting the underlying cognitive biases, thus promoting the development of intention to use. It also included simple aids to help convert positive intention into habitual use. The intervention recognises the importance of influencing social norms to increase toilet use, and included meetings at community and household levels.

To measure the impact of this intervention on attitudes and practices, a randomised controlled trial was designed, with the assignment of wards into treatment and control clusters, in six blocks (in which World Vision India had pre-existing programmes) across six districts in Bihar. The eligible population for the study – households that have functional twin-pit toilets – was identified by a listing exercise, and data were collected from 12 such randomly selected households in each cluster, with an additional 5 in case of replacement.

Data were collected from 44 treatment and 44 control clusters, at baseline and endline, for a panel of approximately 1,100 households. A difference-in-difference analysis was undertaken to assess the impact. In addition, a process assessment at the midline and a qualitative evaluation at the endline were conducted. Together, these assessments provide a comprehensive picture of the effectiveness of the intervention, as well as the reasons for change (or lack thereof), and key implementation lessons.

We find a comparable and significant increase in toilet use across treatment and control areas. Self-reported toilet use increased substantially across three different measures of use (usual use, last time use and last three times use). Of the households in our study population, 83.0% reported that all adult members usually use the latrine, compared with 52.5% in the baseline study. Similarly, the share of households reporting that all members used the latrine the last time they defecated has also increased from 67.0% to 82.5%. This may be attributable to the ongoing efforts of the government and other organisations in eliminating open defecation in both areas. Our

intervention therefore did not have an effect on open defecation. Treatment areas did, however, show an increase in knowledge on correct pit filling rates, and decomposition rates, as well as an increase in the perceived convenience of pit emptying. Most households, however, still reported relying on hiring someone for pit emptying, not always waiting until decomposition was complete.

These results suggest the need for future sanitation programming to focus on knowledge of decomposition rates and the correct disposal of faecal matter, and to emphasise the ease of self-emptying. Sanitation programming must recognise deep-seated social and caste biases, which require sanitation to be treated as a social as well as a health issue.

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## **Abbreviations and acronyms**

BPL	Below poverty line
FGD	Focus group discussions
HABIT	Households' attitudes and behaviours to increase toilet use
HH	Household
IRB	Institutional Review Board
NREGA	National Rural Employment Guarantee Act
OBC	Other backward caste(s)
OD	Open defecation
ODF	Open defecation free
OPM	Oxford Policy Management
SBM	Swachh Bharat Mission
SC	Scheduled caste(s)
ST	Scheduled tribe(s)
SDGs	Sustainable Development Goals
WVI	World Vision India

# 1. Introduction

Safe sanitation is key to promoting better public health. Poor sanitation is known to be associated with childhood diarrhoea, mortality and stunting. A paper has identified exposure to open defecation (OD) as a possible determinant of stunting amongst children in India (Spears et al. 2013). The importance of proper sanitation is also recognised in the Sustainable Development Goals (SDGs), where SDG 6 is: 'Ensure availability and sustainable management of water and sanitation for all'.<sup>1</sup> Thus, health research and policymaking have firmly established the importance of safe sanitation in achieving health, and economic and human development progress.

India's sanitation problem has long puzzled health researchers and economists. Despite a burst of economic growth post-1991 and significant poverty reduction, in the area of sanitation there is still much to be achieved. A 2016 national survey indicated that over 50 per cent of the population in rural India continued to defecate openly (NSSO 2016). This was particularly bad in northern and western states in India, with the state of Bihar reporting the lowest toilet usage in the country (SBM 2019). In comparison, rural rates of OD in Bangladesh hover close to zero and in rural China are approximately 2 per cent (UNICEF 2017).

Several large-scale national programmes with a focus on toilet construction have been launched. However, rates of OD in India have not decreased in proportion to the significant increase in toilet coverage in recent years. National surveys identified the following reasons for non-use amongst toilet-owning households: 'not clean/insufficient water', 'malfunctioning of the latrine' and 'personal preference' (NSSO 2016).

Social scientists have also established a link between deep-rooted caste bias and sanitation practices in India. The Sanitation Quality, Use, Access and Trends Survey argues that persistent low toilet use in India is partly 'attributable to beliefs, values, and norms about purity and pollution of private spaces and of bodies'. These engrained beliefs help to explain household resistance to using affordable pit latrines and aversion to pit emptying, a task which has traditionally been looked upon as one to be done by particular groups (Coffey and Spears 2017). For instance, within the Hindu caste order, the 'outcastes', or Dalits, have traditionally been tasked with unpleasant jobs, such as cleaning human faeces. Dalits are expected to clean the households of higher castes and the 'impurity' associated with these tasks is also used as a reason to continually treat them as inferior (Valmiki 2003).

Similarly, a 2014 study argued that higher-caste groups reinforce their sense of superiority by not using and cleaning toilets – a task they believe belongs to the lowest castes (Modi 2014). Despite a legal ban on manual scavenging,<sup>2</sup> the practice continues.

The Swachh Bharat Mission (SBM), launched in 2014, provided an opportunity to look at the lack of toilet use from the perspective of behaviour change. One of the aims of this programme was to make India open defecation free (ODF) by October 2019. This

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<sup>1</sup> SDG 6 target 2 is: 'By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations' (United Nations 2015).

<sup>2</sup> The Prohibition of Employment as Manual Scavengers and their Rehabilitation Act 2013.

programme recognises the importance of promoting safe sanitation in the country, diverting considerable resources and attention to this aim. In a stark departure from previous sanitation programmes, the SBM recognises the importance of changing attitudes and behaviours around hygiene and sanitation, and includes information, education and communication campaigns.

In light of this socio-economic and policy background, our study tested the impact of simple behavioural nudges on toilet use amongst toilet-owning households in rural Bihar. This study used behavioural nudges to promote the intention to use, and the habit of using, the toilet; and tested the impact of a collection of nudges at household and community levels intended to improve toilet use. Additionally, it explored knowledge of, and attitude to, pit-filling rates and pit-emptying practices amongst toilet-owning households in rural Bihar.

Based on an extensive desk review, formative research and prototyping studies, we designed nudges that tackle knowledge around pit-filling rates, aversion to pit emptying and anxiety around pit maintenance and repair; and used habit-forming commitment devices to improve toilet use in treatment households. The intervention did not address issues with the supply and construction of toilets. A rigorous mixed-methods evaluation was carried out to measure the impact of this intervention. This report presents the results of the impact evaluation.

In the following pages we describe the intervention design, evaluation methodology, key findings and recommendations. Section 2 outlines the intervention design and theory of change. In section 3, we highlight the primary evaluation questions, study methodology and data collection protocol. Section 4 focuses on the key evaluation findings, including both process findings and impact analysis. Section 5 presents a very brief cost analysis. In section 6, we discuss the programme and policy relevance of the results outlined in section 4, placing our evidence within existing literature on sanitation and behaviour change. Here, we also discuss the stakeholder engagement and evidence use plan. Finally, section 7 highlights the key conclusions from this study and its recommendations for stakeholders.

## **2. Intervention, theory of change and research hypotheses**

### **2.1 Context and description**

The Improving households' attitudes and behaviours to increase toilet use (HABIT) intervention is a behavioural intervention directed at changing attitudes and behaviours around toilet use in rural Bihar. The design, implementation and evaluation of this intervention was undertaken by three partners: ideas42 (the behaviour science partner), World Vision India (WVI, the implementation partner) and Oxford Policy Management (OPM, the research and evaluation partner). The project was structured to allow for the evaluation inputs to contribute to the second phase of the SBM (the first phase of which came to a close on 2 October 2019).

Bihar was chosen as the site of the intervention given its poor sanitation record. Bihar performs poorly on various sanitation and health measures, with repeated surveys ranking it as low performing. The Census of India (Office of the Registrar General and

Census Commissioner 2011) reported that over 75 per cent of the state's population did not have access to a latrine. The 2016 Swachhta Status Report (NSSO 2016) found a modest improvement, reporting that 72.8 per cent of rural households in the state did not have access to a latrine facility. The latest figures from the SBM website at the time the intervention was being designed (February–June 2017) showed that Bihar had the lowest toilet coverage in the country, with only 48.4 per cent of households possessing a toilet (SBM 2019). Within Bihar, we decided to implement the intervention in six blocks where WVI was already undertaking its area development programme. The organisation's familiarity with the area, an existing rapport with block officials and the presence of facilitators already working in the area who would be able to undertake the implementation were key factors in taking this decision.

The intervention was designed based on the results of formative work undertaken between November 2016 and May 2017. The formative study involved a review of literature and fieldwork in five villages in the Nalanda district of Bihar (3ie n.d.). The formative research identified the following behavioural barriers to intention (to use the toilet) formation: insufficient information around pit-emptying options; a strong aversion to pit self-emptying; and underestimation of pit-filling rates. In combination, these created a strong belief that the latrine is a limited resource to be used mostly by younger women or the elderly, at night-time or in case of ill health.

It is important to note that, at the time of designing the intervention, we were aware of ongoing SBM activities and the role of local self-help groups in promoting sanitation behaviours in the study areas. SBM activities included construction of toilets and behaviour change messaging. Local JEEViKA self-help groups were used to deliver awareness, training, finance and monitoring information on sanitation and nutrition in an integrated manner.

During the formative research, respondents were questioned about the SBM activities and we found low recall of the programme. However, during the implementation period for the intervention, the intensity of SBM activities in Bihar increased enormously. For example, in April 2018 the prime minister of India stated that 850,000 toilets had been built in a week in the state of Bihar (Economic Times 2018). While the original design acknowledged the presence of SBM activities, and this intervention was designed as SBM+ (as evidenced in the formative and baseline report), the unprecedented increase in intensity of SBM activities did change the operating environment.

Apart from barriers to intention formation, barriers to habit formation are also important. We found that the barriers to habit formation include deeply embedded cultural rituals surrounding OD and lack of immediate, visible rewards for latrine use. Recognition of the health benefits of toilet use was low amongst all respondents. Our formative research focused on barriers that may be amenable to behavioural interventions, thus dissatisfaction with toilet design, although identified, could not be addressed in this study.

### **2.1.1 Intervention**

Based on the formative research, the team – composed of OPM, ideas42 and WVI – entered an iterative design phase, where different design ideas were prototyped and piloted, leveraging WVI's network of community facilitators and volunteers. We designed










these interventions to be implemented through two touch points: community meetings and household visits. At each touch point, similar barriers are addressed, but through different activities (as shown in Figure 1).

Behaviour science aims to pinpoint where cognitive biases drive mental models, resulting in suboptimal behaviour. The interventions in this activity are designed to shift negative mental models resulting in the intention to form positive behaviours around latrine use. Behavioural research in the water, sanitation and hygiene sector demonstrates that simple tools introducing information through demonstrations, games and invitations to share current mental models are often more powerful than simply providing information or training alone (Neal et al. 2016). The activities in community meetings and habit-forming interventions are intended to correct mental models about pit-filling rates and latrine lifetimes. The design team hoped that leveraging the generation effect – where information is better remembered if it is *generated* from one's own mind rather than simply read – will prove effective. In turn, this shift in mental models was expected to lead to intention formation to use the latrine, creating the likelihood of a move towards habitual use.

The eligible population for the study were households that have functional twin-pit toilets in six blocks across six districts of Bihar (Jamui, Khagaria, Madhepura, Nalanda, Nawada and Saharsa) within which our implementation partner, WVI, was already working. We focused on twin-pit toilets, as this is the model recommended for toilets constructed using a subsidy under the government's SBM. Since we hope to feed the results into the government programme, it is important to be aligned with the government's approach.

Figure 1 gives an overview of the intervention design. Adaptations made to the design are described in section 4.1.1.

**Figure 1: Overview of the intervention design**

Meeting type	Frequency	Intervention details	
Community meetings	Two community meetings during the first and fifth months	<ul style="list-style-type: none"> <li>• French drain</li> <li>• Card game</li> <li>• Pledge</li> <li>• Handling of decomposed faecal matter</li> </ul>	   
Household visits	Four household visits during the second, third, fourth and sixth months	<ul style="list-style-type: none"> <li>• Card game</li> <li>• Calendar to track toilet use</li> <li>• Lockbox to save money</li> <li>• <i>Agarbatti</i> demo<sup>3</sup></li> </ul>	  

Source: Photos taken by the members of the Improving HABIT study team.

<sup>3</sup> While the *agarbatti* was initially intended to be a part of the household visit, this was dropped during the intervention. The reasons for this are discussed in section 4.1.1. An *agarbatti* is a thin wooden stick covered in a substance that is burned to produce a pleasant smell, especially as part of a religious ceremony. It is commonly used in Indian households.

The timeline and spacing of activities are shown in Figure 2.

**Figure 2: Implementation timeline**



Note: HH = household.

Community facilitators (who are WVI staff) were responsible for implementing the intervention. Each facilitator worked in a pre-defined area, consisting of approximately two to three panchayats. The facilitators were responsible for conducting the Improving HABIT-related household and community meetings in these jurisdictions. Each facilitator was given a list of eligible households in their clusters, as well as a chalkboard, posters and other intervention material. Facilitators were assisted by local volunteers, who are part of the community and operate at village level.

Community meetings were held at ward level. The meetings included components that addressed intention formation and habit formation:

- During the French drain demonstration, the facilitator used a bucket filled with holes to demonstrate how faecal matter in the pit loses volume during decomposition. The French drain demonstration aimed to create an intention for latrine use by displacing an incorrect heuristic about how quickly the pit fills.
- The card game helped to demonstrate the correct pit-filling rate for a standard-sized pit, based on use by families of different sizes. This game also aimed to create an intention for latrine use by resetting faulty mental models about how long pits take to fill;
- All meeting participants made a pledge to use the toilet regularly. This pledge was meant to help create a habit by getting participants to commit to latrine use; and
- Facilitators handled decomposed faecal matter in order to reduce aversion to pit emptying and handling of decomposed faecal matter. This was meant to create an intention for toilet use.

The household visits included additional components that also addressed barriers to intention and habit formation:

- The card game helped to impart the correct information regarding the pit-filling rate for the household, in order to form intention for toilet use;
- Each household received a poster with their pledge to reaffirm their commitment and help form a habit. The poster also contained contact information of WVI staff in case of queries; and

- Each household received a chalkboard to track the toilet use of different family members and hold family members to their commitment,<sup>4</sup> helping to create a habit of use.

Each household received a lockbox to save money for expenses associated with toilet maintenance and toilet repair. This lockbox acted as a commitment device to help the family maintain their habit of use.

The two community meetings were conducted in the same manner. The content of all four household visits was similar.<sup>5</sup>

## **2.2 Theory of change**

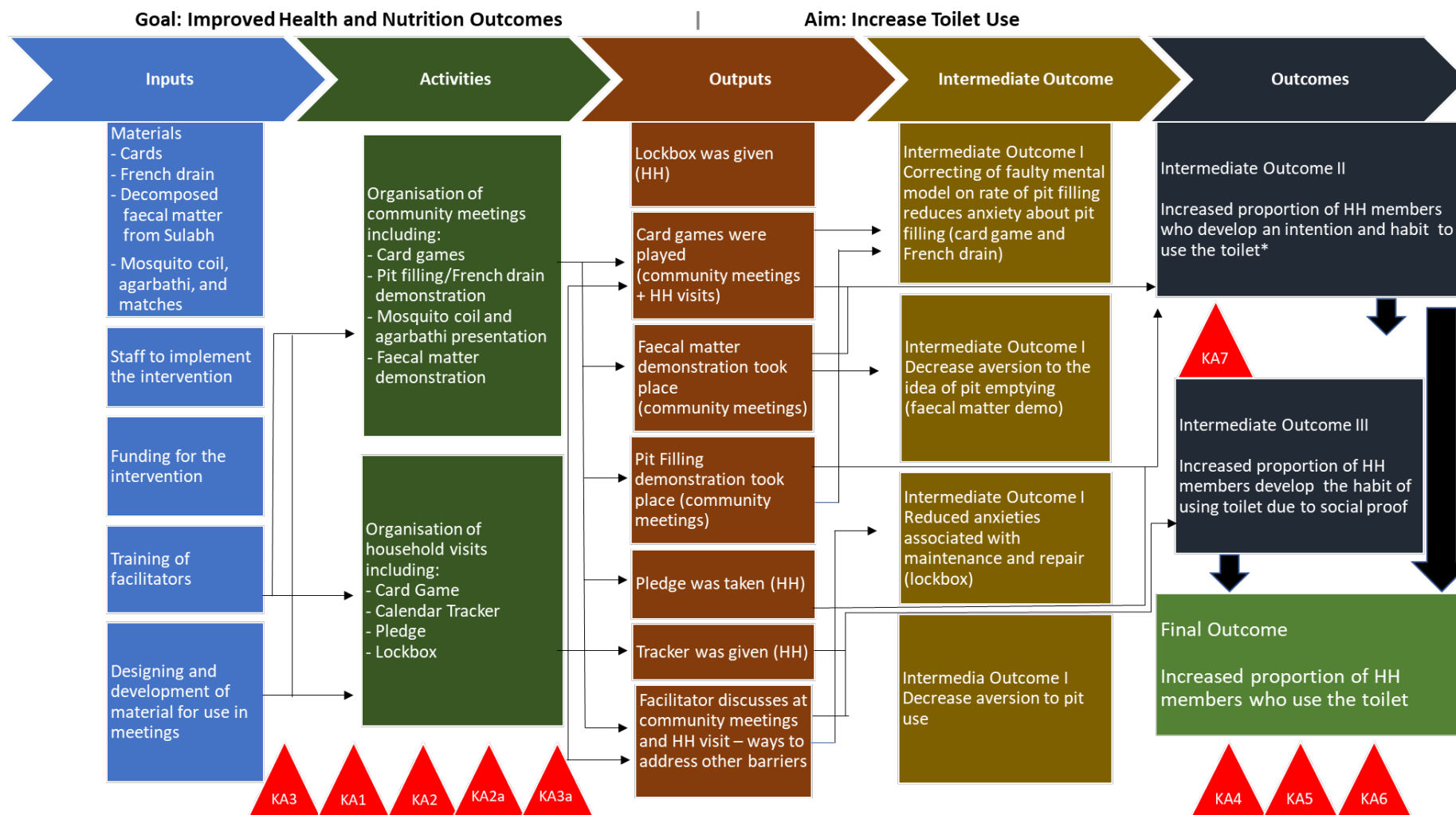
The theory of change for this intervention is represented in Figure 3, together with its underlying key assumptions

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<sup>4</sup> The chalkboard is referred to as a calendar in other documents. Both terms relate to a chalkboard calendar provided to the households to track the toilet use of each household member.

<sup>5</sup> More detail on the manner in which the intervention was carried out by the facilitators can be found in the process assessment report (Padmanabhan et al. n.d.).

Figure 3: Theory of change





The assumptions in the theory of change are given below:

- KA1: Facilitators are trained properly and deliver the programme with fidelity;
- KA2: Target households' attendance at community meetings;
- KA2a:\* Household members present at the community meetings convey the information to household members not present at the community meetings;
- KA3: Presence of at least some household members during household visits;
- KA3a:\* Household members present during the visits convey the information to household members not present during the visits;
- KA4: Increase in the intention to use (given correction of mental models) is not hampered by other barriers to intention formation (which are not addressed by the intervention);
- KA5: Households are committed enough to put money regularly in the lockbox and the amount is sufficient to serve the purpose of allaying anxiety;
- KA6: Households put into practice the discussion on addressing some of the barriers to use, allowing for the development of the habit amongst those who have the intention; and
- KA7: Increase in the translation from increased intention to habitual use is not hampered by other barriers to use.

\* Assumptions KA2a and KA3a were added after the findings of the process assessment (Padmanabhan et al. n.d.).

With regard to assumption KA4, our formative work suggested that other barriers, such as financial constraints can play a role in the inability to construct a toilet, despite there being an intention to use. Since this intervention is implemented in households with pre-existing toilets, this would not be a constraint. With regard to assumption KA7, formative work, as well as regular meetings during monitoring, suggested that there may be non-behavioural barriers to translation of intentions into habits, such as poor quality of construction of the toilet (e.g. poor light, space, ventilation). Since the focus of this intervention was to address behavioural barriers, we were not able to correct such factors.

The validity of the assumptions was qualitatively tested during process assessment and discussed in section 4.1.4.

## **2.3 Intervention monitoring plan**

The research team was cognisant that implementation fidelity was crucial to study the impact of this intervention. To ensure adherence to the intervention protocol, WVI implementation staff were part of an intensive training programme that highlighted the design and goals of the study. This training was co-led by a principal investigator.

OPM designed monitoring sheets to be filled in by the implementation staff after each community meeting and household visit. These sheets were then verified by the OPM team, who checked the data and explored any unusual trends in the data.

Regular Skype meetings between OPM, ideas42 and WVI helped monitor the progress of the implementation. Implementation challenges and design changes (if any) were discussed on these calls and documented in learning journals. Midway through the intervention, in August 2018, an OPM team conducted a process assessment of the

intervention. The team observed community meetings as well as household visits; and key findings from the assessment were shared with the implementation staff.

### **3. Evaluation questions, design, methods, sampling and data**

#### **3.1 Evaluation questions**

Toilet use is the intended outcome of the Improving HABIT intervention. Our intervention was targeted towards increasing the intention to use, and the habit of using, a toilet amongst members of households within our study sample. The sampling frame is restricted to households that have a functional twin-pit latrine. The study design is also tailored to capture any difference in intra-household toilet use. We have included a hypothesis that the intervention will have an impact on the safe disposal of child faeces (Primary hypothesis 2c). While our study was not powered to test this hypothesis, we will explore this indicator as an outcome to test whether toilet use amongst adults translates into positive outcomes for their children.

We have listed the primary hypotheses, intermediate hypotheses and corresponding evaluation questions for this study below:

- Primary hypothesis 1a (H1a) – household level: the intervention will increase toilet use amongst treatment households. Is the behavioural intervention successful at increasing toilet use amongst treatment households (increase in the proportion of households in which all members use the toilet)?
- Primary hypothesis 1b (H1b) – household members, individual level: the intervention will increase the number of members within treatment households who regularly use toilets. In several households, some, but not all, members use the toilet regularly. This intervention targets improving rates of toilet use amongst all individual members of the household. Is the behavioural intervention successful at increasing toilet use amongst household members within treatment households?
- Primary hypothesis 2a (H2a) – individual level: the intervention will increase toilet use amongst adult male members (in this context, adult is defined as aged five and above) within treatment households. Data suggest that gender has a significant impact on rates of OD and that males use a latrine much less often than females. This study explores gender-disaggregated impact on toilet use. Is the behavioural intervention successful at increasing latrine use amongst male members in treatment households?
- Primary hypothesis 2b (H2b) – individual level: the intervention will increase toilet use amongst adult female members (aged five and above) within treatment households. Is the behavioural intervention successful at increasing latrine use amongst female members in treatment households?
- Primary hypothesis 2c (H2c) – individual level: the intervention will increase the safe disposal of child faeces for children below the age of five within treatment households. Is the behavioural intervention successful at increasing safe disposal of faeces for children below the age of five in treatment households?
- Intermediate hypothesis 1a (IH1a): the intervention will increase information on the correct rates of pit filling amongst treatment households. Is the behavioural intervention successful at providing information on the correct rates of pit filling to household members in treatment households?

- Intermediate hypothesis 1b (IH1b): the intervention will correct misconceptions on the rates of pit filling amongst treatment households. The baseline survey found that a majority of the study households incorrectly estimated the rate of pit filling (both overestimation and underestimation). This intervention is targeted at correcting those misconceptions. Is the behavioural intervention successful at correcting incorrect knowledge on the rate of pit filling amongst household members in treatment households?
- Intermediate hypothesis 2 (IH2): the intervention will reduce aversion to pit emptying amongst treatment households. Our formative study, coupled with existing literature, points to deep-seated aversion to pit emptying amongst households in India. This is rooted in concepts of caste, purity and pollution. Most households 'fear' the need to empty the pit or employ a manual scavenger to clean it. This intervention is targeted at mitigating these attitudes to self-pit emptying. Is the behavioural intervention successful at reducing the aversion to self-pit emptying amongst household members in treatment households?
- Intermediate hypothesis 3 (IH3): the intervention will reduce anxiety associated with maintenance and repair of toilets amongst treatment households. During the formative study, many households reported not using toilets due to maintenance, repair and cleanliness issues. This intervention aimed to reduce the anxiety associated with the same and provide a regular savings mechanism, which could be used for maintenance and cleaning of the household toilet. Is there reduced anxiety associated with maintenance and repair of toilets amongst households that receive the treatment?
- Intermediate hypothesis 4 (IH4): the intervention will increase the habit of toilet use amongst treatment households through the mechanisms of a pledge and chalkboard. While some members of the household expressed an intention to use the toilet, this did not always translate into the habit of toilet use. Use of regular reminders, scheduling mechanisms and public commitments can be important devices for translating intention into habit. This intervention uses pledges at community meetings and household-level toilet use chalkboards to promote toilet use amongst households. Is there an increased habit of toilet use amongst members in the treatment households due to the use of a pledge and chalkboard?

Together, these hypotheses seek to test the impact of the Improving HABIT behavioural intervention on the intention to use, and the habit of using, the toilet in treatment households. In addition to the primary indicator of toilet use, the intervention also tests impact on other behavioural barriers, such as knowledge of pit filling and attitudes towards pit emptying. These provide indications on the potential impact of behavioural interventions in changing attitudes around toilet use and pit emptying.

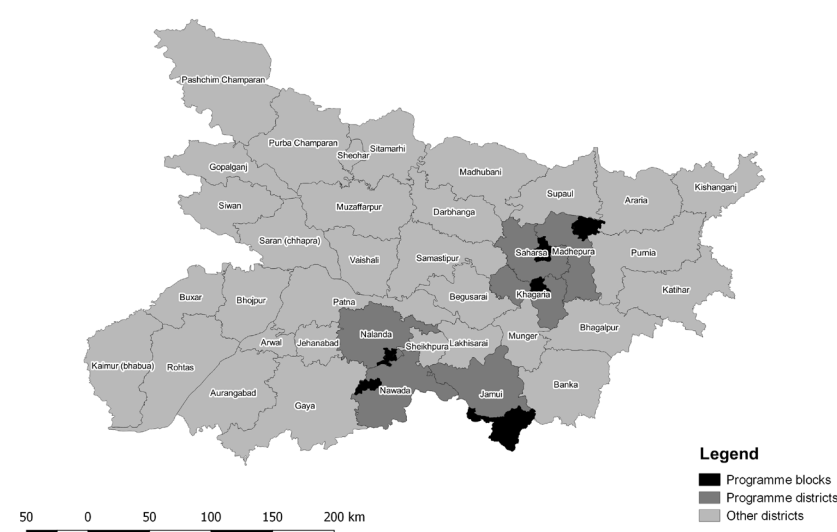
### **3.2 Evaluation design and methods**

This study tests the impact of a behavioural intervention in changing attitudes and practices around toilet use in rural Bihar. To test this impact, we used a randomised controlled trial design of experimental evaluation, where the treatment group consists of households targeted for the intervention, to be compared with the control group where households are not targeted. By random assignment, using a panel and comparing differences between baseline and endline, any difference in the outcome indicators between the groups can be attributed to the intervention.

The intervention provided information aimed at correcting faulty mental models related to latrine use. Since behaviour change interventions run the risk of spillovers, we adopted a village-level clustering design. This cluster approach also captures the positive externalities of the intervention, such as the peer effect of toilet usage. To ensure comparability between treatment and control groups and address selection bias, we randomly assigned clusters into the two arms of the study. Online appendix D presents the evaluation design.

The eligible population for the study were households that have functional twin-pit toilets<sup>6</sup> in the six blocks within which our implementation partner, WVI, operates.

**Figure 4: Map of study areas in Bihar**



Source: <http://projects.datameet.org/maps/districts/> (map prepared using QGIS software)

There are 92 villages with eligible households in which WVI operates. These 92 villages formed our sampling frame, from within which we randomly selected 43 treatment and 43 control villages to be a part of our study. Wards within the selected villages were selected using probability proportional to size sampling for the implementation of the study.<sup>7</sup> All households within treatment wards that met the selection criteria were eligible to receive the intervention. The sampling process followed is described further in section 3.4.

While the intervention targeted all eligible households in treatment areas, participation in the intervention was voluntary.<sup>8</sup> Also, there can be a knowledge spillover effect from the participating households to non-participating households. Hence, a simple comparison of outcomes for participant households versus non-participant households may overestimate the causal impact of the intervention. To address this problem, we applied intention-to-treat estimates, which consider the outcome of the households in the treatment and control groups, irrespective of their actual treatment receipt.

<sup>6</sup> The criteria for a functional toilet are: (1) pan is not cracked/broken; (2) pan is not blocked; (3) latrine has a completed pit (can be defined as a covered pit); and (4) link between pan and pit is not broken.

<sup>7</sup> A ward is an administrative unit within a village. Each ward has its own elected representative.

<sup>8</sup> Non-participation from an eligible household could be due to a number of reasons outside the control of the intervention. For example, households may or may not attend community meetings, or allow the facilitator to complete the household-level intervention.



Power calculations at the inception stage indicated that collecting data from a panel of 10 eligible households in 86 clusters<sup>9</sup> (43 clusters in each study arm) is sufficient to detect a 10 per cent change in the proportion of eligible households where at least one person is defecating in the open.<sup>10</sup> This corresponds to a 0.2 (approximate) standardised effect size, which is a reasonable level of change to be expected in quantitative impact evaluations (Cohen 1988). Online appendix H presents the values of relevant technical parameters used in estimating power for the survey.

To account for attrition, we aimed to cover 90 clusters (45 clusters in each arm) and 12 eligible households (instead of 10) in each cluster. Our target sample size was 1,080 households. During the baseline survey, we collected data from 1,108 households (557 in the control arm and 551 in the treatment arm) spread across 88 clusters (44 in each treatment and control arm). Of these, we revisited and collected endline information from 1,085 households, comprising 534 and 551 households in the treatment and control arms, respectively. The attrition rate from baseline to endline was 2.08 per cent. The final sample size of 1,085 in the balanced panel meets our target of 1,080 households, which was required to maintain the power of the impact estimates.

Since we have used a village-level clustering to prevent spillovers, this study will likely not be adequately powered to conduct subgroup analysis, and subgroup analysis is not expected.

### **3.2.1 Qualitative design**

Our research approach was a mixed-methods sequential explanatory design, in which qualitative data collection followed quantitative data collection and analysis—collected one after the other. The qualitative study used research methods such as in-depth interviews, key informant interviews and focus group discussions (FGDs). Each method is particularly suited for obtaining a specific kind of data, which also enabled us to substantiate the findings of the quantitative study. The qualitative study also leaned on the insights from the process assessment, conducted in August 2018. Triangulation and cross-fertilisation of quantitative and qualitative approaches took place at:

- Methodological stage – Quantitative data and analysis and the process assessment informed the development of qualitative sampling and tools;
- Inferential stage – Quantitative and qualitative inferences were analysed through each other's lenses and discussed during meetings/workshops. Each section was jointly written by qualitative and quantitative teams to draw a coherent narrative on the impact of the intervention; and
- Meta-inferential stage<sup>11</sup> – Meta-inferences from the data analysis were discussed and agreed on by both teams. Combined meta-inferences gave rise to joint policy recommendations.

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<sup>9</sup> Clusters refer to wards selected to be a part of the study.

<sup>10</sup> OPM's own power calculation formula produced similar results.

<sup>11</sup> In most mixed-methods research studies, there are usually two strands – a qualitative and a quantitative which could be conducted simultaneously, concurrently or sequentially. Relevant inferences of each strand are made using data and analysis of that strand, but inferences of different strands are integrated to produce a meta-inference that can illustrate how the overall findings explain the purpose of the mixed-methods research study. This often feeds into the recommendations stemming from the study (Riazi 2016).

The various methods used in the study were:

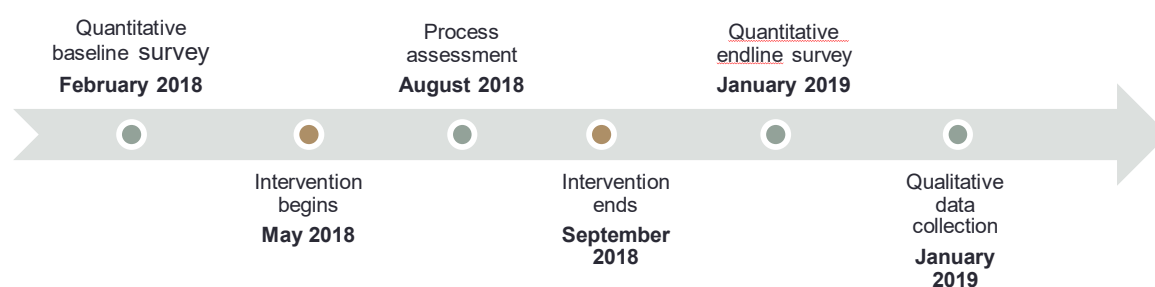
- In-depth interviews with household members: conducted with one adult member per household, who was present for at least one of the two interventions (community meeting and household visit). The respondents in the sample belonged to scheduled caste (SC) and other backward caste (OBC) households;
- FGDs with community members who attended community meetings: were conducted primarily with women. The caste composition of the focus groups was completely homogeneous, with respondents belonging to either SC or OBC households, depending on the caste predominant in the sampled ward. The age group of the women in the focus group ranged from 24 to 50 years;
- Key informant interviews were conducted with the following people:
  - Members of village institutions such as the *mukhiya* (village head), ward members and JEEViKA cluster mobilisers, to gain a better understanding of parallel sanitation interventions ongoing at the village and block level;
  - People who empty pits for a living, to understand the existing pit-emptying behaviour of households and supply-side issues related to pit emptying; and
  - WVI representatives, to document implementation challenges (if any) and gain contextual understanding of the region and household practices, in general.

More details on the qualitative sampling including a table on the respondents can be found in section 3.4.

### 3.2.2 Evaluation timeline

A quantitative baseline household and community survey were conducted in February 2018. The Improving HABIT intervention started in May 2018. A process assessment of the intervention was conducted in August. Following the completion of the intervention in September 2018, we conducted the endline data collection, both quantitative and qualitative, in January 2019.

**Figure 5: Timeline of activities**



### 3.3 Ethics

Ethical consent for carrying out the data collection, both qualitative and quantitative, for this study was received from the Sigma Institutional Review Board (IRB).<sup>12</sup> Consent procedures were in line with those laid out by the IRB. Consent forms informed survey respondents of the expected time of participation, and the benefits, risks and discomforts associated with participating. The respondents were informed that participation in the survey was voluntary and that they were free to stop answering the questions at any time. After a full informed consent statement was read to the respondents, oral consent to proceed with the interviews was obtained and documented by the enumerator.

<sup>12</sup> Sigma IRB approval number: 10065/IRB/D/18-19.

Enumerators were trained to pay attention to cultural sensitivities, as well as the privacy and confidentiality of respondents. Adequate ethical training was given to all enumerators and OPM staff. Given that interviews could bring up topics such as caste hierarchies, purity and pollution, enumerators were trained to keep in mind cultural notions and norms. Enumerators also have the potential to influence the responses, so they were trained to remain neutral and make the respondents comfortable. All qualitative interviews were monitored by OPM staff who are trained to oversee and guide qualitative research, ensuring that no ethical protocols were violated.

The confidentiality of electronic data was maintained. Personal identifiers were removed from data collected. Any physical data will be securely stored for three years in accordance with general practice. Data were computer-entered using password protection. Only research staff have access to collected data.

### 3.4 Sampling and data collection

#### 3.4.1 Quantitative sampling

A three-stage sampling procedure was used to achieve a representative sample of households to be interviewed (Online appendix D has a detailed chart describing the selection process):

1. **Selecting villages:** treatment and control villages were selected using simple random sampling from the list of all villages where WVI has a presence. There were 43 treatment and 43 control villages selected for panel data collection across the baseline and endline surveys.
2. **Selecting wards:** there were 45 treatment and 45 control wards selected using probability proportional to size sampling from the list of all wards in the randomly selected treatment (and control) villages. Prior to sampling, very large wards were broken up into smaller units. Out of the selected wards, small wards were combined with nearby non-selected wards to ensure that each survey cluster had roughly 30 eligible households. In the absence of suitable wards to combine with, two treatment wards with fewer than 30 eligible households and two control wards with fewer than 30 eligible households were combined. This process resulted in a total of 44 treatment and 44 control wards, respectively. In the case of combined treatment wards, the intervention was implemented in the larger combined wards by WVI. This process is described in greater detail in the baseline report for this study (Viswanathan et al. 2018).
3. **Selecting households:** eligible households in the selected wards were identified through a comprehensive household-listing exercise. A sample of 12 households (and a replacement sample of 5 households) were selected using simple random sampling and interviewed from each cluster. Table 1 provides the achieved sample sizes across the baseline and endline surveys.

One adult woman respondent in each sample household was interviewed. Some modules were preferentially administered to adult males (around specifics of toilet construction such as materials used, money spent etc), if one was available during the interview. During the endline, efforts were made to interview the same respondent who was interviewed at baseline. Where this was not possible, another adult woman from the household was interviewed.

**Table 1: Final sample size by district**

District	Control areas			Treatment areas		
	Wards	Baseline households surveyed	Endline households surveyed	Wards	Baseline households surveyed	Endline households surveyed
Jamui	4	50	50	1	7	7
Khagaria	23	299	296	12	153	148
Madhepura	2	24	23	4	52	52
Nalanda	8	98	96	10	128	126
Nawada	3	36	36	7	88	82
Saharsa	4	50	50	10	123	119
<b>Total</b>	<b>44</b>	<b>557</b>	<b>551</b>	<b>44</b>	<b>551</b>	<b>534</b>

### 3.4.2 Data description

We used two instruments for quantitative data collection: a household-level instrument and a community-level instrument. Detailed information on both instruments is provided in Online appendix F.

### 3.4.3 Specifications and explanatory variables

To evaluate the impact of the intervention, we have used the following specification:

$$Y_{ijts} = \beta_0 + \beta_1 Treat_j + \beta_2 Post_t + \beta_3 (Post_t * Treat_j) + \beta_4 X_i + \beta_5 Strata_s + e_{hjt}$$

where  $Y_{ijts}$  is the outcome of interest for household  $i$  at time  $t$  in ward  $j$  and  $Strata_s$ . The dummy variable  $Treat$  captures the differences between the treatment and control groups, equalling ‘1’ if households belong to a treatment ward. The time-period dummy variable  $Post_t$  is an indicator that equals ‘1’ if the time period is 2019 (12-month follow-up). It captures aggregate factors that lead to change in  $Y_{ijts}$  even in the absence of an intervention. The interaction term  $(Post_t * Treat_j)$  represents the observations that received the intervention (i.e. treatment group) by the end of the intervention; this is the difference-in-differences estimator.  $X_i$  is a vector of household- and individual-level characteristics, which include: the education level, religion, caste and sex of the household head; the household’s poverty line status; the share of individuals within the household who work in agriculture, and the share of disabled members within the household; and water availability, as well as indices capturing toilet infrastructure, use and barriers to use.  $Strata_s$  refers to district-specific fixed effects.<sup>13</sup> This specification has been estimated using ordinary least squares.

<sup>13</sup> District-level fixed effects were applied because we find that the districts vary considerably on socio-economic and sanitation parameters. We expect limited within-group variations at the village level, with many of the variations in ‘unobservable’ characteristics likely captured by household-level characteristics such as religion, caste, etc. As a robustness check, we ran the primary outcome indicator of toilet use using a variation on the district-level fixed effects model by using village-level fixed effects instead, as well. We find that this does not change the direction or strength of the impact estimates. Consequently, we have applied district-level fixed effects throughout the analysis.



The outcomes of interest are:

- toilet use
- receipt of information on pit-filling rates
- correct knowledge of pit-filling rates
- aversion to pit emptying
- expenditure on maintenance and repair of latrines.

These are described in greater detail in section 4.2.2, where the impact estimates for each are presented.

#### **3.4.4 Mitigating bias**

Toilet use is a key outcome variable, with a sizeable potential for self-report bias. Some possible reasons for this include: (1) SBM and the government's push towards toilet use, incentivising all respondents to report socially desirable behaviour; and (2) selection of households based on toilet characteristics may have revealed the objectives of the study to respondents.

Based on this understanding, we adopted the following mitigation strategies during data collection: (1) toilet use questions were asked immediately after the health and disability roster and before detailed questions on toilet attributes, which could bias answers; (2) the consent form did not focus on health and hygiene but mentioned broader topics about life and livelihood in villages; (3) questions on children's defecation practices were asked before questions on adults; and (4) we employed temporal variations to the questions on toilet use (for example, by asking both where household members defecate *usually* and where they defecated *the last time*, respectively). In addition, we also employed direct observation of toilet characteristics to determine whether the toilets appeared to be in use.

Despite these measures, we acknowledge that respondents may have over-reported toilet use in the survey. However, we do not expect the over-reporting to be very different between control and treatment clusters.

For our qualitative study, we designed tools that included detailed probes on toilet use, focusing on challenges related to using the toilet. We also re-confirmed responses by repeating questions on toilet use towards the end of the interviews and asking field investigators to observe toilet characteristics to determine usage. Investigators were also trained to avoid asking leading questions, to avoid biasing responses.

#### **3.4.5 Addressing potential spillover effects**

##### *Contamination*

We expect little risk of spillover from the treatment to the control, as no treatment and control cluster were in the same village. However, it was still possible for control and treatment clusters from different villages to be adjacent to each other. To limit this, we created maps of treatment and control clusters with as much precision as possible, to make sure that the majority of control and treatment areas were non-contiguous.

Since WVI staff operate in both treatment and control areas, the risk of spillover due to programme-level factors still exists.<sup>14</sup> To combat this, we held detailed training for the WVI staff, and do not expect such spillovers to be significant.

#### *Hawthorne effects*

Hawthorne effects are unlikely to affect treatment and control households in our experiment. Our survey includes direct observation of toilets to indirectly measure use at the household level. Since households did not have prior information about the interview, they could not have modified the appearance of their toilets before the direct observation.

#### *Positionality effects*

Researcher positionality is likely to have a limited effect. All researchers engaged in data collection were from similar areas, with limited field presence from the core research team.

#### *John Henry effects*

John Henry effects are unlikely to occur in our experimental setting, as households in the control group do not have access to the intervention or information around it.<sup>15</sup>

### **3.4.6 Qualitative sampling**

For the qualitative study, we used a purposive sampling strategy to identify respondents.<sup>16</sup> This strategy ensures maximum coverage of areas while incorporating insights from a cross-section of respondents.

- 1. Selection of districts:** a few key preliminary quantitative findings were used to guide the qualitative sampling. Change in incidence of OD was used as the main parameter for identifying districts. Change in toilet use patterns is our key indicator of interest. We believed that exploring variation in this would help us understand the extent to which the intervention influences toilet use behaviour.<sup>17</sup> Based on these indicators, the two districts selected for the sample were Saharsa and Nalanda.
- 2. Selection of villages and wards:** within sample districts, two treatment villages with the highest number of intervention households were selected. Within each village, we selected wards with a high number of intervention households and a relatively higher representation of marginalised castes, includes SC, OBC and scheduled tribes (ST). The wards within the selected districts that we visited for the qualitative study were: Baijnathpur Wards 5 and 2, Chandaury East Ward 1, Beldariya Ward 3 and Puraini Ward 5.

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<sup>14</sup> WVI staff work in the areas of child nutrition, education, drinking water and sanitation across the study areas. For example, a WVI staff member may have been put in charge of the intervention in a given treatment area, while he/she continued to conduct his/her regular duties in a nearby control area.

<sup>15</sup> The study randomisation was carried out at the village level and the treatment was carried out at the ward level, with the treatment ward randomly chosen amongst all wards in the treatment village. Households in the control group do not have access to the intervention or information around it. Moreover, the package of activities planned at the community and household levels is not subsidy based, making it unlikely for households in control areas to react to the exclusion.

<sup>16</sup> Purposive sampling is a non-probability sampling strategy that is selected based on characteristics of a population and objective of the study. This is useful when proportional sampling is not the motive but to reach a targeted sample quickly.

<sup>17</sup> The qualitative study also made the active choice not to visit the districts visited during the process assessment (Nawada and Khagaria).

- 3. Selection of respondents:** to develop a holistic picture of the intervention impact and general toilet use behaviours in the wards, we interviewed a range of respondents in each ward. The respondents were categorised into two groups: participants (people who received treatment) and key informants (people who could provide contextual understanding, for data triangulation). Table 2 outlines the respondents and data collection methods used.

**Table 2: Qualitative study respondents**

Respondents	Data collection method	Interviews conducted		
		Per village	Per district	Total
Individual household members	IDI	4	8	<b>16</b> (10 females, 6 males)
Village institution representative	KII	1	2	<b>4</b> (1 <i>mukhiya</i> , 1 ward member, 2 JEEViKA cluster mobilisers)
WVI representative	KII	-	1	<b>2</b>
De-sludger	KII	-	1	<b>2</b>
Community members	FGD	1	2	<b>4</b> (All females)
<b>Total</b>				<b>28</b>

Notes: IDI = in-depth interview; KII = key informant interview.

More details on the qualitative sample and fieldwork strategy are provided in Online appendix F.

### 3.4.7 Quality control

OPM India has extensive quality control measures for quantitative and qualitative surveys, which include: field supervision and quality assurance; daily data consistency checks; data back checks; daily debriefs; and revisiting interviews where necessary.

## 4. Findings

### 4.1 Intervention implementation fidelity

In this section, we use integrated mixed-methods analysis to describe the intervention's fidelity, intervention take-up, constraints and assessment of the assumptions in the theory of change. Our findings draw on qualitative interviews with households and WVI staff from the process assessment (Padmanabhan et al. n.d.) conducted in August–September 2018 and WVI's monitoring data. We find that, while the intervention had broad fidelity, several factors such as extent of exposure to the intervention, varying levels of adherence to the 'intervention script' and contextual factors influenced the implementation and intervention take-up.

#### 4.1.1 Fidelity

Implementation fidelity refers to the degree to which the implementation was delivered as intended (Carroll et al. 2007), and is assessed by its coverage, dose, exposure and content, as defined in Table 3. In this section, we discuss the intervention's fidelity using these components.

**Table 3: Definitions of terms used to assess implementation fidelity**

<b>Components of implementation fidelity</b>	<b>Definition</b>
<b>Coverage</b>	Whether all the people who should be participating in an intervention do so
<b>Dose and exposure</b>	Dosage (dose delivered) and exposure (dose received) refers to whether the incidence and duration of the activities are as prescribed
<b>Content</b>	Whether a programme, service or intervention is being delivered as it was designed

### *Coverage*

The intervention had high levels of coverage. According to monitoring sheets, almost all households identified as eligible for the intervention received it. Of a total of 1,806 eligible households, WVI was not able to visit only 5 households for the first household visit, 10 for the second one, and 11 each for the third and fourth ones. The main reasons for not covering households included: (1) the non-availability of the household at the time of the meetings; and (2) the household toilet being demolished or not functional at the time of the household visit. Two community meetings were conducted, with an average of 44 participants per meeting.

### *Dose and exposure*

The dose and exposure of the intervention varied by facilitator and local volunteer. The implementation guidelines do not prescribe the duration for the household or community meetings, leaving it up to the facilitators' discretion.

The duration of the household visits observed varied from 10 to 30 minutes each. Facilitators reported spending considerable time with households during the first meeting. For subsequent meetings, they made an informed decision about the level of reinforcement required per household. According to facilitators, repeating information to household members who had high levels of awareness or recall rates could lead them to have negative attitudes towards the intervention. As dose varied, so did levels of volunteer engagement across villages. Local volunteers were immensely helpful at mobilising the community and organising community meetings. However, without an articulated strategy for volunteer engagement, such an arrangement substantially increased households' exposure to the intervention in areas with active volunteers.

On the one hand, the differences in intervention dose and exposure could have influenced its impact. On the other, leaving the precise dose up to facilitators empowered them to take informed decisions in the field and maintain positive relationships with household members. This difference would be useful to keep in mind while interpreting the impact of the intervention in section 4.2.

### *Content*

The content of the intervention varied, as in some cases the facilitators did not adhere to the intervention script, blurring the distinction between household and community intervention activities. For instance, a community facilitator spoke about marking the chalkboard and use of a lockbox at a community meeting, in a context where all participants were not necessarily aware of these intervention activities. The main reason for non-adherence is that there was only one set of guidelines for household visits and

community meetings. The guidelines did not account for differences in content between each of the three household visits and two community meetings. While this granted the facilitator a degree of flexibility in adapting the guidelines to local contexts, it also resulted in non-standardised content.

#### *Implementation adaptations*

During the implementation, certain adaptations had to be made to the programme activities and delivery process. These included: (1) omission of *agarbatti* demonstration, as households complained that *agarbattis* were used for religious purposes and were not well received as toilet additions; and (2) the addition of a male-focused community meeting, in addition to the two community meetings, since many men were unable to attend these due to work-related reasons.

#### **4.1.2 Implementation take-up**

This subsection discusses take-up of the intervention, as well as the extent to which the participants matched the intervention's intended target population.

##### *Intervention take-up*

Intervention take-up can be defined as its acceptance and acceptability to those receiving it (Carroll et al. 2007). We found high levels of take-up, as the participants understood the purpose of the intervention and had adopted intervention practices. All households we visited for the process assessment had a poster, a filled-in chalkboard (like a calendar) and a lockbox with money. However, many households interviewed for the endline assessment did not have these items, suggesting a drop-off in the presence of posters, chalkboards and lockboxes. Thus, high levels of external facilitation might be required to ensure sustainability.

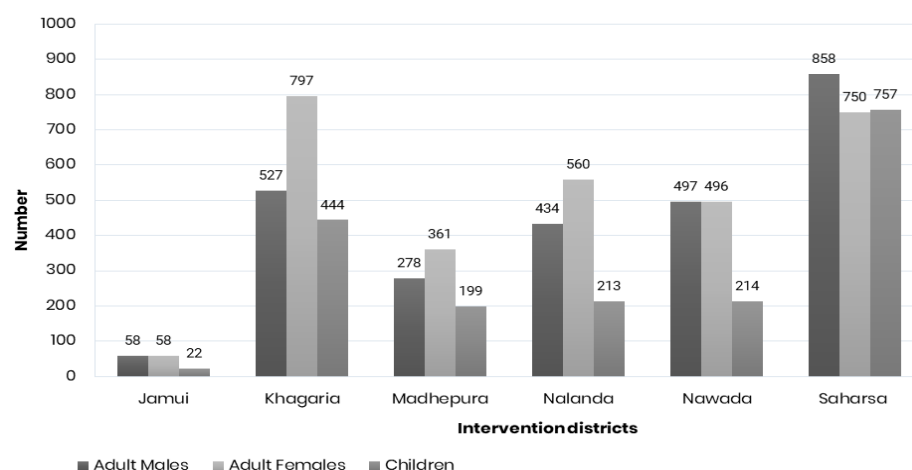
##### *Intended target populations*

While the intervention achieved coverage, questions remain as to whether all the households that received the intervention were eligible, as well as whether the intervention was able to sufficiently target male members.

To be eligible, a household had to have a standard twin-pit latrine. However, during the process assessment we received conflicting information on the toilet types. On the one hand, some households reported that they had toilets other than a standard twin pit. For instance, some had cement rings that were 10 feet (3 metres) deep and others had single pits. On the other hand, an independent monitor verified a sub-sample of households, and confirmed that they had twin-pit toilets. This highlights the problems with the use of self-reported data (Contzen et al. 2015) in designing interventions.

The intervention attempted to increase use amongst male members, as evidence suggests that more women use the toilet compared with men (Coffey et al. 2015; Coffey and Spears 2017). However, due to high rates of out-migration in rural areas, men were not at home during the household or community visits, affecting intervention attendance. Figure 6 uses monitoring data to show the attendance averaged over two community meetings, disaggregated by adult males, females and children.

**Figure 6: Total attendance at community meetings during the intervention**



#### **4.1.3 Constraints to implementation**

Some of the key binding constraints that prevented the intervention from being implemented as planned included contextual factors, such as the out-migration of men affecting attendance, multiple messages on sanitation by groups such as JEEViKA (this affected intervention recall), and engrained notions of purity and pollution (which affected intervention take-up).<sup>18</sup>

#### **4.1.4 Discussion on the assumptions in the theory of change**

Our findings from the process assessment suggest a mixed picture about the validity of the key assumptions in the theory of change. Some assumptions hold true, while findings suggest caveats for the others.

Two assumptions that are valid are KA5, which is about commitment to use the lockbox for savings; and KA6, which is about putting into practice some of the practices discussed regarding barriers to use. The assumption about facilitators' skill and fidelity (KA1) is valid for facilitators formally trained in early 2018. However, we found that facilitator turnover, as well as the use of volunteers, may have affected fidelity and skill levels. At the time of writing the process assessment (Padmanabhan et al. n.d.), two facilitators had left the intervention, according to WVI staff. The endline results on impact will have to be interpreted, keeping in mind varying levels of facilitator skill and training. Such differences in facilitator skill and training would, however, be expected during any real-world implementation, especially if scaled up under a government programme.

Similarly, assumptions about attendance at community meetings (KA2) and household visits (KA3) need to be caveated by the finding that many men were absent and had migrated for livelihood opportunities. Should the intervention be successful, this would indicate that women had communicated the content of the intervention to men. The revised theory of change has incorporated additional assumptions (KA2a and KA3a) to account for this.

Finally, the theory of change assumes that the toilet was constructed with an intention to use it, but we found that many households had constructed toilets with the motivation to earn money under the SBM.

<sup>18</sup> More detail on this can be found in the process assessment report (Padmanabhan et al. n.d.).



## 4.2 Impact analysis

### 4.2.1 Descriptive statistics and balance tables

#### *Description of the quantitative baseline sample*

Columns (1) and (2) in Table 4 summarise the quantitative sample from baseline data collection. The household characteristics include socio-economic status, demographic profile, and access to water supply and sanitation facilities in the household. The social characteristics are represented by the household's religion and caste; economic status is represented by the household's below poverty line (BPL) status and coverage under the Mahatma Gandhi National Rural Employment Guarantee Act (NREGA); demographic profile is represented by the household size and age composition of family members; and access to water and sanitation facilities are represented by access to piped water, latrine facilities within the household and cost incurred to build a latrine.

Hindu households (92.5%) dominated our sample, with Muslim households a much smaller proportion (7.2%). In terms of castes, OBC had the highest proportion, at 69.5%, followed by the SC population at 21.9%; only 2.3% of households in the sample belonged to the ST population. Approximately 46% of households in the baseline sample had a BPL ration card that could be verified by enumerators during the survey, and 25.3% had an NREGA job card. Approximately 18% of the households in the sample were female headed. The average household size for the sample was 5.7 people. Only 4.5% of the households in the sample reported having a piped water supply, while approximately 26.3% had a latrine within the household premises. Approximately 53% of the households reported having at least one family member who defecated in the open.

The individual characteristics are represented in two groups: adult and child (in this context, defined as below the age of five). The adult characteristics include age, gender, disability, morbidity and OD practices, while child characteristics include age, gender, morbidity and safe disposal of faecal matter. Approximately 15% of adults and 29% of children had diarrhoea in the two weeks prior to the survey. The proportion of adults who practised OD was about 34% in the baseline. The proportion of children whose faeces were safely disposed of was 35.9%.

Table 4 also presents community characteristics: ODF status of the village and access to services. The village sample shows that 64.3 per cent of the villages have been certified ODF; and, in about 61 per cent of the villages, Water, sanitation and hygiene mobilisation activities have been held in the past. All the villages have primary schools within 5 kilometres (approximately 3 miles), and about half of them have a health subcentre or primary healthcare centre.

**Table 4: Weighted balance tests for baseline quantitative sample – household, individual and community characteristics**

Indicator (1)	Mean (2)	Std error (3)	Mean (4)	Std error (5)	Mean (6)	Std error (7)
<b>Panel A: Household characteristics</b>	<b>Overall (n = 1,108)</b>		<b>Control (n = 557)</b>		<b>Treatment (n = 551)</b>	
Proportion of Hindu households	92.5	(3.03)	87.4	(5.32)	98.4**	(1.03)
Proportion of Muslim households	7.2	(3.02)	12.1	(5.32)	1.4*	(1.02)
Proportion of SC households	21.9	(4.31)	20.4	(6.39)	23.6	(5.71)
Proportion of ST households	2.3	(0.88)	3	(1.49)	1.5	(0.78)
Proportion of OBC households	69.5	(4.5)	71.4	(6.08)	67.4	(6.84)
Proportion of households with a BPL ration card that could be observed	45.7	(3.01)	46.4	(4.76)	45.0	(3.47)
Proportion of households with a NREGA card	25.3	(3.66)	23.4	(3.87)	27.6	(6.65)
Proportion of households with access to piped water	4.5	(1.09)	5.8	(1.64)	3.0	(1.25)
Proportion of households whose latrine is inside	26.3	(2.32)	24.4	(3.15)	28.6	(3.29)
Proportion of female-headed households	18.1	(2.21)	22.4	(2.96)	13.2**	(2.83)
Average household size	5.7	(0.10)	5.5	(0.14)	5.9*	(0.15)
Average number of children aged 5 or under	0.8	(0.06)	0.7	(0.07)	0.9*	(0.08)
Average number of elderly aged 60 or over	0.4	(0.03)	0.4	(0.03)	0.5	(0.05)
Average number of adults aged 18 to 59	2.6	(0.06)	2.5	(0.10)	2.7	(0.09)
Average number of young aged 6 to 17	1.8	(0.06)	1.8	(0.09)	1.8	(0.09)
Proportion of households where at least one-person practises OD	52.5	(3.44)	53.8	(4.27)	51.0	(5.53)
<b>Panel B: Individual adult characteristics</b>	<b>(n = 5,277)</b>		<b>(n = 2,589)</b>		<b>(n = 2,688)</b>	
Age in years	28.4	(0.34)	28.2	(0.46)	28.7	(0.52)
Proportion of adult males	49.2	(0.75)	48.6	(1.33)	50.0	(0.66)
Average number of years of education of adults	4.7	(0.15)	4.7	(0.21)	4.7	(0.21)
Proportion of disabled persons	2	(0.24)	2.3	(0.32)	1.7	(0.35)
Proportion of adults who were sick in the last 30 days	30.3	(1.52)	31.8	(2.49)	28.6	(1.58)
Proportion of adults who had diarrhoea in the last 2 weeks	14.7	(1.61)	15.7	(1.86)	13.6	(2.55)
Proportion of adults who practise OD	33.8	(3.88)	37.9	(4.77)	29.3	(5.88)
<b>Panel C: Individual child* characteristics</b>	<b>(n = 590)</b>		<b>(n = 434)</b>		<b>(n = 456)</b>	
Age in years	2.7	(0.07)	2.7	(0.09)	2.6	(0.11)
Proportion of male children	50	(2.06)	51.2	(3.89)	48.9	(1.61)
Proportion of children that were sick in the last 30 days	43.1	(2.38)	46.9	(3.46)	39.6	(2.79)
Proportion of children that had diarrhoea in the last 2 weeks	28.8	(2.70)	37.9	(4.29)	20.5***	(2.74)
Proportion of children for whom faeces are	35.9	(4.44)	31.9	(4.52)	39.6	(6.94)

Indicator (1)	Mean (2)	Std error (3)	Mean (4)	Std error (5)	Mean (6)	Std error (7)
safely disposed						
<b>Panel D: Community characteristics</b>	<b>(n = 59)</b>		<b>(n = 30)</b>		<b>(n = 29)</b>	
Proportion of villages certified ODF	64.3 <sup>†</sup>	(9.22)	66.7	(14.21)	62.5	(12.50)
Proportion of villages with WASH activities held in past	61	(6.40)	46.7	(9.26)	75.9**	(8.09)
Proportion of villages where distance of primary school is within 5 km	100	(0.00)	100	(0)	100.0	(0)
Proportion of villages where distance of health subcentre is within 5 km	71.7	(5.87)	70	(8.51)	72.4	(8.45)
Proportion of villages where distance of PHC <sup>19</sup> is within 5 km	46.7	(6.49)	60	(9.10)	31.0**	(8.74)
Proportion of villages with <i>Pakka</i> road	71.2	(5.95)				
Proportion of villages where mason-constructed toilets in past	98.3	(1.69)	100	(0)	96.6	(3.45)

Source: HABIT baseline survey (March 2018): Saith et al. 2018.

Notes: WASH = water, sanitation and hygiene. † Child is defined as below the age of five. ‡ Amongst all other community characteristics indicators, the proportion of villages certified ODF had 32 missing values in 60 villages. \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . p-values obtained by clustering at ward level. Standardised baseline weights utilised.

In comparison with the baseline sample, approximately 27% of households in the endline sample have a BPL ration card (a drop of 18.7 percentage points from baseline).<sup>20</sup>

During endline, there is a significant drop in households where at least one member practices OD, from 52.5% in baseline to approximately 40% in endline; similarly, the proportion of adults who practice OD drops sharply, from approximately 34% in baseline to approximately 15% in endline. The proportion of children whose faeces were safely disposed is 46.9%, up from 35.9% in baseline.

#### *Balance across treatment and control study arms*

We present the weighted results of conducting balance tests of the randomised experiment of the endline sample in columns (4) to (7) in Table 4 above. The balance test estimates show that the treatment and control groups were balanced on most of the indicators and not balanced on 8 out of 34 indicators for the weighted estimate. We utilised t-tests comparing the means for the treatment and control groups. The baseline sample was imbalanced significantly and substantially (with  $p < .05$ ) in terms of the proportion of Hindu households (87.4% in control group against 98.4% in treatment group), the proportion of female-headed households (22.4% in control group against 13.2% in treatment group), the proportion of children who had diarrhoea in the last two weeks of data collection (37.9% in control group as against 20.5% in treatment group).

The covariates for which the endline sample is not balanced, and which are not be affected by the intervention, are included in the model specification to assess the impact.

<sup>19</sup> Primary health centre: a rural healthcare facility run by the government of India. These are basic healthcare centres and operate as single-physician clinics. No major surgeries or procedures are undertaken there.

<sup>20</sup> It is important to note that this drop can also be attributed to the transition to a new BPL registration system, which has led to a temporary withdrawal of BPL cards in some areas.

### *Description of the qualitative endline sample*

For the qualitative study, we sampled based on the list of intervention households provided by WVI. Only those members who were direct recipients of at least one of the interventions (community meeting or household visit) were included. The final participant sample includes 16 individual interviews and 4 FGDs. The sample has a mix of OBC and SC households. All FGDs were conducted only with women and they comprised the majority of the sample.<sup>21</sup> The male respondents were farmers and agricultural labourers, and female respondents participated in household and agricultural work.

In addition to the intervention households, the sample also included village institution members like *mukhiya* (the village chief), ward members, JEEViKA community mobilisers and WVI representatives. We also interviewed people who are involved in cleaning and emptying pits (de-sludgers) in the sample districts. These respondents belonged to the Dom caste and have traditionally been involved in manual scavenging (Shahid 2015).<sup>22</sup>

### **4.2.2 Research analyses**

In this section, we investigate the evaluation questions outlined in section 3.1 of this report. This section is structured in accordance with the intermediate and primary hypotheses (and associated evaluation questions) for this study.

#### *Knowledge about pit filling*

A key intermediate outcome in the theory of change is the correction of faulty mental models around pit filling, by improving knowledge on pit-filling rates and pit emptying. In the baseline, we found that households both underestimate (i.e. think their pits will fill up faster than they actually would) and overestimate (i.e. think their pits will fill up slower than they actually would) the pit-filling rate. Households underestimating the time it takes for the pit to fill up might incorrectly assess the toilet to be a scarce resource and therefore reduce their use of the toilet within their household. To address this, our intervention included components designed to correct estimations of pit-filling rates, including a card game, a French drain demonstration and a poster given to households. These have been described in greater detail in section 2.1.

Below, we describe the impacts of the intervention on: (1) the receipt of information around pit-filling rates; and (2) the increase in knowledge around pit-filling rates.

#### Intermediate hypothesis 1a (IH1a)

The intervention will increase information on the correct rates of pit filling amongst treatment households. Is the behavioural intervention successful at providing information on the correct rates of pit filling to household members in treatment households?

To test this hypothesis, we estimated whether households received information on pit-filling rates differentially between control and treatment groups. When considering only

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<sup>21</sup> The dominance of women in the qualitative sample can be attributed to two factors: (1) more women were available to participate in the data collection exercise; and (2) more women were direct recipients of the intervention, due to their availability at the time of visit and meeting. The latter point has also been discussed in the process assessment (Padmanabhan et al. n.d.).

<sup>22</sup> The Dom caste is an SC prevalent in parts of north India. In Bihar, Doms are classified as Mahadalits.

information provided through non-governmental organisations (NGOs) (since our intervention's implementer is one), we find that households in treatment areas are 17.7 percentage points more likely to have received information from NGOs on pit-filling rates.

When we expand the definition of information providers to include all sources, we find that households in treatment areas are 6.2 percentage points more likely to have received information on pit-filling rates, but this effect is not statistically significant (Table 5). This is an expected finding given the sanitation interventions currently being implemented by a host of different actors, including the government, JEEVIKA functionaries and other NGOs.

We find that the share of households reporting receiving any information on pit-filling rates has increased significantly and uniformly across control and treatment areas, with 47 per cent of households reporting receiving relevant information, compared with 29 per cent during the baseline survey (Figure 7). While it is important to recognise this improvement, it is also worth noting that this represents less than half of the households in our study sample, suggesting that the coverage and penetration of messages around pit-filling rates is still limited.

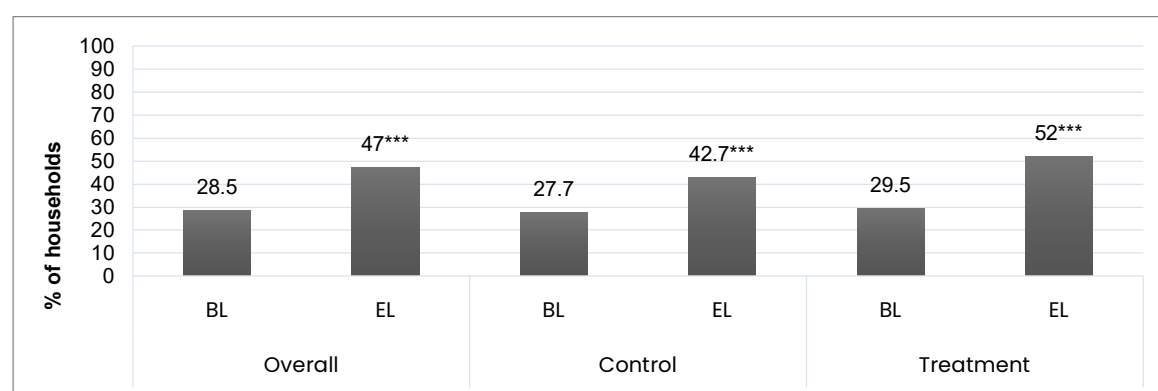
**Table 5: Impact estimate for receipt of information on pit-filling rates**

Receipt of information on pit-filling rates	Any source	NGO(s)
ITT	0.0626	0.177***
	(0.0712)	(0.0496)
Observations	2,005	2,005

Source: HABIT baseline and endline surveys (March 2018, January 2019). Viswanathan et al. 2018.

Notes: ITT = intention-to-treat. Standard errors clustered at the ward level reported in parentheses. \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ . The dependent variable equals 1 if the household reported receiving any information from any source and from an NGO source, respectively for models 1 and 2. Socio-economic and demographic controls have been used.

**Figure 7: Households receiving any information on pit-filling rates**



Notes: BL = baseline; EL = endline. \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ . Standard sample weights utilised.

We also collected information on what topics respondents remembered having discussed during any community meetings held in their village on sanitation and toilet

use-related topics during the endline survey.<sup>23</sup> These findings are presented in Table 6. We find in both control and treatment areas that most households do not recall learning about pit-filling rates during community meetings, although recall for this topic is better in treatment areas.

These findings show that the recall value of messages shared on pit-filling rates is limited. However, we find that recall on other messages, such as use of decomposed faecal matter as manure, is over three times higher in treatment areas than control areas. Similarly, treatment group respondents were over 10 times more likely to recall safety of decomposed faecal matter as a topic discussed during community meetings (Table 6). This suggests that the intervention was successful at improving knowledge in other areas, beyond pit-filling rates.

**Table 6: Percentage of households reporting topics discussed during community meetings on toilet use**

Households that have attended any community meetings on toilet use	Overall (n = 503)	Control (n = 209)	Treatment (n = 294)
Pit-filling rate	28.9	21.7	35.4**
	(3.00)	(4.08)	(3.91)
How to switch between pits	49.2	45.2	52.8
	(4.10)	(3.56)	(7.09)
Waiting period before pit emptying	12.0	9.6	14.2
	(2.12)	(2.31)	(3.46)
Safety of decomposed faecal matter	6.4	1.3	11.1*
	(3.17)	(0.74)	(5.56)
Using decomposed faecal matter as manure	19.5	8.2	29.8***
	(3.99)	(2.38)	(6.07)
Pledge to use the toilet for defecation	60.7	65.2	56.7
	(4.57)	(7.27)	(5.31)

Source: HABIT endline surveys (January 2019). Viswanathan et al. 2019.

Notes: Standard errors clustered at the ward level reported in parentheses. \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ . Standard sample weights utilised.

Qualitative interviews in the intervention areas validate this finding. We find that retention of the messages around pit-filling rates, which were central to the card game intervention, was limited. Recall is largely limited to visual aspects of the demonstration; respondents were unable to remember specific messages or the rationale behind the card game. Similarly, while many respondents were able to recall the visual aspects of the French drain demonstration, showing how liquids do not affect the pit-filling rate, they were unable to recall the specific messages around pit-filling rates that were shared with this demonstration.

While other informational interventions have been successful at facilitating message recall amongst recipients (Rahman et al. 2016), our process assessment revealed a degree of variance in facilitator quality that could have affected the quality of communication on pit-filling rates to households. Since message recall has been previously associated with

<sup>23</sup> Note that given the many community-level interventions around sanitation and toilet use, and the difficulty in identifying the exact provider of information, this includes households that reported attendance of at least one community meeting and not just households that specifically attended WVI community meetings in intervention areas.



knowledge levels in the context of behaviour change interventions, we think that the limited recall value of our intervention's messages may be linked to the lack of impact on the knowledge of pit-filling rates (Kilian et al. 2016). These findings highlight the challenges associated with successfully establishing and maintaining the quality of communication channels for behaviour change messaging on sanitation.

#### Intermediate hypothesis 1b (IH1b)

The intervention will correct misconceptions on the rates of pit filling amongst treatment households. Is the behavioural intervention successful at correcting incorrect knowledge on the rate of pit filling amongst household members in treatment households?

To assess whether the intervention improved assessments of pit-filling rates amongst treatment households, we estimated whether there were significant differences between control and treatment areas in terms of the share of households that were able to correctly estimate the amount of time it takes for a 3 feet by 5 feet (0.9 metres by 1.5 metres) pit to fill up, when used by a 6-member household. We find that households in the treatment group are 6.1 percentage points more likely to correctly estimate the pit-filling rate than their control counterparts. However, this effect is not detectable at appropriate levels of significance (Table 7).

**Table 7: Impact estimate for correct and under-estimation of pit-filling rate (3 feet by 5 feet pit) for a 6-member household**

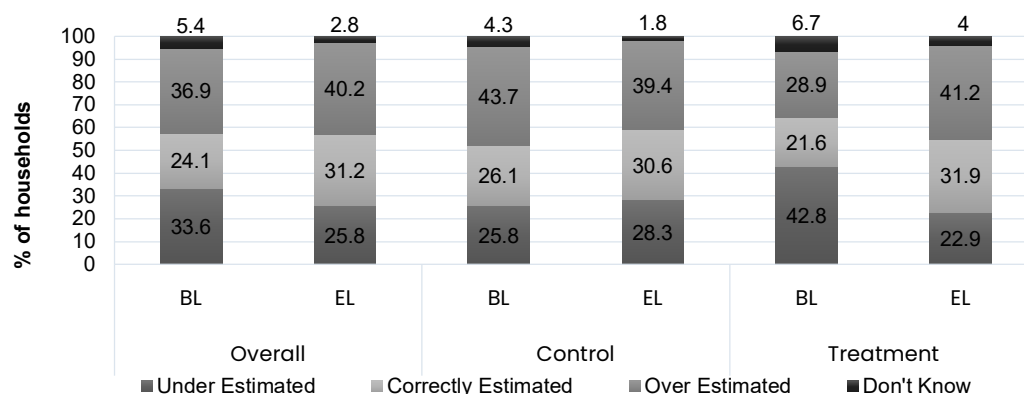
	<b>Correctly estimated pit-filling rate for a 3 ft by 5 ft pit</b>	<b>Under-estimated pit-filling rate</b>
ITT	0.0615	-0.251***
	(0.0432)	(0.0669)
Observations	2,130	2,130

Source: ITT = intention-to-treat. HABIT baseline and endline surveys (March 2018, January 2019). Viswanathan et al. 2018; 2019.

Notes: Standard errors clustered at the ward-level reported in parentheses. \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ . The dependent variable in model 1 equals 1 if the household was able to correctly estimate the pit-filling rate for a 3 feet by 5 feet pit in a 6-member household. The correct estimate ranges from three to four years. The dependent variable in model 2 equals 1 if the household underestimated the pit-filling rate for a 3 feet by 5 feet pit in a 6-member household. Respondents were counted as having underestimated the rate if they said the pit would take less than three years to fill.

While there is an improvement in the number of households that can correctly estimate the pit-filling rate, we continue to see many households that both underestimate and overestimate pit-filling rates across treatment and control areas (Figure 8). At endline, 31% of all households correctly estimated the pit-filling rate, but 25% underestimated the rate and 40% overestimated the rate. It is interesting to note that, while the number of people underestimating the amount of time taken for pits to fill has *increased* in control areas, this number has fallen substantially in treatment areas from 43% to 23%. We find that treatment area respondents were 25.1 percentage points less likely than control respondents to underestimate the pit-filling rate (Table 7). Given that underestimating the amount of time it takes for a pit to fill up can lead to the perception of pits as a scarce resource, this suggests a positive development in treatment areas.

**Figure 8: Estimated pit-filling rate for a 3 feet by 5 feet pit (6-member household)**



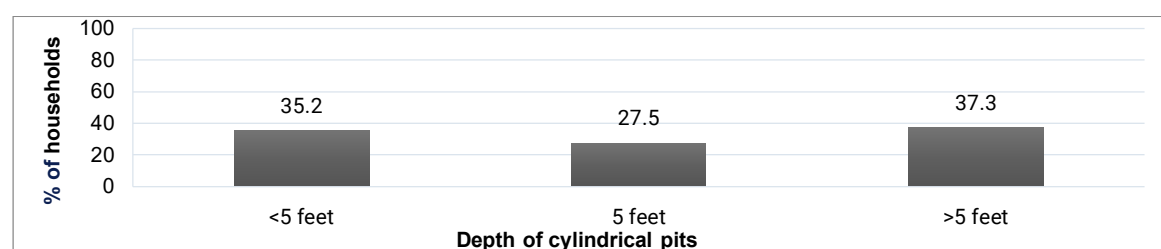
Notes: BL = baseline; EL = endline. Standard sample weights utilised.

While we assessed the ability of households to correctly estimate pit-filling rates using standard pit size and household member specifications through the quantitative survey. We also asked households in the qualitative sample to assess when their own twin pits would fill up. Interviewed households were generally unable to estimate the pit-filling rate for their own pits and quoted arbitrary time periods when asked to assess how long their pits would take to fill up.

These findings should be interpreted in the context of sanitation programming in Bihar. Calculations of pit-filling rates are complicated by the number of factors that affect the actual amount of time it takes for pits to fill up. These include specific pit dimensions, the number of household members using the toilet, weather and climatic patterns etc. (Still et al. 2012). Additionally, our study population have pits of varying dimensions that do not necessarily adhere to standard measures; within our sample, 28% of households with cylindrical pits reported they had a depth of 5 feet (1.5 metres), 37% reported depths of less than 5 feet, and 35% reported depths of more than 5 feet (Figure 9). Qualitative interviews with residents indicated that pits constructed with government/non-governmental organisation (NGO) support tended to be 3–4 feet (0.9–1.2 metres) deep, whereas privately constructed pits were considerably deeper, ranging from 7 feet to 20 feet (2.1 metres to 6.1 metres) in depth.

Despite the differences in pit size across households, respondents reported receiving standardised messages around pit-filling rates. For instance, they were told that their pit would fill in 5–10 years regardless of family size and other factors. These messages were disseminated by different actors, including JEEViKA functionaries, ward representatives and NGOs. This highlights the difficulty of targeting informational interventions when the requirements are household-centric.

**Figure 9: Reported depth of cylindrical pits**



Notes: n = 989; 5 feet = 1.5 metres

Another confounding factor here is quality of pit construction. We found that several toilets observed in the qualitative sample were poorly constructed. According to some respondents in our interviews, both pits in their twin-pit construction were simultaneously operational, undercutting the intent behind twin-pit toilets and their self-emptying design. As a result, the intervention's information on pit-filling rates would not have been applicable to these households.

Respondents did note that being exposed to the intervention had informed them about the correct specifications and design of twin pits. This can be considered a positive, if unintended, outcome of the intervention.

#### *Attitudes and practices around pit emptying*

##### Intermediate hypothesis 2 (IH2)

The intervention will reduce aversion to pit emptying amongst treatment households. Is the behavioural intervention successful at reducing the aversion to self-pit emptying amongst male household members in treatment households?

Our formative research suggests that anxiety about one's pit filling up and aversion to emptying the pit were key reasons for low toilet use amongst households that had a toilet. To tackle these barriers, the treatment households were shown decomposed faecal matter during community meetings. Additionally, households were provided with information about decomposition rates and the importance of letting faecal matter decompose before emptying the pit. We found that knowledge about decomposition rates was higher in treatment areas, with treatment households having a 15.7 percentage-point improvement beyond that of the control (Table 8). This change is significant and suggests that the intervention was successful in conveying information on decomposition of faecal matter.

**Table 8: Impact estimate for correct estimation of decomposition rate (3 feet by 5 feet pit)**

Correctly estimated decomposition rate of faecal matter for a 3 ft by 5 ft pit (6-member household)	
ITT	0.157*
	(0.0639)
Observations	2,130

Source: HABIT baseline and endline surveys (March 2018, January 2019). Viswanathan et al. 2018; 2019.

Notes: ITT = intention-to-treat. Standard errors clustered at the ward level reported in parentheses. \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ . The dependent variable equals 1 if the household was able to correctly estimate the decomposition rate for faecal matter in a 3 feet by 5 feet pit.

The correct estimate ranges from 1 to 2 years. The percentage of those who correctly estimated the decomposition rate went up from 29.1% to 32.8% in the control group and from 20.4% to 42.2% in the treatment group between baseline and endline surveys, respectively.

The difference-in-differences estimator for the main outcome variable (i.e. 'perceived ease of pit emptying')<sup>24</sup> indicates that the variable is higher by 6 percentage points in treatment households compared with control households (Table 9); however, since this change is not significant, we are not able to attribute impact. It is pertinent to note the positive direction of change for those households that received treatment compared with the negative direction of change over time for those households in the control group.

**Table 9: Impact estimate for perceived convenience of pit emptying**

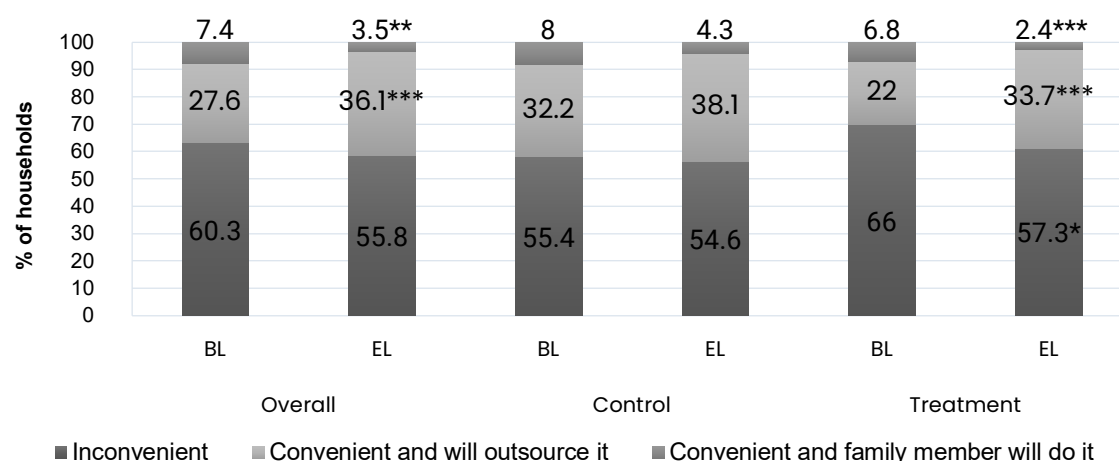
Perceived convenience of pit emptying	
ITT	0.0854
	(0.0716)
Observations	2,053

Source: HABIT baseline and endline surveys (March 2018, January 2019). Viswanathan et al. 2018; 2019.

Notes: ITT = intention-to-treat. Standard errors clustered at the ward level reported in parentheses. \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ . The dependent variable equals 0 if respondents reported finding pit emptying inconvenient; 1 if respondents reported finding pit emptying convenient and said they would outsource it if the need arose; and 2 if respondents reported finding pit emptying convenient and said a family member would do it if the need arose.

The descriptive statistics for the aversion indicator also indicate that treatment households overall display a sharper increase in perceived convenience of pit emptying (or decrease in percentage of households that perceived pit emptying to be inconvenient) than control households. The changes from baseline to endline are shown in Figure 10.

**Figure 10: Perceived convenience of pit emptying**



Notes: BL = baseline; EL = endline.

<sup>24</sup> This indicator was created using two items on the household questionnaire: it took the value 0 if respondents reported finding pit emptying inconvenient; 1 if respondents reported finding pit emptying convenient and said they would outsource it if the need arose; and 2 if respondents reported finding pit emptying convenient and said a family member would do it if the need arose.

Although there was an overall improvement in perceived convenience of pit emptying, this seems to be largely driven by reliance on pit emptying through an outside source, and is largely caste based. As is shown in Figure 10, treatment and control households both indicate an increase in perceived convenience of pit emptying through an outside source and a reduction in perceived convenience of emptying of the pit by a family member.

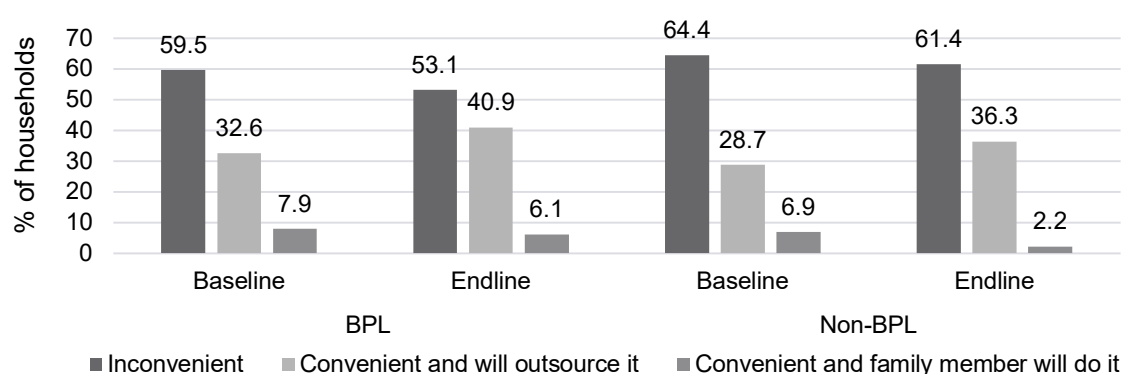
The qualitative study corroborates the continued dependence on caste-based pit emptying or de-sludging. In fact, some women expressed disgust at the thought of having to touch faecal matter. This disgust persists despite exposure to decomposed faecal matter in the community meetings.

We don't want to touch the faecal matter with our bare hands. It is disgusting. —  
Female respondent, Nalanda

It is important to note that most interviewed households had not emptied their pits since construction, making most responses to pit emptying hypothetical. While most households were aware that faecal matter in the pits turned into manure (this information was given through multiple channels, such as JEEViKA and SBM, as well as at the community meetings), there was no clarity on the correct time to empty the pit. When asked, some stated that they would empty it immediately after it filled up, while others said that they would expedite the decomposition process by putting sand inside the pit and then emptying it.

Interestingly, we found that self-emptying was not preferred unless the household was economically constrained (defined as owning a BPL/NREGA job card) or belonged to an SC. The regression results from the quantitative study show significant positive correlation between having a BPL ration card or NREGA job card and the perceived convenience of pit emptying (see detailed table in Online appendix G). Households with these cards reported, on an average, a 12 percentage-point (p-value = 0.04) higher perceived convenience than households without cards. The absolute numbers of those who report self-emptying to be convenient continues to be low. It is unclear if perceived convenience translates into the practice of self-emptying of pits. Thus, our analysis finds that, even though the treatment households exhibited improved knowledge of decomposition timelines, this did not translate into reduced aversion to self-emptying.

**Figure 11: Economic status and perceived convenience of pit emptying**



Note: BPL = below poverty line.

It would also appear that households are not clear on safe disposal of decomposed faecal matter, often cleaning the pit when the waste is still 'wet'. Our interviews suggest that manual scavenging does not ensure safe and hygienic disposal of the waste, with most de-sludgers merely transporting the non-decomposed waste from one location to another, undercutting the public health benefits of using the toilet in the first place.

This suggests that future messaging needs to emphasise the importance of waiting until the matter has decomposed, and the dangers of improper emptying and disposal of faecal matter. We also find that there was limited to no impact on aversion to self-emptying. While the demonstration of safely handling decomposed faecal matter sought to reduce aversion, deep-seated notions of purity and pollution (Dumont 1980) are unlikely to change in the short time span of an intervention and it is essential to engage with such structural issues over a longer period of time (Thorat and Joshi 2015).

#### *Maintenance and repair of toilets*

##### Intermediate hypothesis 3 (IH3)

The intervention will reduce anxiety associated with maintenance and repair of toilets amongst treatment households. Is there reduced anxiety associated with maintenance and repair of toilets amongst households that receive the treatment?

This section will discuss the role played by the intervention in reducing anxiety associated with maintenance and repair of toilets amongst treatment households. Our formative research concluded that anxiety associated with maintenance and repair of the toilets was leading to non-use of toilets at the household level. Households reported not using the toilets due to the money required to repair or clean the toilet. The intervention included a savings commitment device, in the form of a lockbox, to help improve toilet use.

I usually clean the toilet with the brush and Harpic [cleaning liquid] but my husband buys the supplies monthly. We usually spend Rs. 175 per month for this which is taken from the household budget. — Female respondent, Saharsa

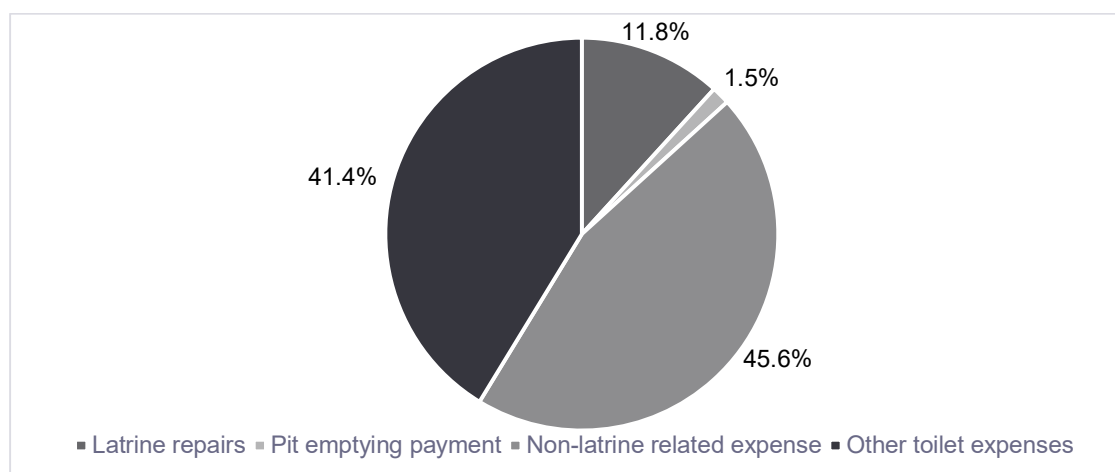
The endline assessment found that most treatment households had received the lockbox (62.92% of the treatment households reported having received the lockbox, 47.94% reported having ever put money in it and only 17.04% reported having ever used the lockbox money). Of the people who had used the money from the lockbox, only 11.83% used it for latrine repairs and 41.41% used it for other toilet-related expenses (non-maintenance repair, non-pit emptying expenses).<sup>25</sup> Our qualitative findings suggest that the non-maintenance/repair, non-pit emptying expenses were related to the cleaning of toilets, which was undertaken by households on a weekly basis. The materials (brush and cleaning liquid) were procured by the male members of the household, whereas the cleaning was done by the women.

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<sup>25</sup> The non-toilet-related expenses for which the lockbox money was used were coded at the time of data collection as non-toilet-related and therefore we do not have data on what these expenses were specifically.



**Figure 12: Proportion of expenses for which lockbox money was used**



However, the assessment did not find any significant impact of the lockbox intervention on households spending their own money on maintenance and repair of the toilets in treatment households when compared with control households between baseline and endline (Table 10).

**Table 10: Impact estimate of amount of own money spent by households on toilet repair and maintenance**

Amount of own money spent by households on toilet repair and maintenance	
ITT	-239.6
	(207.7)
Observations	2,170

Source: HABIT baseline and endline surveys (March 2018, January 2019). Viswanathan et al. 2018; 2019.

Notes: ITT = intention-to-treat. Standard errors clustered at the ward level reported in parentheses. \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ . The dependent variable equals the amount of money (reportedly) spent by the households on toilet repair/maintenance. Currency used is INR. The intention-to-treat estimate in US dollar terms would be (minus) USD3.41.

**Figure 13: Broken clay lockbox in Saharsa**



Photocredit: Shamayita Das (2018)

The qualitative findings demonstrate that, while the rationale behind the intervention was largely understood by the female members of the household, a few found the idea of saving money in a lockbox ‘childish’. Additionally, maintenance and sustained use of the lockbox was difficult due to the inter-district variability in the kinds of lockboxes distributed (some of them received lockboxes made of clay which broke easily). The clay lockboxes broke within a few weeks of receiving them, as children would play with them.

Respondents made a distinction between small toilet repairs and toilet cleaning and maintenance; the money saved was used for the latter. Overall, we found that there was not any perceptible reduction in anxiety associated with maintenance and repair of toilets because of the intervention. From our qualitative work, we conclude that this could be due to two reasons. Firstly, interviewed households did not seem to be very worried about toilet-related expenses and reported that they were able to budget for them in the monthly household expenses. Secondly, many households had not undertaken repair or maintenance of the toilet at the time of data collection and all their responses to these questions were hypothetical.

Both the qualitative and quantitative studies suggested that the money in the lockbox, if it was being saved, was largely being used for toilet-cleaning-related expenditure and not for maintenance or repair, which was the original goal of the intervention. Though not the expected outcome, this intentional use of saved funds for toilet-related expenses can be considered a positive outcome of the lockbox intervention.

The costs we would incur for toilet repairs depends on the kind of repairs we will need to undertake in the future. We’ll deal with the issue when it arises – not now. — Male respondent, Nalanda

#### *Use of pledge and chalkboard*

##### Intermediate hypothesis 4 (IH4)

The intervention will increase the habit of toilet use amongst treatment households through the mechanisms of a pledge and chalkboard. Is there an increased habit of toilet use amongst members in the treatment households due to the use of a pledge and chalkboard?

The pledge and chalkboard were introduced with the aim of converting the intention to use the toilet into a habit, with the pledge representing a commitment towards toilet use and the chalkboard as a regular reminder and tracker for toilet use. We discuss the extent of their take-up and their impact on the toilet use behaviour of the households below.

The qualitative and quantitative exercises collected data around recall of the habit formation devices in the intervention (the pledge and the chalkboard); acceptance of these interventions; and its impact, if any, on recipients’ behaviours.

Approximately 50 per cent of the respondents who attended the community meetings reported taking a pledge to use the toilets. Curiously, a substantial number of respondents from the control group also reported undertaking a similar pledge. During qualitative data collection, we realised that households were unable to distinguish between the different sanitation messaging from various sources. As discussed in a previous section, similar messaging on toilet use has been undertaken by block and panchayat representatives, JEEViKA functionaries, *swachhagrahis* and different NGOs. We believe this overlap and saturation in sanitation messaging might explain why

households in control villages also reported taking the pledge to use the toilet. This implies that multiple sources may have contributed to behaviour change across treatment and control groups.

However, none of the respondents in the qualitative study mentioned taking the pledge in the household visit. This suggests that the pledge during the household visit may not have been successful in instilling a commitment to use the toilet. The quantitative data reveal poor correlation between the pledge during community meetings and usage of latrines amongst the household members in the treatment group (correlation coefficient is  $< 0.2$ ).

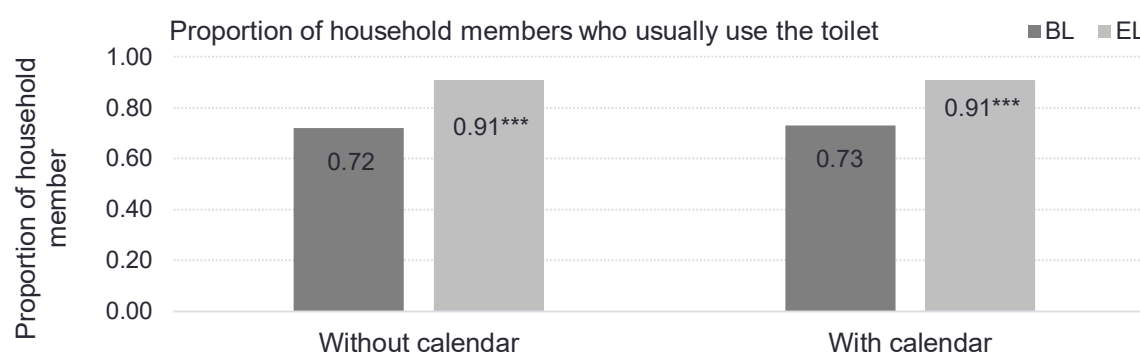
At the endline, we found that, although most households reported having received the chalkboard during the intervention, not all of them had retained it. Quantitative data show that out of the total 534 treatment households, only 63 per cent had their chalkboards in place. In the qualitative assessment, respondents stated having misplaced or damaged their chalkboards. Only 16 per cent of the households that had the chalkboards reported ever having used it. Our qualitative findings corroborate low use of the chalkboards. None of the households interviewed for the qualitative study reported using the chalkboard. Most of the chalkboards were observed to be blank and the remaining ones had not been updated recently. It is important to note that this finding is in contrast with the process assessment. All households observed in the process assessment had updated chalkboards. This suggests either: (1) a sample-specific problem; (2) the need for sustained interaction with the implementation agency for this habit formation device to be used; or (3) once toilet use became a habit, the incentive to use the chalkboard may have reduced (showing lower levels by the time the endline data were collected).

Although most households interviewed were clear on how to use the chalkboard, they did not see it as a tool for habit formation. Most respondents reported finding the chalkboard inconvenient and a burden, and did not fill it in daily. A few respondents also found the chalkboard to be humiliating, especially in front of their guests. Further, amongst households that reported regular use of the toilet, the chalkboard was not seen as being relevant.

If one goes in [the toilet], would they rather defecate or think about marking the chalkboard. — FGD respondent, Nalanda

The chalkboard was pasted there but I don't know who took it [smiling]. — Male respondent, Saharsa

**Figure 14: Changes in toilet usage amongst households with chalkboard and without chalkboard**



Source: HABIT baseline and endline survey. Note: \*\*\* $p < .01$ , \*\* $p < .05$ , \* $p < .1$

To quantitatively test the impact of the chalkboard on toilet use, we estimated toilet use amongst households that had the chalkboard at the time of the endline survey and those that did not have the chalkboard at the time of the endline survey.<sup>26</sup> However, the interaction variable between the treatment (in this case the households that had the chalkboard) and time dummy was insignificant in the difference-in-differences regression, indicating no significant impact on toilet usage amongst the treatment households by the chalkboard intervention. This is in line with the qualitative findings.

Our analysis finds low uptake of the pledge and chalkboard in treatment households, with many reporting that it was cumbersome to regularly fill in the chalkboards. We cannot conclude that there was any impact of the pledge or the chalkboard in promoting toilet use amongst treatment households.

#### *Toilet use at the household level*

We find that toilet use increased in control and treatment areas. We also find a uniform improvement in the number of members within households who regularly use toilets in both areas.

The increase in toilet use might be explained by contextual factors, such as JEEViKA's behavioural change interventions, as well as messaging by other non-profit organisations. The additional utility of future behaviour change interventions needs to be assessed, keeping in mind the saturation of sanitation programming at the village level. In treatment areas, further improvements are constrained by factors such as multiple households using a toilet and the migration of men, as well as supply-side issues such as access to water.

We present the household, as well as intra-household-level findings (H1a and H1b) below.

#### Primary hypothesis 1a (H1a)

*Household level:* the intervention will help increase the toilet use amongst treatment households. Is the behavioural intervention successful at increasing toilet use amongst treatment households (increase in the proportion of households in which all members use the toilet)?

#### Primary hypothesis 1b (H1b)

*Household members, individual level:* the intervention will increase the number of members within treatment households who regularly use toilets. Is the behavioural intervention successful at increasing toilet use amongst household members within treatment households (increase in the number of household members within households using latrines)?

Self-reported toilet use has increased substantially across three different measures of use (usual use, last time use and last three times use). At endline, 83.0% of households in our study population reported that all adult members usually used the latrine, compared with 52.5% in the baseline study (Table 10). Similarly, the share of households reporting that all members used the latrine the last time they defecated has also

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<sup>26</sup> Question Z.09 in the endline survey looked at whether the household had the chalkboard at the time of the endline survey. This graph estimates proportion of household members using the toilet in households that were noted as having the chalkboard (treatment) against toilet use in those households who did not have the chalkboard (treatment + control)

increased, from 67.0% to 82.5%. Even toilet use over the last three times has improved dramatically, from 55.6% to 76.9% of households. During interviews, many respondents stated that the toilet had benefited them, as they could use it at any time of day and did not have to worry about being bitten by snakes and insects, especially during the monsoon. The improvements in toilet use are uniformly spread across study areas and our impact estimation shows no significant differences between control and treatment households, with treatment households marginally less likely to practise toilet use.

**Table 11: Household- and individual-level toilet use**

	<b>Overall (n = 1,085)</b>		<b>Control (n = 551)</b>		<b>Treatment (n = 534)</b>	
	<b>BL</b>	<b>EL</b>	<b>BL</b>	<b>EL</b>	<b>BL</b>	<b>EL</b>
<b>Latrine used usually</b>						
Proportion of households (all members)	52.5	83.0***	50.6	84.5***	54.8	81.2***
	(3.58)	(4.16)	(4.54)	(5.45)	(5.63)	(6.38)
Proportion of individuals aged 5 and over within households	69.5	90.0***	66.8	90.1***	72.7	90.0***
	(3.49)	(3.43)	(4.12)	(5.18)	(5.66)	(4.30)
<b>Latrine used the last time for defecation</b>						
Proportion of households (all members)	67	82.5***	66	83.7***	68.2	81.0***
	(3.53)	(4.16)	(3.65)	(6.06)	(6.31)	(5.59)
Proportion of individuals aged 5 and over within households	82	90.5***	81.5	90.8***	82.6	90.2***
	(2.97)	(3.17)	(3.33)	(4.82)	(5.13)	(3.91)
<b>Latrine used the last 3 times for defecation</b>						
Proportion of households (all members)	55.6	76.9***	53.9	77.5***	57.7	76.1***
	(3.50)	(4.39)	(4.16)	(5.86)	(5.77)	(6.64)
Proportion of individuals aged 5 and over within households	73.6	85.9***	72.6	86.0***	74.8	85.8***
	(3.13)	(3.84)	(3.45)	(5.37)	(5.43)	(5.48)
<b>Latrines observed to be in use</b>						
Proportion of households	90.7	89.7	91.5	89.8	89.8	89.6
	(1.89)	(2.84)	(2.86)	(4.57)	(2.35)	(3.03)

Source: HABIT baseline and endline surveys (March 2018, January 2019). Viswanathan et al. 2018; 2019.

Notes: BL = baseline; EL = endline. Standard errors clustered at the ward level reported in parentheses. \* p < .05, \*\* p < .01, \*\*\* p < .001. Standard weights utilised.

**Table 12: Impact estimates for toilet use at the household and individual level**

	Household level	Individual level
<b>Latrines used usually</b>		
ITT	-0.0394	-0.0262
	(0.0632)	(0.0486)
<b>Latrine used the last time for defecation</b>		
ITT	-0.0242	0.00145
	(0.0492)	(0.0371)
<b>Latrine used the last 3 times for defecation</b>		
ITT	-0.0205	-0.00191
	(0.0600)	(0.0411)
Observations	2,131	2,131

Source: HABIT baseline and endline surveys (March 2018, January 2019). Viswanathan et al. 2018; 2019.

Notes: ITT = intention-to-treat. Standard errors clustered at the ward level reported in parentheses. \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ . The dependent variable in model 1 is equal to 1 if all members within the household use toilets. The dependent variable in model 2 is defined as the proportion of members aged five years and over within each household who use toilets.

Similarly, even at the intra-household level, there has been a uniform improvement in the number of members who regularly use toilets in both control and treatment areas. On average, 90 per cent of members within households now usually use the latrine, compared with 70 per cent at baseline (Table 11). We find no detectable differences in the proportion of household members using the latrine between control and treatment groups after the intervention. There is a 0.1 percentage point positive difference between control and treatment for the proportion of household members reporting using the latrine the last time they defecated. Conversely, there is a 2 percentage point negative difference between control and treatment for the proportion of household members reporting usually using the latrine for defecating, and a 0.2 percentage point negative difference between the proportion of household members using the latrine all of the last three times for defecating (Table 12). These effects are statistically insignificant, however.

Our data from the observation of toilets corroborate these findings. Enumerators were asked to note whether toilets looked like they were in regular use, based on the availability of water and absence of detritus such as leaves and dirt from the toilet site. Based on these observations, we found that 90.7 per cent of the toilets surveyed looked used (Table 11), suggesting that there is unlikely to be self-reporting bias, where respondents tend to exaggerate true behaviour due to the perceived social desirability of the ideal behaviour (Contzen et al. 2015).

#### *Potential factors responsible for the increase in toilet use*

Contextual factors are likely to have increased toilet use in both control and treatment areas. In Bihar, the National Rural Livelihood Mission's JEEViKA groups were tasked with ensuring that households used toilets. JEEViKA groups are ubiquitous in the state; their primary mandate is to encourage livelihoods and entrepreneurship activities amongst women. However, at present, one of their main activities is to convince village residents to construct and use toilets through behaviour change campaigns under the SBM. The campaigns include information dissemination, as well as several pressure



tactics, including fining open defecators, shining torches on them whilst they are defecating, and even garlanding them after they have defecated (Priyadarshini 2018). JEEViKA groups also employ sanctions such as withholding subsidised food benefits, agricultural assistance and other aid given to households (O'Reilly and Louis 2015) to disincentivise OD.

If we go out, they will break our legs; they will beat us a little if we go outside. — FGD respondents, Saharsa

When I go out, I feel like some guard will come at me from behind. — Female respondent, Saharsa

We built and use the toilet out of pressure by the didis. — Male respondent, Nalanda

On the one hand, the ethics of using fear and humiliation in campaigns is increasingly being questioned as a tool for behavioural change (Bateman and Engel 2018; Chatterjee 2011; Galvin 2015). On the other hand, perhaps due to these pressure tactics, toilet use has shown a marked increase in both control and treatment areas. During the process assessment as well as the qualitative endline study, many respondents reported experiencing pressure to build and use toilets. One of the main reasons reported by respondents for using toilets was to avoid being fined or shamed by JEEViKA representatives. In fact, respondents from Nalanda were told that it would be difficult to get ration cards or even send their child to school if they did not use toilets.

Another factor explaining the increase in use in both areas is the work of several NGOs and development agencies on sanitation issues in Bihar. Several organisations<sup>27</sup> have conducted large-scale interventions on sanitation in the recent past. In fact, during the intervention, WVI had set up a coordination committee at the village level to coordinate the efforts of all the non-profits, as village residents were receiving a lot of messaging around sanitation issues. Respondents were unable to easily differentiate the intervention's community meetings and household visits from other meetings held in the village.

#### *Barriers to toilet use*

Of the small proportion of households and household members who still report practising OD, it is likely that factors such as multiple households using a toilet, migration of men and supply-side infrastructural issues such as access to water, as well as attitudes towards OD, constrain them from changing their behaviour.

Firstly, we find little movement in attitudes towards OD, with no significant changes in attitudes around convenience, pleasure and comfort of OD (Table 13). This highlights the challenges associated with changing these practices, especially through an intervention with a short time span.

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<sup>27</sup> Organisations including Population Services International, Project Concern International, CARE, Alive & Thrive and Digital Green have disseminated information on the importance of sanitation and toilet use since the SBM.

**Table 13: Select reasons for open defecation amongst households with at least one member who defecates in the open (%)**

	Overall		Control		Treatment	
	BL (n = 541)	EL (n = 275)	BL (n = 274)	EL (n = 138)	BL (n = 267)	EL (n = 137)
Pleasure	8 (2.22)	9.4 (2.27)	7.4 (3.15)	6.5 (2.80)	8.7 (3.11)	12.5 (3.33)
Comfort	18.1 (2.64)	15.0 (2.61)	19.6 (2.77)	16.1 (4.25)	16.3 (4.68)	14.0 (3.16)
Convenience	29.5 (2.91)	29.7 (3.85)	33.1 (4.14)	32.0 (5.58)	25.1 (3.82)	27.1 (5.63)
Faulty toilet infrastructure	5 (1.15)	16.0 (6.52)	4.3 (1.43)	20.0 (11.04)	5.8 (1.89)	11.6 (3.89)
Water issues with latrine	5 (2.42)	25.0*** (4.85)	2.9 (1.49)	26.8*** (5.87)	7.7 (4.84)	23.1*** (8.00)
Open defecation is hygienic	17 (3.68)	5.0*** (1.78)	12.2 (2.59)	1.3*** (1.00)	23.1 (6.69)	9.1** (2.60)
Afraid that pit will become full with use	14.1 (2.75)	11.9 (4.30)	9.8 (3.01)	14.7 (7.07)	19.4 (5.07)	8.9 (3.73)
Lack of toilet access when at place of work	11.4 (2.62)	37.2*** (3.58)	16.5 (3.90)	35.5*** (4.42)	5 (1.82)	39.1*** (5.59)

Source: HABIT baseline and endline surveys (March 2018, January 2019). Viswanathan et al. 2018; 2019.

Notes: BL = baseline; EL = endline. Standard errors clustered at the ward level reported in parentheses. \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ . Standard weights utilised.

Secondly, in some areas, one household shared a toilet with as many as five other households. Many 'lower' caste households did not own a toilet exclusively for their use, either because of land or resource constraints. In fact, in some instances, WVI had constructed one toilet for 3–4 households. As a result, in these areas, 10–15 residents shared a toilet, making it difficult for everyone to use it regularly; qualitative interviews suggest that men continued to defecate openly, whilst women and children used the toilet.

Thirdly, the out-migration of male residents for livelihood opportunities and, relatedly, the lack of toilets at their place of work results in non-use. This is discussed in detail under hypothesis 2a.

Finally, although the intervention did not address supply-side issues, problems with water supply have increased and could have resulted in the unchanged levels of intra-household use. This increase in water scarcity cannot be explained by seasonal differences since both rounds of data collection were conducted in the same month a year apart. About a quarter of households (25%) reported water issues with the latrine as reasons for OD at endline in both control and treatment areas (Table 13). Most toilets are constructed without taps, requiring the household to collect and store water in the toilet daily.

However, seasonal availability of water does appear to affect toilet use (Table 14). Households reported that there were severe water shortages in summer, resulting in a dearth even of drinking water, making it impractical for them to store water for toilet use. Amongst households that reported not being able to use the toilet during specific times of year, 58.6 per cent reported summer (which includes the months from March to June) as the season when they could not use the latrine.

**Table 14: Reported times of year when toilet cannot be used**

	<b>Overall (n = 1,058)</b>	<b>Control (n = 540)</b>	<b>Treatment (n = 518)</b>
Proportion of open-defecating households reporting a time of year when they cannot use latrine	13.4	15.3	11.1
	(3.44)	(4.17)	(5.64)
<b>Times of year reported</b>	<b>(n = 130)</b>	<b>(n = 85)</b>	<b>(n = 45)</b>
Monsoons/Rains	15.5	21.2	6.1*
	(5.08)	(6.16)	(5.00)
Summer	58.6	53.3	67.3
	(5.70)	(8.74)	(6.50)
Winter	13.1	12.8	13.5
	(3.27)	(3.36)	(6.57)
Others	12.8	12.7	13.1
	(2.37)	(3.35)	(3.04)

Source: HABIT baseline and endline surveys (March 2018, January 2019). Viswanathan et al. 2018; 2019.

Notes: Standard errors clustered at the ward level reported in parentheses. Sample weights.

We do not have water to drink, water is a big problem. We need a tanker system here. When there is no water, we leave the toilet dirty and cannot use it. When we get water, we throw it into the toilet. — Male respondent, Nalanda

To summarise, the increases in toilet use amongst households, as well as at the intra-household level, are a positive development and are likely to have resulted from contextual factors in the wake of the SBM. Despite this, barriers to toilet use persist. One barrier to toilet use is attitudinal; changing the way OD is perceived will require long-term engagement at the village level. Other barriers are non-behavioural in nature and can be addressed by providing toilets at places of work, as well as rectifying supply-side issues, such as water supply and faulty toilet infrastructure.

#### *Toilet use at the individual level*

##### Primary hypothesis 2a (H2a)

*Individual level:* the intervention will increase toilet use amongst adult male members (aged five and above) within treatment households. Is the behavioural intervention successful at increasing latrine use amongst male members in treatment households?

A key outcome of the intervention was increased toilet use amongst male members of the household. This section will discuss the findings on toilet use amongst male members, as well as the reasons for non-use.

It is important to note that absenteeism was high amongst male members, and the intervention was mainly received by the female members who were present during the community meetings as well as the household visits. As a result, the information the men had about the interventions was through the conversations they had with their wives.<sup>28</sup>

The quantitative assessment found no significant impact of the intervention on latrine use by male household members.

<sup>28</sup> This finding has been highlighted in the process assessment (Padmanabhan et al. n.d.), and an additional key assumption was introduced in the theory of change.

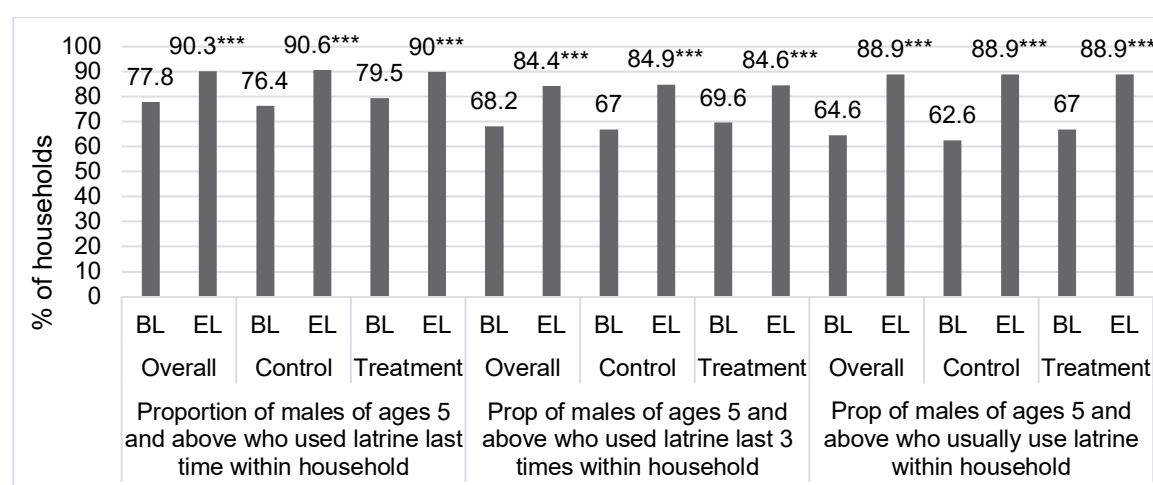
**Table 15: Latrine use by males**

Proportion of males (aged 5 and over) from within the household who use/d the latrine	Last time	Last 3 times	Usually
ITT	-0.0168	0.00124	-0.00738
	(0.0415)	(0.0487)	(0.0592)
Observations	2,047	2,042	2,050

Source: HABIT baseline and endline surveys (March 2018, January 2019). Viswanathan et al. 2018; 2019.

Notes: ITT = intention-to-treat. Standard errors clustered at the ward level reported in parentheses. \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ .

Other findings show that there has been a 10 percentage-point increase in the proportion of males aged five years and over who used the latrine in both treatment and control households. There have also been improvements of 30 and 20 percentage points in the proportion of male members aged five years and over who usually use latrines within the households, in control and treatment households respectively. The uniform improvement across treatment and control groups could be attributed to the multiple interventions and messaging encouraging toilet use and discouraging OD from the SBM, as well as JEEViKA and other NGOs. The process assessment data further elaborate on this issue, and we find that the atmosphere of fear and shame associated with OD is likely to result in increased levels of toilet use out of fear of sanctions, such as withdrawal of social welfare benefits and public shaming.

**Figure 15: Toilet use patterns (males aged five years and over)**

Notes: BL = baseline; EL = endline.

The main outcome indicators (latrine use) were also found to be significantly correlated with explanatory variables such as highest level of education (positive correlation) in the households, poverty status (negative correlation) and proportion of working-age household members engaged in agricultural activities (negative correlation). This indicates that toilet use is likely to be higher in households that have higher levels of education, are richer and have fewer household members who work in agricultural activities.

This relationship between working in the field and defecating more frequently in the open, for male members of the household, was also verified through the qualitative

interviews. On reviewing related literature, we find corroborating evidence in this regard. It is common knowledge that many men who own latrines and contribute to construction with their own labour do not use them; and, in many villages, latrine owners and non-latrine owners alike share the view that men have no physical problems walking long distances and no social constraints, hence prefer defecating in the open when they work in the fields (Coffey and Spears 2017).

During the formative research, men were identified as a priority group for the intervention, as the literature – including our baseline findings – suggests that their toilet use is low compared with women (Coffey et al. 2015; Spears et al. 2013; Viswanathan et al. 2018). However, due to high rates of out-migration, men are not at home for large parts of the month, affecting their opportunity to use household toilets.

Alongside out-migration, the nature of work also has an impact on toilet use. The most commonly cited barrier to latrine use is the lack of access to latrines at places of work, with 39 per cent of open-defecating households reporting this as a reason for OD. Many respondents were agricultural labourers who left the house early and did not have access to toilets throughout the day.<sup>29</sup> Others, who are lorry drivers, also do not have access to toilets for defecation. Even those who work in the village cannot return in the middle of a workday, just to use the latrine. The reviewed literature corroborates these findings to suggest that male members who engage in agriculture or other work spend large amounts of time outside the household and prefer defecating in the open (Coffey and Spears 2017).

When men go to the fields in the morning, they don't come back to use the toilet during the day. They find it more comfortable to defecate/urinate in the open. —  
Male respondent, Nalanda

Most men also reported that when it came to toilet use they would give preference to the female members of the household, as well as the elderly and disabled, as they had a greater 'need'. This phenomenon is likely the result of the perception of the household toilet as a limited resource,<sup>30</sup> which needs to be rationed only to those who need it most.

Although very few men were available to be interviewed during the qualitative study, those who we interviewed reported that males who live in the village and work in the fields largely prefer defecating in the open.

Overall, we find a significant increase in toilet use across treatment and control areas. This may be attributable to the general sanitation messaging across the state. The qualitative study found that men were not actively involved in the intervention and relied on information provided by their wives. Most male members who did defecate in the open stated that convenience and habit, as well as the need to give preference to women, were the main reasons. Future programming targeting male toilet use needs to account for high out-migration and lack of toilets in the field.

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<sup>29</sup> Very few men were interviewed for the qualitative study, as most were either working in the field the entire day or had out-migrated for work to other parts of Bihar and other states such as Punjab and Haryana.

<sup>30</sup> This could be as only one person can use the toilet at a time; therefore, if individuals need to use it at the same time of the day, women may be prioritised.

## Primary hypothesis 2b (H2b)

*Individual level:* this intervention will increase toilet use amongst adult female members (aged five and above) within treatment households. Is the behavioural intervention successful at increasing latrine use amongst female members in treatment households?

This section discusses findings related to female toilet use. Overall, there was a high uptake of the intervention amongst female household members, as they were present during the community meetings as well as the household visits. Qualitative interviews suggest that most respondents understood the rationale of the interventions and communicated this to those household members who were not present during the community meetings or household visits.

As in the case of male toilet use, the quantitative assessment found no impact of the intervention on female toilet use outcomes.

**Table 16: Latrine use by females**

Proportion of females aged 5 and over from within the household who use/d the latrine	Last time	Last 3 times	Usually
ITT	0.0101	-0.00758	-0.0516
	(0.0335)	(0.0367)	(0.0443)
Observations	2,129	2,128	2,129

Source: HABIT baseline and endline surveys (March 2018, January 2019). Viswanathan et al. 2018; 2019.

Notes: ITT = intention-to-treat. Standard errors clustered at the ward level reported in parentheses. \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ .

The descriptive statistics show a nearly uniform increase in toilet usage amongst women in both treatment and control households (Figure 16). During the endline, 90 per cent of all households reported females aged five years and over using the toilet. Qualitative responses show that preference is given to female members of the household, especially adolescent girls, in terms of toilet use.

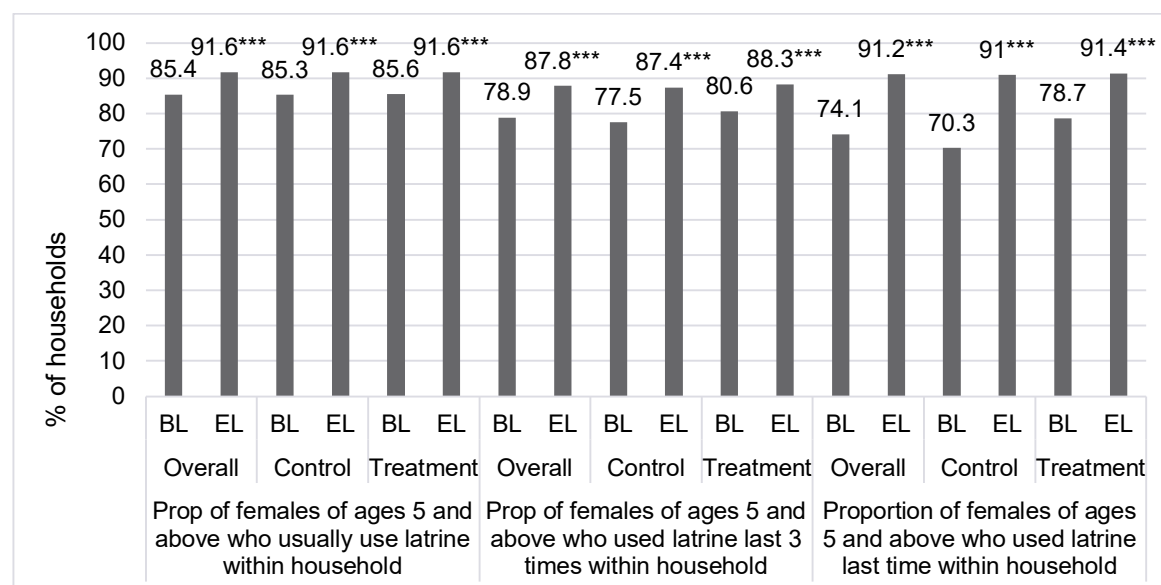
Due to the high proportion of reported toilet use amongst women,<sup>31</sup> we struggled to find responses showing reasons for non-use. The small number of women that did cite reasons for non-use mentioned water issues and lack of toilet access at the workplace, as well as convenience, hygiene levels and the socialisation aspects of OD.

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<sup>31</sup> It is important to caveat here that women have high incentives to report high toilet use due to various programmes that target and monitor toilet usage using coercive methods, especially amongst women.



**Figure 16: Toilet use patterns (females aged five years and over)**



Notes: BL = baseline; EL = endline.

Latrine use amongst female members of the household has been encouraged by national campaigns such as the SBM and Beti Bachao, Beti Padhao.<sup>32</sup> These campaigns tie toilet use to security and dignity of women.

JEEVIKA, along with the village-level *swachhagrahis*,<sup>33</sup> have used gendered messaging relating to privacy and self-respect to encourage women to use toilets. As highlighted in the formative research, toilet use amongst women is still tied to women's security and dignity.

Women, children and elderly people have all benefited from the construction of toilets. But adolescent girls have benefited the most. They don't feel like their dignity may be violated every time they step out to use the toilet. — Female respondent, Nalanda

Therefore, since findings suggest improved toilet use across the board, amongst women across treatment and control groups, we cannot conclude that the intervention has had an impact on improving toilet use amongst women.

### 4.3 Heterogeneity of impacts

The Improving HABIT baseline and endline sample provides the scope to assess the heterogeneity of impact by gender, age and caste. Approximately 50% of the individual sample are female; 11% are children under 5 years of age and 9% are adults aged 60 years or over. At the household level, approximately 46% have a BPL ration card or NREGA card, and 26% identify as an SC or ST.

<sup>32</sup> Beti Bachao, Beti Padhao is a campaign of the Government of India that aims to generate awareness and improve the efficiency of welfare services intended for girls.

<sup>33</sup> A *swachhagrahi* is a person who leads the Nigrani (monitoring) Samiti in a village and is trained on Community-Led Total Sanitation and given ownership to make their village ODF. Their progress is reviewed at block and district levels through ODF monitoring teams.

The key aspect of heterogenous impact we expected to see was around gender. Our formative research and baseline results indicated a gendered difference in toilet use. Additionally, the process assessment suggested that women were primary recipients of the intervention and were more likely to be present during the household visits and community meetings. The endline analysis sees a uniform decrease in OD figures amongst men and women, although women were still more likely to use toilets than men. Reasons for this difference have been discussed in previous sections.

For our endline individual adult sample (aged five and above), the OD rate amongst males overall is higher (12.23%) than that of females (9.22%) (Table 17). This is also true for all the age groups. The lowest OD rate for both males and females is for the group aged 18–35 years. It is highest for the oldest age group (60 years and over), again for both males and females.

**Table 17: Open defecation across age by sex amongst individual adults in endline sample**

Age group	Male			Female		
	Mean (%)	Std error	N	Mean (%)	Std error	N
All ages	12.23	0.63	2,675	9.22	0.56	2,708
6–17 years	11.06	0.96	1,074	9.32	0.92	993
18–35 years	10.63	1.11	766	7.54	0.92	817
36–59 years	14.05	1.46	568	10.19	1.21	626
60 years and over	17.84	2.35	267	11.48	1.94	272

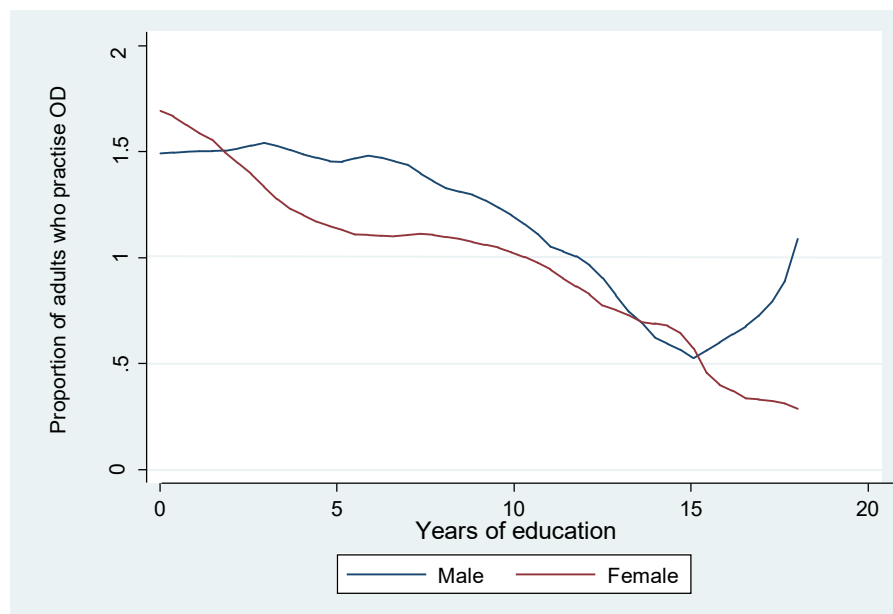
Source: HABIT endline survey (January 2019). Viswanathan et al. 2019.

Notes: Standardised baseline weights utilised.

The kernel-weighted regressions on the relationship between education level, sex and toilet use amongst individual adults (aged five and above) in the households in the endline sample show that, overall, the rate of OD is higher amongst males than females for the same education level (Figure 17). However, we also find that, with very low levels of education (less than two years of formal education), OD rates are higher amongst females than males. In addition, there is a small variation around the education level of 15 years, where female OD rates are higher than male.<sup>34</sup>

<sup>34</sup> The upturn towards the end of the graph (Figure 17) was caused by a very small sample of females with a graduate level of education: 1 out of 6 graduate females reported OD, compared with 2 out of 30 graduate males.

**Figure 17: Open defecation across education level by sex amongst individual adults in endline sample**

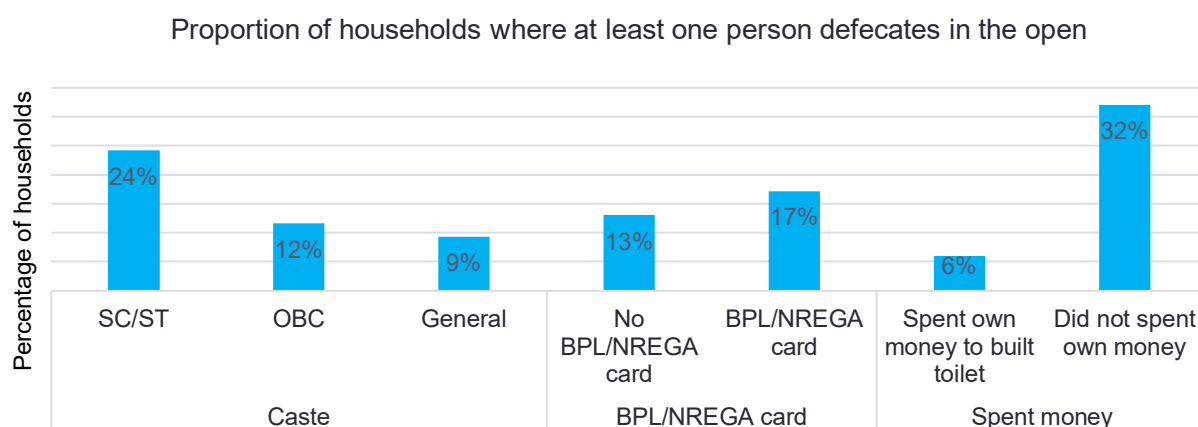


Source: HABIT endline survey (January 2019). Viswanathan et al. 2019.

The figure above represents the OD rates across various socio-economic indicators at the household level. The percentage of households with at least one member practising OD is higher amongst SC and ST households (24%) than OBC (12%) and general caste (9%) households.

On the economic status, we find that the incidence rate of OD is slightly higher amongst households with a BPL or NREGA card (17%) than amongst households with neither a BPL nor a NREGA card (13%). At the same time, households that have spent their own money on toilet construction have a substantially lower rate of OD than those that did not spend their own money to build a toilet. This last result is in line with the findings of Coffey and colleagues (2014), who show that people who live in households with a toilet that was built with government support have a higher probability of defecating in the open than people who live in households where the toilet was privately constructed.

**Figure 18: Toilet use at household level by caste, poverty and spending**



Source: HABIT endline survey (January 2019). Viswanathan et al. 2019.

## 5. Cost analysis

A formal cost-effectiveness analysis was not conducted as part of this study. The intervention was, however, designed so that it could be implemented within the existing SBM structures. In Table 18 we have outlined the costs associated with delivering the intervention. This does not, however, capture the costs incurred in designing and piloting the intervention.

**Table 18: Cost of procuring materials for the intervention**

Community meetings	Approximate cost <sup>35</sup>
Card game	INR60 (USD0.86)
Plastic bucket	INR150 (USD2.15)
Household visits	Approximate cost
Card game	INR60 (USD0.86)
Chalkboard	INR50 (USD0.72)
Lockbox	INR50 (USD0.72)

Recurring costs in delivery of such an intervention would include the salaries of facilitators who delivered the household visits and community meetings.

## 6. Discussion

### 6.1 Summary of findings

This study tests the impact of simple behavioural nudges in promoting toilet use in rural Bihar and tests the behavioural barriers to toilet use. The intervention was implemented in the context of increasing sanitation focus across the state and the country, and a push to declare large parts of the country ODF. Although a small pilot, findings could serve as inputs into future sanitation policy.

Highlights of the findings on the effectiveness of the intervention are as follows.

#### 6.1.1 On toilet use

Our study finds significantly high improvements (at  $p < .001$ ) in toilet use at the household and individual levels across both the control and treatment groups. Baseline household-level usage increased from 52.5% to 83% at endline for the indicator 'latrine used usually', with similarly high changes for usage the last time or last three times for defecation. Usage at the individual level also increased from 69.5% of the proportion of individuals aged five years and over within the household at baseline to 90% using the latrine 'usually' at endline, again with similar high changes with regard to latrine usage last time or last three times. This is, however, consistent across treatment and control areas, with no discernible impacts of the intervention.

We believe that these improvements in toilet use can be attributed to the overarching sanitation messaging from the government, and the work of local self-help groups to convince village residents to construct and use toilets through behaviour change

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<sup>35</sup> Costs of these materials may depend on the quality of material used and regional variation in prices. Conversion from INR to USD is based on rates as of 20 June 2019.

campaigns under the SBM. The campaigns include information dissemination, as well as several tactics including fining open defecators, shining torches on them whilst they are defecating, and garlanding them after they have defecated (Priyadarshini 2018).

JEEViKA groups also employ sanctions such as withholding subsidised food benefits, agricultural assistance and other aid given to households (O'Reilly et al. 2015) to disincentivise OD. In addition, several NGOs and development agencies have conducted large-scale interventions on sanitation in the recent past.<sup>36</sup> The combination of these positive and negative reinforcements has improved toilet use behaviour in study areas.

We are aware that a recent working paper by Gupta and colleagues (2018), from r.i.c.e. and the Accountability Initiative, looking at changes in toilet usage between 2014 and 2018, suggests that toilet use is still at quite a low level in Bihar, approximately 40 per cent overall. Although at first, these results may seem contradictory, there are several differences between our study and that of Gupta and colleagues. Firstly, whilst they focused on toilet use at an overall level, our study focused on toilet use amongst households with functional toilets. Secondly, Gupta and colleagues included all types of toilets in their study, whereas our focus is on functional twin-pit latrines.

In order to ensure that our findings are robust, we have tested the potential for self-reporting bias (given the extensive focus on ODF and therefore implicit pressure to report usage), by comparing different modes of reporting toilet use – latrine used usually, used last time, and used last three times the person defecated. We also looked at the observation module in our survey: 91 per cent of the toilets surveyed looked used, suggesting that there is unlikely to be self-reporting bias. However, it is important to note that the toilet observation module can only comment on the usage by at least one member of the household, not regular usage by all members of the household.

Another reason for the difference in findings could be that our survey, which took place in 2019, captures changes later than those in the study by Gupta and colleagues. The push to increase toilet use became much greater with the approaching 2 October 2019 deadline to make India ODF. A recent study also reports on high levels (95%) of toilet use (amongst toilet owners) in a sample collected in Bihar and Tamil Nadu, adding to the evidence of a shift in toilet-use behaviour (Bicchieri et al. 2017).

Access to water, structural breakdown of the toilet, and migration or travel to the fields continue to be barriers to universal toilet use. The importance of the first two factors has also been highlighted in the context of rural Odisha by Routray and colleagues (2015). Migration and lack of access to toilets at the place of work (fields) play an important role in the continuing differences seen in OD by gender. Whilst both men and women showed an increase in toilet use over time, endline data show a persisting difference, with the OD rate of males being overall higher (12%) than that of females (9%). These differences are, however, quite marginal.

Whilst Bicchieri and colleagues (2017) report overall similarities in toilet use across genders, they mention a spike in OD amongst young men between 30 and 35 years of

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<sup>36</sup> Organisations including Population Services International, Project Concern International, CARE, Alive & Thrive and Digital Green have disseminated information on the importance of sanitation and toilet use since the SBM.

age, possibly occurring during their time away at work. In their 2018 report, they do also describe women reporting higher exclusive toilet use in the past week compared with men. Whilst earlier SBM campaigns highlighting women's dignity have played a role in the increased rates of female use, some studies also suggest restrictions on women leaving the home unaccompanied as playing a role in promoting use of household-owned toilets (Caruso et al. 2017; Khanna and Das 2016).

Our study also confirms the correlation between toilet use and socio-economic factors in rural Bihar (as reported by Bicchieri et al. 2017), with higher OD levels found to be persisting amongst SC and ST groups, and those belonging to a lower economic status and with a lower level of education.

### **6.1.2 On habit formation**

We found the habit formation sections of the intervention had a limited and mixed impact on toilet use. The lockbox had a mixed reception among the treatment households. Qualitative findings suggest that, whilst respondents understood the purpose of the lockbox and were able to save money using this device, some thought it was childish. Most households reported some cleaning expenses for the toilet, but most had not incurred maintenance or repair expenses at the time of the study.

Findings on the chalkboard are mixed: whilst they were used during the process assessment, respondents at the endline reported discomfort with displaying their toilet use behaviour. Differences between the process assessment and endline study suggest that habit-forming aspects require a sustained intervention presence and are difficult to maintain once the intervention period has ended.

### **6.1.3 On pit emptying and pit filling**

A key behavioural barrier to toilet use was aversion to pit emptying and misconception around pit-filling rates. An equal number of treatment and control households reported receiving some messaging on pit-filling rates, which is not surprising given the presence of various interventions in Bihar. We find, however, that households in the treatment group are 6.1 percentage points more likely to correctly estimate the pit-filling rate than their control counterparts (although the difference was not significantly different even at 95 per cent significance levels). Additionally, whilst the number of people underestimating the amount of time it takes for pits to fill has *increased* in control areas, this number has fallen substantially in treatment areas, from 43 per cent to 23 per cent. Given that we think underestimating the amount of time it takes for a pit to fill up is linked with the misidentification of pits as a scarce resource, this suggests a positive development in treatment areas.

With regard to attitudes related to self-pit emptying, the reduction in households reporting that they found this inconvenient was higher in the treatment group than in the control group. However, in both groups, most households reporting that they did not find it inconvenient seem to have done so on the basis of getting someone else to do it. Overall, only approximately 3–4 per cent of households responded positively to the query on whether a family member would clean the pit if the need arose. This alludes to the persistence of outsourcing of pit emptying, with possibly a lack of understanding of the self-emptying design of the twin-pit toilet, and also to the persistence of notions of pollution and purity (Coffey et al. 2015).



Bicchieri and colleagues (2017) also report finding that a non-Dalit emptying a pit was an extremely rare occurrence, with the emptying of a pit by a non-Dalit being considered wrong by a majority of respondents. Additionally, our interviews with manual de-sludgers and toilet-using households suggested limited understanding of the need to allow faecal matter to decompose before emptying. In many instances, pits with undecomposed matter are emptied, and the pathogenic faecal matter is disposed of in an open field. Undecomposed faecal matter poses public health risks and is akin to the risks posed by defecating openly in the first place.

This finding raises concerns about the sustainability of toilet use, the increased incentives for manual scavenging with higher toilet use, as well as the loss of public health gains of toilet use due to incorrect information on decomposition of faecal matter in the twin pit. To achieve its public health outcomes, phase 2 of the SBM needs to focus on pit emptying and the need for faecal matter to decompose before emptying the pit. A concentrated effort to eliminate manual scavenging and ensure self-emptying has to be the thrust of the next phase.

## **6.2 Limitations and validity**

The study has some limitations, as follows.

### **6.2.1 Internal validity**

During the endline data collection, the survey tool included questions on the outcome indicators and implementation strategies. The responses were self-reported by the respondents for the majority of the indicators. We built observational questions to counter self-reporting bias. However, there is a small possibility that the actual changes in behavioural parameters might be lower than estimated by the study.

In addition, participation in the intervention, particularly in the community meetings, was voluntary, leading to a self-selection bias to participating in the actual intervention. Although efforts were made to control for it by introducing explanatory variables in the regression models, it limits the generalisability of the findings. Note, however, that self-selection was not an issue with regard to household visits. Eligible households were visited by the facilitators. Their informed consent was obtained, but given the familiarity of households in the area with WVI facilitators, this rarely posed any issues.

### **6.2.2 External validity**

The evaluation used a randomised control trial design. However, with the backdrop of the SBM, the target population in the treatment and control cohorts went through interventions from various sources other than WVI, focusing on the knowledge, awareness and practice of toilet usage. Therefore, it limits being able to attribute any changes in outcome behaviour (especially for toilet usage) amongst the treatment group to the Improving HABIT intervention solely.

### **6.2.3 Measurement error**

The evaluation is based on the panel data analysis at the household level, not at the individual level. This restricts the findings to assessing the changes in outcome indicators at the individual level.

### **6.3 Policy and programme relevance: evidence uptake and use**

This study adds to the growing body of literature around sanitation behaviour in India and its link to notions of caste, pollution and purity. The findings of this study validate previous literature on barriers to toilet use, whilst recognising the improvement in toilet use spurred by the government push to make India ODF. Some findings that can provide input into the next phase of SBM programming include the need to focus on pit emptying and greater messaging on the design of the twin pit. In the absence of this, the potential health gains from increased toilet use might be lost. We are therefore cognisant of the need to engage with the government and other stakeholders.

We have been engaging with a range of stakeholders throughout the study. This has included sharing information about the ongoing study with other study teams and donors. During a workshop for training facilitators (organised in April 2018) to undertake the implementation, we invited local government officials from the block and district levels. Unfortunately, only the local block development officer was able to attend. Further, it has been difficult to engage with government officials due to the pressures of the ongoing SBM programme. Despite repeated attempts to engage with the central ministry, our efforts have been unsuccessful, partially due to the increased focus on achieving government sanitation targets.

In light of this, the study team revised its stakeholder engagement plan in consultation with 3ie. Stakeholder engagement for this study needs to be balanced with the overarching climate around sanitation programming in the country. It was important for the study team to be confident of its findings before engaging with government stakeholders. Once the report is finalised, we expect to engage with SBM officials at the state and district levels, highlighting the findings of the study and the opportunities it presents for future sanitation programming in the country. In addition, we are working with our implementation partner to tailor some of these findings to its future programming: specifically, increasing the messaging around pit emptying.

### **6.4 Challenges and lessons**

With regard to the implementation and evaluation, this study highlights: (1) the importance of constantly engaging with implementers and being flexible enough to change aspects of the design in response to challenges being faced on the ground; and (2) the challenge of running a small behavioural intervention in concurrence with a larger, more resource-intensive government programme. Given the massive push towards sanitation messaging by the government, complemented by the efforts of NGOs, it was difficult to test the incremental impact of the intervention on sanitation attitudes and behaviours. The increased intensity of SBM and local self-help group activities during the course of the intervention contributed to the overall high levels of messaging around sanitation in the study areas.

In addition, the findings highlight the limitations of short-term behavioural interventions in changing entrenched social attitudes. These interventions can work only in conjunction with bottom-up social change and will not be sufficient, in isolation, to change deep-seated biases.

Regarding evidence uptake, a key learning is the importance of awareness of changing political economy imperatives. Whilst the SBM provides a big opportunity, the focus of the government was on highlighting gains as the deadline neared. Reflections on improving shortcomings and aiming towards sustainability need to be put forth together with highlighting the gains that have been made.

## **7. Conclusions and recommendations**

In this report, we examine the impact of a six-month behavioural intervention in changing attitudes and practices around toilet use. We find a comparable and significant increase in toilet use across both treatment and control areas. This may be attributed to the ongoing efforts of the government and a number of other organisations in eliminating OD in both areas. Our intervention therefore did not have an additive effect on latrine use.

However, intermediate outcomes suggest that the intervention has influenced knowledge on, and attitudes around, decomposition of faecal matter and pit emptying. The intervention showed significant impact on knowledge around pit decomposition, suggesting that the intervention was successful in conveying information on decomposition of faecal matter. Treatment areas reported improvement in the perceived ease of pit emptying.

Our study also confirms deep-seated caste biases in pit emptying. Most households, including those that showed an improvement in the perceived ease of pit emptying, reported that they would hire someone to clean the pit. This points to the persistence of caste-based division in undertaking such tasks, corroborated by the qualitative findings that the people employed to clean pits almost always belonged to the Dom caste. The qualitative study also finds that some households are emptying pits without waiting for the required decomposition of the faecal matter, an action which raises serious public health concerns.

The uniform increase in toilet use across treatment and study areas points to the success of the SBM in improving toilet behaviours, in our study area. Other studies are also pointing towards similar trends (World Bank 2019). Local, state and national bodies have focused on improving this outcome indicator, and there is saturation in sanitation messaging with a good understanding of accepted toilet behaviours within study communities. The findings of our study identify some areas of focus for future sanitation programming to ensure the sustainability of the behaviour, as well as to realise the health benefits of eliminating OD.

For national- and state-level policymakers, the findings of this report highlight the importance of focusing future sanitation programming on pit-emptying attitudes and practices. Increasing information on decomposition and safe pit-emptying practices, whilst explicitly encouraging self-pit emptying would be important. A more explicit link between toilet use, proper disposal of faecal matter and public health needs to be established, as current messaging has tended to focus on notions of security, honour and shame.

The process assessment identified facilitator attrition and varying skills of facilitators as having potentially had an impact on the delivery of the intervention. Whilst this is normal across programmes, it is important for implementers and researchers to ensure

continuous standardised training of facilitators. This will mean there is minimal disruption to programmes as a result of attrition and skill variance. This would be of particular interest for programmes being implemented over a long time period.

An additional point of interest for programme implementers and government officials is around construction of toilet pits, and inconsistency in type and size. Although our study focused on twin pits, the vastly varying size and quality of pits make it difficult to tailor standardised messaging around pit filling. Conflicting messaging can increase misconceptions around pit filling.

For researchers, this study provides support to the evidence around aversion to pit emptying and deeply entrenched notions of caste, purity and pollution. Most respondents expressed 'disgust' at the idea of self-pit emptying and relied on hiring someone else to empty their pits. This highlights the importance of treating sanitation as a social issue, and not merely as one related to access to toilets and toilet use behaviour. This is also pertinent for civil society and programme implementers. Providing adequate information to ensure conversion of faecal matter to non-pathogenic decomposed matter and framing the sanitation issues around social attitudes and behaviours will be necessary to promote self-emptying and to avoid further entrenchment of caste-based pit emptying.

For those interested in behaviour science, this highlights the limitations of behavioural interventions when faced with deep-seated social biases. Whilst our intervention increased knowledge on aspects related to decomposition, it does not seem to have had a significant impact on increasing self-emptying. There is also emerging research on the role of social networks in improving sanitation behaviour (Bicchieri et al. 2017). Looking at leveraging sanitation communication through social networks could provide a way to improve sanitation behaviours in a sustainable manner.

For those designing behavioural interventions, our findings highlight the need to contextualise programme components. The use of a chalkboard to track and motivate habit formation was not successful in the current study. Interviews suggest that households were uncomfortable with tracking their toilet use and having it visible to others, especially guests in their households. Piloting and detailed qualitative interviews during the piloting phase would help gauge adverse reactions to intervention design.

This study is important in understanding the changing practices around toilet use in rural Bihar, and associated behaviours. Sustaining the current increases in toilet use may require, in addition to the current focus on acceptable toilet behaviour, increased understanding of aspects related to rates of pit filling, decomposition in the pit, the non-pathogenic nature of the decomposed material and proper disposal. These are important to ensure that the public health benefits of eliminating OD are realised. Given deep-seated social biases about pit emptying, the findings also point to the need for a concentrated effort from the government, civil society and programme implementers to design messaging to change attitudes around caste-based pit emptying and the need to look at sanitation behaviours from a social change standpoint.

## **Online appendixes**

### **Online appendix A: Qualitative notes**

<https://www.3ieimpact.org/sites/default/files/2019-08/TW14.1005-Online-appendix-A-Qualitative-notes.pdf>

### **Online appendix B: Survey instruments**

<https://www.3ieimpact.org/sites/default/files/2019-08/TW14.1005-Online-appendix-B-Survey-instruments.pdf>

### **Online appendix C: Pre-analysis plan**

<https://www.3ieimpact.org/sites/default/files/2019-08/TW14.1005-Online-appendix-C-Pre-analysis-Plan.pdf>

### **Online appendix D: Evaluation design**

<https://www.3ieimpact.org/sites/default/files/2019-08/TW14.1005-Online-appendix-D-Evaluation-design.pdf>

### **Online appendix E: Quality control measures**

<https://www.3ieimpact.org/sites/default/files/2019-08/TW14.1005-Online-appendix-E-Quality-control-measures.pdf>

### **Online appendix F: Qualitative sample and fieldwork strategy**

<https://www.3ieimpact.org/sites/default/files/2019-08/TW14.1005-Online-appendix-F-Qualitative-sample-and-fieldwork-strategy.pdf>

### **Online appendix G: Detailed difference-in-differences regression results**

<https://www.3ieimpact.org/sites/default/files/2019-08/TW14.1005-Online-appendix-G-Detailed-DID-regression-results.pdf>

### **Online appendix H: Technical parameters of the quantitative survey**

<https://www.3ieimpact.org/sites/default/files/2019-08/TW14.1005-Online-appendix-H-Technical-parameters-of-the-quantitative-survey.pdf>

### **Online appendix I: Implementation findings from process assessment**

<https://www.3ieimpact.org/sites/default/files/2019-08/TW14.1005-Online-appendix-I-Implementation-findings-from-process-assessment.pdf>

## References

- Bateman, M and Engel, S, 2018. To shame or not to shame—that is the sanitation question. *Development Policy Review*, 36(2), pp.155–73.
- Bicchieri, C, Ashraf, C, Das, U, Kohler, H, Kuang, J, McNally, P, Shpennev, A and Thulin, E, 2017. *Phase I Project Report – Social Networks and Norms; Sanitation in Bihar and Tamil Nadu, India*. Philadelphia: Penn Song Social Norms Group. Available at: <<https://repository.upenn.edu/cgi/viewcontent.cgi?article=1015&context=pennsong>> [Accessed 24 September 2019].
- Carroll, C, Patterson, M, Wood, S, Booth, A, Rick, J and Balain, S, 2007. A conceptual framework for implementation fidelity. *Implementation Science*, 2(1), p.40.
- Caruso, B, Clasen, T, Hadley, C, Yount, K, Haardörfer, R, Rout, M, Dasmohapatra, M and Cooper, H, 2017. Understanding and defining sanitation insecurity: women's gendered experiences of urination, defecation and menstruation in rural Odisha, India. *BMJ Global Health*, 2(4), e000414. Available at: doi: <https://doi.org/10.1136/bmjgh-2017-000414>.
- Chatterjee, L, 2011. Time to acknowledge the dirty truth behind community-led sanitation. *The Guardian* [online], 9 June. Available at: <<https://www.theguardian.com/global-development/poverty-matters/2011/jun/09/dirty-truth-behind-community-sanitation>> [Accessed 14 March 2019].
- Coffey, D and Spears, D, 2017. *Where India Goes: Abandoned toilets, stunted development and the costs of caste*. New Delhi: Harper Collins.
- Coffey, D, Gupta, A, Hathi, P, Khurana, N, Spears, D, Srivastav, N and Vyas, S, 2014. Revealed preference for open defecation. *Economic & Political Weekly*, 49(38), p.43.
- Coffey, D, Gupta, A, Hathi, P, Spears, D, Srivastav, N and Vyas, S, 2015. *Culture and the Health of Transition: Understanding Sanitation Behaviour in Rural North India*. International Growth Centre. Working Paper, April.
- Cohen, J, 1988. *Statistical Power Analysis for the Behavioral Sciences*. 2nd ed. New Jersey: Lawrence Erlbaum.
- Contzen, N, De Pasquale, S and Mosler, HJ, 2015. Over-reporting in handwashing self-reports: Potential explanatory factors and alternative measurements. *PloS one*, 10(8), e0136445.
- Dumont, L. *Homo hierarchicus: The caste system and its implications*. University of Chicago Press, 1980.
- Economic Times, 2018. Swachh Bharat: PM Modi praises Bihar govt for making 8.5 lakhs toilets in a week [online], 10 April. Available at: <<https://economictimes.indiatimes.com/news/et-tv/swachh-bharat-pm-modi-praises-bihar-govt-for-making-8-5-lakhs-toilets-in-a-week/videoshow/63695125.cms>> [Accessed 20 September 2019].

Galvin, M, 2015. Talking shit: is Community-Led Total Sanitation a radical and revolutionary approach to sanitation? *Wiley Interdisciplinary Reviews: Water*, 2(1), pp.9–20.

Gupta, A, Khalid, N, Desphande, D, Hathi, P, Kapur, A, Srivastav, N, Vyas, S, Spears, D and Coffey, D, 2019. *Changes in Open Defecation in Rural North India: 2014–2018*. IZA Discussion Paper No. 12065. Bonn: Institute of Labor Economics. Available at: <<http://ftp.iza.org/dp12065.pdf>> [Accessed 24 September 2019].

International Initiative for Impact Evaluation (3ie), n.d. *Improving HABIT: Households' Attitudes and Behaviours to Increase Toilet Use. Formative Study Report*. New Delhi: 3ie. Available at: <<https://www.opml.co.uk/files/Publications/a1638-improve-habit-households-attitudes-behaviours-increase-toilet-use/formative-study.pdf?noredirect=1>> [Accessed 20 September 2019].

Khanna, T and Das, M, 2016. Why gender matters in the solution towards safe sanitation? Reflections from rural India. *Global Public Health*, 11(10), pp.1185–201. Available at: doi: <https://doi.org/10.1080/17441692.2015.1062905>.

Kilian, A, Lawford, H, Ujuju, CN, Abeku, TA, Nwokolo, E, Okoh, F and Baba, E, 2016. The impact of behaviour change communication on the use of insecticide treated nets: a secondary analysis of ten post-campaign surveys from Nigeria. *Malaria Journal*, 15(1), p.422.

Modi, N, 2014. No Swachh Bharat without Annihilation of Caste. *Economic & Political Weekly*, Volume 49(45), p.11.

Neal, D, Jelena, V, Burns, R, Wood, W and Devine, J, 2016. *Nudging and habit change for open defecation: new tactics from behavioral science* (English). Water and Sanitation Program. Washington, DC: World Bank Group. Available at: <<http://documents.worldbank.org/curated/en/905011467990970572/Nudging-and-habit-change-for-open-defecation-new-tactics-from-behavioral-science>> [Accessed 24 September 2019].

National Sample Survey Office (NSSO), 2016. *Schwachhta Status Report 2016*. New Delhi: NSSO and Ministry of Statistics and Programme Implementation, Government of India. Available at: <[http://indiaenvironmentportal.org.in/files/file/Swachhta\\_%20Status\\_Report2016.pdf](http://indiaenvironmentportal.org.in/files/file/Swachhta_%20Status_Report2016.pdf)> [Accessed 20 September 2019].

O'Reilly, K, Louis, E, Thomas, E and Sinha, A, 2015. Combining sensor monitoring and ethnography to evaluate household latrine usage in rural India. *Journal of Water, Sanitation and Hygiene for Development*, 5(3), pp.426–38.

Office of the Registrar General and Census Commissioner, 2011. *Census of India*. New Delhi: Ministry of Home Affairs, Government of India. Available at: <<http://censusindia.gov.in/>> [Accessed 20 September 2019].

Padmanabhan, V, Saith, R and Viswanathan, S, n.d. *Process Assessment: Improving HABIT Intervention*. Oxford: Oxford Policy Management. Available at: <<https://www.opml.co.uk/files/Publications/a1638-improve-habit-households-attitudes-behaviours-increase-toilet-use/process-assessment-annexure.pdf?noredirect=1>> [Accessed 20 September 2019].



- Priyadarshini, A, 2018. Tempering Patriarchy and Reinventing Gender. *The Journal of Migration Studies*, 1(1), pp.111–21.
- Rahman, A, Leppard, M, Rashid, S, Jahan, N and Nasreen, HE, 2016. Community perceptions of behaviour change communication interventions of the maternal neonatal and child health programme in rural Bangladesh: an exploratory study. *BMC Health Services Research*, 16(a), 389. Available at: doi: <https://doi.org/10.1186/s12913-016-1632-y>.
- Riazi, M, 2016. *The Routledge Encyclopedia of Research Methods in Applied Linguistics*. Abingdon: Routledge.
- Routray, P, Schmidt, W, Boisson, S, Clasen, T, and Jenkins, MW, 2015. Socio-cultural and behavioural factors constraining latrine adoption in rural coastal Odisha: an exploratory qualitative study. *BMC Public Health*, 15, p.880.
- Shahid, M, 2015. Manual scavenging: Issues of caste, culture and violence. *Social Change*, 45(2), pp.242–55.
- Spears, D, Ghosh, A and Cumming, O, 2013. Open defecation and childhood stunting in India: an ecological analysis of new data from 112 districts. *PloS One*, 8(9), e73784.
- Still, D, Foxon, KM and O’Riordan, M, 2012. *Tackling the challenges of full pit latrines*. Water Research Commission.
- Swachh Bharat Mission (SBM), 2019. *Dashboard*. Available at: <http://sbm.gov.in/sbmdashboard/Default.aspx> [Accessed 20 September 2019].
- Thorat, A and Joshi, O, 2015. The continuing practice of untouchability in India: Patterns and mitigating influences. *India Human Development Survey Working Paper*, (2015-2).
- United Nations, 2015. *Transforming our World: The 2030 Agenda for Sustainable Development*. A/RES/70/1. New York: United Nations. Available at: <https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf> [Accessed 20 September 2019].
- UNICEF, 2017. *Progress on drinking water and sanitation: 2017 update*, New York: UNICEF.
- Vālmīki, O, 2003.. *Joothan: A Dalit's Life*.: Columbia University Press.
- Viswanathan, S, Saith, R, Lamba, S, Joshi, S, Purty, N, Datta, S and Harris, J, 2018. *Improving H.A.B.I.T.: Households’ Attitudes and Behaviours to Increase Toilet Use*. Oxford: Oxford Policy Management. Available at: <https://www.opml.co.uk/files/Publications/a1638-improve-habit-households-attitudes-behaviours-increase-toilet-use/habit-baseline-study-report.pdf?noredirect=1> [Accessed 23 September 2019].
- World Bank, 2019. The National Annual Rural Sanitation Survey (NARSS) 2018–19, [https://jalshakti-ddws.gov.in/sites/default/files/National\\_Report\\_NARSS\\_2018\\_19.pdf](https://jalshakti-ddws.gov.in/sites/default/files/National_Report_NARSS_2018_19.pdf) [Accessed 09 December 2019].

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*Truth-telling by third-party audits and the response of polluting firms: Experimental evidence from India*, 3ie Impact Evaluation Report 10. Duflo, E, Greenstone, M, Pande, R and Ryan, N, 2013.

*No margin, no mission? Evaluating the role of incentives in the distribution of public goods in Zambia*, 3ie Impact Evaluation Report 9. Ashraf, N, Bandiera, O and Jack, K, 2013.

*Paying for performance in China's battle against anaemia*, 3ie Impact Evaluation Report 8. Zhang, L, Rozelle, S and Shi, Y, 2013.

*Social and economic impacts of Tuungane: final report on the effects of a community-driven reconstruction programme in the Democratic Republic of Congo*, 3ie Impact Evaluation Report 7. Humphreys, M, Sanchez de la Sierra, R and van der Windt, P, 2013.

*The impact of daycare on maternal labour supply and child development in Mexico*, 3ie Impact Evaluation Report 6. Angeles, G, Gadsden, P, Galiani, S, Gertler, P, Herrera, A, Kariger, P and Seira, E, 2014.

*Impact evaluation of the non-contributory social pension programme 70 y más in Mexico*, 3ie Impact Evaluation Report 5. Rodríguez, A, Espinoza, B, Tamayo, K, Pereda, P, Góngora, V, Tagliaferro, G and Solís, M, 2014.

*Does marginal cost pricing of electricity affect groundwater pumping behaviour of farmers? Evidence from India*, 3ie Impact Evaluation Report 4. Meenakshi, JV, Banerji, A, Mukherji, A and Gupta, A, 2013.

*The GoBifo project evaluation report: Assessing the impacts of community-driven development in Sierra Leone*, 3ie Impact Evaluation Report 3. Casey, K, Glennerster, R and Miguel, E, 2013.

*A rapid assessment randomised-controlled trial of improved cookstoves in rural Ghana*, 3ie Impact Evaluation Report 2. Burwen, J and Levine, DI, 2012.

*The promise of preschool in Africa: A randomised impact evaluation of early childhood development in rural Mozambique*, 3ie Impact Evaluation Report 1. Martinez, S, Naudeau, S and Pereira, V, 2012.

Progress on eliminating open defecation in India depends on developing scalable, cost-effective interventions to bridge the gap between latrine ownership and latrine use. Authors of this impact evaluation report evaluate the impact of a behaviourally-informed intervention designed to increase intent, and habit, of toilet use among toilet-owning households in rural Bihar. The study found that latrine use increased during the study period. While increases were consistent in both intervention and control groups, the intervention group had significant improvements in their knowledge regarding latrine use as well.

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