# TW14 Pre-analysis plan

Evaluating a behavioural intervention to improve toilet use amongst toilet owning households in rural Bihar

## Intervention

## Theoretical framework

Please describe the underlying behavioural theory - which will be used to guide your strategy for eliciting behaviour change through your intervention.

**Underlying Behavioural Theory**

The overall goal of the intervention is to aid in the formation of regular latrine-use habits to ensure the safe disposal of child and adult faeces and the elimination of OD. This project will measure the impact of a set of inter-related behaviourally informed interventions on latrine use among members of HOUSEHOLDs in rural Bihar who do possess a latrine, but where one or more members continue to practice OD.

Overcoming aversion to use and establishing habits around regular use requires insights about human decision-making and behaviour change. These insights aim to bridge the intention-action gap around use by decreasing aversion to use and establish habit formation to encourage regular use. Following social proof theory, such a drastic change in injunctive norms would further contribute by negatively impact individuals who continue to practice open defecation.

The intervention first considers constraints under which people make decisions. This framework is driven by the understanding that cognitive resources, much like material resources, are limited. All humans are characterized by bounded cognitive capacity, which in turn influences how we process information, make decisions, and ultimately behave.

The physical presence of latrines is necessary to automatically trigger context clues and encourage use. Maximizing physical ability makes the appearance that a latrine is a ubiquitous tool and encourages habit formation.[[1]](#footnote-1) Coffey also cites the important need to teach citizens that latrines take years to fill, when the perception is often months.[[2]](#footnote-2)

The treatment of supplies as a limited resource is a familiar issue within behavioural economics. For example, humans also exhibit this behaviour when they skip medication doses to make the medication last longer.[[3]](#footnote-3)

**Behaviour Change in Community & Household Meetings**

The intervention aims to change behaviour at both the HOUSEHOLD and community levels by shifting norms related to the acceptability of open defecation. Specifically, the intervention will:

1. Correct mental models about pit filling. (addressing lack of intention)
2. Address reasons for latrine aversion. (addressing lack of intention?)
3. Address anxiety about pit emptying. (addressing lack of intention)
4. Create commitment to use latrine. (addressing the intention – habit gap)

Community Meetings  
The community meeting targets behavioural barriers such as: overestimation of pit filling rates, unclear rewards to latrine use, and ambiguity around pit decomposition and emptying. During the meetings, a set of activities seek to reset faulty mental models of the relationship between regular latrine use and the filling up of the latrine pit in order to challenge a widely prevalent notion of the latrine as a limited resource that must therefore be conserved[[4]](#footnote-4). These activities are buttressed by others intended to make salient benefits of using latrines generated by existing users within target households, demystify the emptying of latrine pits, reinforce the notion of reusability of pits, and use of a commitment device to promote habit and save money for toilet repair.

Household Visits

The community meetings are supplemented and reinforced by a set of nudges, commitments and pledges during ongoing household-level visits. HOUSEHOLDs are encouraged to develop more concrete plans around latrine use. The HOUSEHOLD-level interventions revisit the same barriers discussed in the community meetings, but also include information tailored to household needs. Households will also be assisted in operationalizing the previously provided commitment device to reduce anxiety associated with pit-emptying.

*Note: The behaviour change theory provides the rationale for the hypotheses to be tested along the causal chain, in addition to the intervention and related activities. We assume that the concepts within the theory will become more context-specific during the course of the evaluation. In this way, describing the underlying theory in the pre-analysis plan will facilitate the interpretation of findings which might vary from what was originally expected. Documenting changes or additions will better inform the underlying theory.*

## Intervention summary

Please summarise your intervention.

The interventions will be introduced to villages through program staff visits to households. The intervention consists of two main touch-points: 1) *Community Meetings*: 1-2 meetings for all study households in a hamlet 2) *Household Visits*: Six household-level visits will occur over the 12-month intervention period and will begin the week of the community meeting. Only households with a functional pit latrine will be eligible for the intervention.

**Community Meetings**

Community meetings will be held at the tola level. Each tola will have separate meetings for men and women. Facilitators will start by welcoming everyone and discuss the benefits of using a latrine. Facilitators will ask questions and encourage participation from all members of the audience.

After introductions, the facilitator will use a “French drain” to demonstrate how matter in the toilet loses its volume during the decomposition process. The drain will be positioned on the ground and filled with mud, water and stones. During the meeting the water will slowly drain back into the ground in the background of the community meeting. The Facilitator will return to the French drain at the end of the community meeting to revisit how matter decomposes and loses its volume. By this time, all water will have been eliminated from the drain.

Next attendees will play a card game about pit-filling rates. One side of the card will have the size of the family and the other size will have the number of years a drain takes to fill. The group will have to guess how long it takes to fill the pit. The other side of the card will reveal the actual pit filling time. Based on the information learned, families will create an estimate of filling time for their pit assuming everyone in family uses the latrine daily.

During the meeting, the facilitator will also address common issues with the use of latrines such as smell and mosquitos. The facilitator should discuss the use of agarbathi sticks as a means of supressing smell and reducing the amount of mosquitos. The facilitator will also allow attendees to handle decomposed faecal matter.

**Household Visit**

At the first two HOUSEHOLD visits, families will play the same card game that was present in the community meeting. A facilitator will provide each HOUSEHOLD with a poster indicating the self-determined date their pit was constructed, the date a family should switch to a second pit and the date a pit can be emptied. This poster will also contain the pledge repeated at the community meeting and a space for each HOUSEHOLD member to write their name next to the pledge. Contact information for the WVI facilitator will be provided if any family members have questions.

A chalkboard with calendar outline will be also be given to families. The chalkboard will allow families to check each day every member of the family used the latrine. The facilitator will assist families with redrawing their chalkboard during the monthly HOUSEHOLD visits. Additionally, within each HOUSEHOLD the eldest female will be identified as the Toilet Champion and will be asked to insert a 2Rs coin into a lockbox each day, that all members of the family use the latrine. This gesture acts as a savings plan for materials necessary to keep the latrine clean and free of mosquitos. The facilitator will provide the lockbox.

## Evaluation Questions and Hypotheses

* 1. *What are the main evaluation question(s) the study seeks to answer?*

Latrine use is the **final outcome** across the interventions designed. Our intervention is especially targeted towards increasing latrine use among male members in households with functional twin pit latrines that are not used by any or all household members (or one or more or all members in the household continue to practice open defecation). In that sense this intervention is tailored to target intra-household toilet use and it would be important to capture use across household members.

* ***H1a: Primary Hypothesis 1a: Household level:* This intervention will help increase the toilet use amongst treated households.** Is the behavioural intervention successful at increasing toilet use at the household level with a functional twin pit latrine in the intervention areas of WVI?
* ***H1b: Primary Hypothesis 1b: Household members - Individual level:* This intervention will increase the number of members within treated households who regularly use toilets.** Is the behavioural intervention successful at increasing toilet use among household members within households with a functional twin pit latrine in the intervention areas of WVI? i.e increase in number of household members within households using latrines
* ***H2a: Primary Hypothesis 2a Individual level*: This intervention will increase toilet use amongst adult male members (above age of 5) within treated households:** Is the behavioural intervention successful at increasing latrine use among male members in households that have functional latrines?
* ***H2b: Primary Hypothesis 2b Individual level:* This intervention will increase toilet use amongst adult male members (above age of 5) within treated households:** Is the behavioural intervention successful at increasing latrine use among female members in households that have functional latrines?
  1. What are the hypotheses to be tested throughout the causal chain?

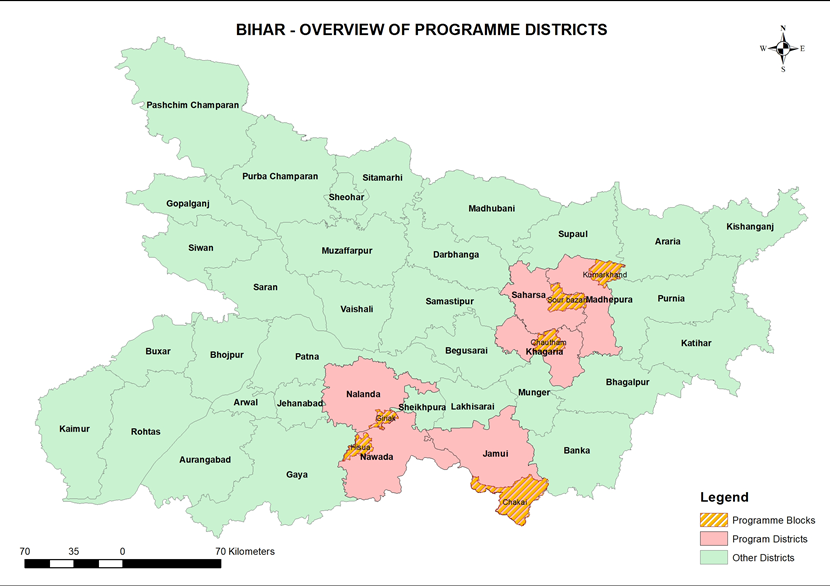
*There are several hypothesized intermediate outcomes that we will be testing throughout the causal chain. These are entwined with the different components of the intervention (as specified in the depiction of the Theory of Change).*

* ***IH1a: Intermediate Hypothesis 1a:* This intervention will increase information on the correct rates of pit filling amongst treated households*:***Is the behavioural intervention successful at providing information of the correct rates of pit filling to household heads in households with a functional twin pit latrine?
* ***IH1b: Intermediate Hypothesis 1b:* The intervention will increase knowledge on the correct rates of pit filling amongst treated households*:***Is the behavioural intervention successful at correcting the faulty mental models on the rate of pit filling among household heads in households with a functional twin pit latrine?
* ***IH2: Intermediate Hypothesis 2:* This intervention will reduce aversion to pit emptying amongst treated households**: Is the behavioural intervention successful at reducing the aversion to self-pit emptying among male household heads in households with a functional twin pit latrine?
* ***IH3: Intermediate Hypothesis 3*: This intervention will reduced anxiety associated with maintenance and repair of toilets amongst treated households**: Is there reduced anxiety associated with maintenance and repair of toilets amongst households that receive the treatment? Does this contribute to increasing the habit of toilet use?
* ***IH4: Intermediate Hypothesis 4*: This intervention will increased habit of toilet use amongst treated households through the mechanisms of a pledge and lock box.** Is there increased habit of toilet use amongst members in the treated households due to the use of a pledge and lockbox?

## Sampling

* 1. Sampling frame
  2. Please list any additional inclusion and/or exclusion criteria for the eligible population.

The eligible population for the study is households that have functional[[5]](#footnote-5) twin-pit latrines in the six blocks within which our implementation partner, World Vision, operates. The map below displays the six blocks and the six districts within which they are located.

**Fig. 1. State of Bihar map: Programme Districts and Blocks**

Within these six blocks, World Vision is operating in a subsample of villages and wards as indicated in the table below. There are 92 villages with eligible households in which World Vision operates. These 92 villages form our sampling frame, from within which we will select 49 treatment and 43 control villages randomly. Quantitative data will be collected from 43 treatment and 43 control villages - 6 (randomly selected) treatment villages will not be covered by the quantitative surveys, but will be used to inform the process evaluation component of this study.

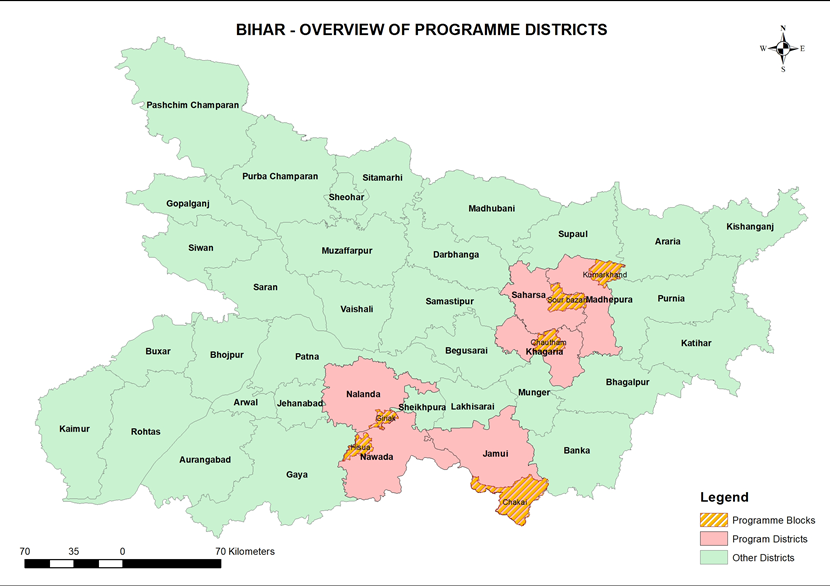
Treatment will be assigned to a single randomly chosen ward within each treatment village. All eligible households in the selected treatment ward (in each treatment village) will receive treatment. Moreo****ver, we restrict our sampling frame to only those wards which have at least 12 eligible households. This is because our power analyses indicated that we would need to sample 10-12 households per cluster. Further, an intervention such as this is likely to be less suitable in a place which has hardly any households with functional latrines, thereby reducing the probability of a change in community norms. A ward which has at least a certain threshold of eligible households, will likely be more ideal for changing a behavioural nom, as more households will receive the intervention and be exposed to the same messaging.

Table 1 below presents the number of villages, and wards in each study block.

**Table 1. Sampling Frame for the Study**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **District** | **Program Block** | **# of villages in which World Vision is active which has >0 eligible households** | **# of wards in which World Vision is active which has >0 eligible households** | **# of World Vision wards which have at least 12 eligible households (HOUSEHOLD)** |
| Jamui | Chakai | 16 | 16 | 16 |
| Khagaria | Chautham | 12 | 72 | 59 |
| Madhepura | Kumarkhand | 7 | 25 | 25 |
| Nalanda | Giriak | 26 | 51 | 39 |
| Nawada | Hisua | 23 | 27 | 27 |
| Saharsha | Sour Bazar | 8 | 46 | 46 |
| Total | | 92 | 237 | 212 |

* + 1. What are the main characteristics of your population?

According to the SQUAT report[[6]](#footnote-6), it is estimated that in Bihar, 44% of households with a latrine, at least one member continues to openly defecate, and at the individual level 23% of people with a latrine continue to openly defecate. At the state level the recent Swatchhta status reports[[7]](#footnote-7) that 70% of all people in rural Bihar defecate in the open, the remaining (30%) of people are assumed to be regular latrine users. It is important to note that 30% is likely to be an overestimate of the true proportion of people who regularly use their twin-pit latrine since[[8]](#footnote-8):

* Of the people that reportedly use latrines, many own septic tanks, which usually have higher rates of use. Among the population which owns twin-pit latrines, latrine use is expected to be lower.
* Latrine use is difficult to measure. Most existing measures are likely biased upwards[[9]](#footnote-9).
  + 1. What is the expected sample size?

A representative sample of eligible households from 43 treatment and 43 control wards will be drawn at the baseline stage. Our power calculations indicate that collecting data from 10 eligible households in 86 villages (i.e. a total sample size of 860 households) is enough to detect, at a minimum, a 10% change in the proportion of eligible HOUSEHOLDs where at least one person is defecating in the open.

In order to account for attrition and refusal, we will aim to cover around 12 eligible households in each survey village. Therefore, our expected sample size is 1032 households (86\*12). A comprehensive household listing exercise will be conducted at the time of the baseline survey to identify eligible households in each treatment and control survey ward. From this list of eligible households, 12 households will be randomly selected to take part in the quantitative survey. Households selected at baseline will be re-visited at endline – this is a panel of households.

* + 1. Is there any reason to believe that the sample differs from the population? If so, how does it differ?

We have defined our population as the villages within which World Vision operates. Since World Vision tends to operate in the most vulnerable areas in its selected programme blocks, our sample of households will likely be relatively poorer and more socially backward compared to the overall population of Bihar.

* + 1. Please describe the anticipated subgroups, which will be studied, if relevant.

*Note: Since behaviour change interventions require village-level clustering to prevent spillovers, studies will likely not be adequately powered to conduct subgroup analysis, and subgroup analysis is not expected. Proposals to do subgroup analysis should be accompanied by an explanation of how studies will be able to detect differences between subgroups.*

While power analysis has been carried out at the household level, we expect to carry out sub-group analysis across gender, and age of the household member and other parameters. This has been detailed in the section 5.4 on heterogeneous effects further.

* 1. **Statistical power**
     1. What is the effect size that you will be able to detect?
        1. What are your assumptions about your alpha level?
        2. What are your assumptions about your statistical power?
        3. What are your assumptions about variability in your effect size?
        4. How many clusters will you have?
        5. How many people will you have in each cluster?
        6. How sensitive is your effect size to changes in your parameters?

We utilized a household level outcome indicator, the proportion of eligible households where at least one person is defecating in the open, for the power analysis. Power calculations performed using parameter values presented in Table 3 show that with the proposed sample size, our estimation model will be able to detect with statistical confidence an attributable increase in the use of latrine of at least 10%. This corresponds to approximately 0.2 standardized effect size, which is a reasonable level of change to be expected in quantitative impact evaluations.

**Table 3. Parameters used for Power Analysis**

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Value** | **Sources/Assumptions** |
| Expected baseline levels – proportion of eligible HOUSEHOLDs where at least one person is defecating in the open | 41% | 3ie RICE data |
| MDE | 10% points | Assumed target |
| Significance level (alpha) | 0.05 | Standard |
| Desired power of the test (beta) | 0.8 | Standard |
| Number of households in each cluster | 10 | Practical considerations |
| Intra-cluster correlation | 0.10 | 3ie RICE data |
| Inter-temporal correlation | 0.7 | Lies within the standard range assumed for a panel of households |
| Number of clusters (villages) in each arm | 43 | Calculated using OPM’s power calculation tool |

* + 1. If you plan to include covariates in your analysis, what share of variance do you expect to predict with your co-variates?

*Note: It is not required that you include covariates*

Since we are conducting an RCT, it is not required to include covariates. However, we will include the covariates that are theoretically driven (for example, caste, religion, education, and indicative measures of wealth), to increase the specificity and reduce variance of our estimates. We expect our covariates to be significant in explaining variation in our main outcome variables.

* 1. **Assignment to treatment**
     1. How will individuals be assigned to treatment and control conditions?
     2. How will you check that individuals in the treatment condition received treatment as anticipated?

We will conduct randomized assignment of treatment at the village level. It is precisely this random assignment that leads to the identification of a control group which by construct is statistically identical to the treatment group.

We will have a monitoring tool that will track that the household and community meetings are happening as per the intervention design.

## Data Collection

* 1. **Primary data collection instruments**
     1. What data collection instruments will you employ for quantitative and qualitative analysis?

**4.1.1.1 Data Collection Instruments for Quantitative Analysi**s

For quantitative analysis, we will be using two instruments for data collection, one at the household level and the other at the community level. The household instrument aims at capturing both household level and individual level data in accordance with the indicators. The community instrument on the other hand will capture data on community characteristics.

The household survey tool will measure several key indicators related to knowledge, attitude (perceptions and intentions), practices (habits and time-use patterns) around latrine use at the individual and household level for all sampled households. Measuring latrine use at the individual level is especially important given that a key goal of the study is to measure the intervention’s impact on latrine use separately for men and women within the household. We have subdivided the household survey into several modules for a more comprehensive classification of data. Te 8 modules in the survey are listed below:

1. **Household Roster:** to capture general information about the members of the household, name, age, marital status, educational qualification, gender composition, employment status etc
2. **Health and Disability Roster:** to capture data on the health/disability status of each household member so as to know if they might/might not have issue using the toilet for health/disability reasons
3. **Household Demographics:** to know the socio-economic status of the household; caste, religion, income status etc
4. **Water availability, access and usage:** to know the water accessibility, distance of the water sources for domestic purposes and its sufficiency
5. **Toilet attributes:** to capture the dynamics around toilet construction; the cost, inputs/materials, government/NGO incentives (if any), maintenance/beautification costs etc
6. **Household Checklist:** to capture the surveyors’ observation of the toilet in the household to verify usage instead of solely relying on self-reporting
7. **Knowledge and Perceptions:** to capture household’s intent to use, and perceptions about toilet usage, pit-filling and emptying
8. **Toilet Use:** to capture the toilet usage patterns and open defecation behaviors of each household member in the household

We have included a table with examples of indicators (mapped to specific modules in the household tool) below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Theme** | **Indicator** | **Numerator** | **Denominator** | **Module in Household Tool** |
| Toilet Attributes | % of households with functional latrines | Households with a (i) twin pit latrine, (ii) Pan is not cracked/ broken, (iii) Pan is not blocked, (iv) Latrine has a completed pit (can be defined as a covered pit) and (v) Link between pan and pit is not broken | All households | *Section K* |
| Toilet Attributes | % of households with latrines that have a roof, windows for ventilation, door that can be locked from inside and other markers for toilet super structure quality | Households where the interviewer responds "Yes" to these indicators | All households | *Section K* |
| Toilet Construction | % of households who received money or resources to construct latrine from the government (SBM), NGO or other sources | Households where the household head responds saying that they received funds/materials from government for toilet construction | All households | Section I |
| Toilet Construction | % of households who received money or resources to construct latrine from the government (SBM) | Households where the household head responds saying that they received funds/materials from government for toilet construction | All households | Section I |
| Toilet Construction | % of households who spent their own resources (only) to construct latrine | Households where the household head responds saying that they spent only their own money on latrine construction and received no support from govt or NGO/panchayat | All households | Section I |
| Water Availability | % of households with water source piped into dwelling/yard | Households where the respondent responds saying that the primary source of water is piped into dwelling or yard | All households | Section H |
| Water Availability | % of households with an improved source of water | Households where the respondent responds saying that they have an improved source of water (JMP definitions) | All households | Section H |
| Knowledge of correct rates of pit filling | % of respondents (household head) who can correctly estimate the year a standard pit is likely to fill up | Households where the household head (male respondent) correctly estimates the number of years it takes faecal matter to decompose | All households | *Section J* |
| Knowledge of correct rates of fecal decomposition | % of respondents (household head) who can correctly estimate the time taken for fecal matter decomposition | Households where the household head (male respondent) correctly estimates the number of years it takes a standard pit to fill up | All households | *Section J* |
| Toilet Use | % of households where at least one person usually defecates in the open | Households where at least one adult household member is reported/self reports usually defecating in the open | All households | Section F (Roster) |
| Toilet Use | % of households where at least one person defecated in the open the last time they defecated | Households where at least one adult household member is reported/self reports defecating in the open the last time they went | All households | Section F (Roster) |
| Toilet Use | % of adult males that are using latrines within each household | Adult males who self-reported or were reported to have used a latrine to 'usually' defecate | All adult males in our sample | Section F (Roster) |
| Safe Disposal of Child Feces | % of children under the age of 5 years whose (last) stools were disposed of safely. | Number of children between the ages of 0-59 months whose feces were disposed off safely (as per JMP definition) or the children used latrine for defecation. Safe disposal means - (i) Child used toilet/latrine, (ii) Feces was put/rinsed into toilet or latrine and (iii) Feces was buried | All children between the ages of 0-59 months | Section F (Roster) |
| Diarrhea Incidence | % of households with children aged 0-59 months with diarrhoea in last two weeks | Households with children of 0-59 months who suffered from diarrhoea in the last two weeks | Households with children between the ages of 0-59 months | Section F (Roster) |
| Increase in manual pit emptying practices | (i) % of respondents (household head) who responded saying they would empty pit when asked what they would do when pit fills up | Household head (male respondent) who responded saying they would empty pit when asked what they would do when pit fills up | All households | *Section J* |
| Increase in manual pit emptying practices | Among (i) above: % of respondents (household head) who who respond saying that they will hire manual labour to empty pit when asked what they would do when pit fills up | Household head (male respondent) who respond saying that they will hire manual labour to empty pit when asked what they would do when pit fills up | Households who said they would empty pit when it fills up | *Section J* |
| Increase in manual pit emptying practices | Among (i) above: % of respondents (household head) who replied that they would empty pit themselves when asked what would they do when pit fills up | Household head (male respondent) who replied that they would empty pit themselves when asked what would they do when pit fills up | Households who said they would empty pit when it fills up | *Section J* |
| Poverty | % of households who have a BPL card | Households who self-report having a NREGA card | All households | Section G |
| Poverty | % of households who have a NREGA card | Households who self-report having a BPL card | All households | Section G |
| Caste | % of households who belong to Scheduled Caste | Households who self-report being part of Scheduled Caste | All households | Section G |
| Education | Average number of years of education of the primary caregiver (primary respondent) | Calculate average years of education from the highest educational attainment of the primary caregiver | All primary caregivers (primary respondents) | Section E (Roster) |
| Education | Average number of years of education achieved by any household member within the household | Calculate average years of education from the highest educational attainment of the primary caregiver | All primary caregivers (primary respondents) | Section E (Roster) |

The Community instrument has also been divided into 5 modules:

1. **Community characteristics:** socio-economic characteristics of the village; caste, religion, sources of livelihood etc
2. **Access to services:** to capture the community member’s vicinity to basic services like school, health centres, grocery shops, banks etc
3. **ODF status:** to know if the village has been already declared ODF by the government or is aspiring to be
4. **Intervention history:** to know if there ever has been a sanitation intervention in the village and if it had any impact on the village sanitation practices as a whole
5. **Supply side considerations:** to know if the suppliers for input for toilet construction are present in the village

**4.1.1.2 Data Collection Instruments for Qualitative Analysis**

The qualitative data collection for the impact evaluation will only take place at the endline, currently qualitative data collection is expected to take place in January 2019. The nature of the instruments for qualitative data collection will be guided, in part, by the findings from the quantitative evaluation (for more detail please refer to Section 5.2).

The evaluation team at OPM has extensive experience designing qualitative instruments. While the exact nature of the instruments will be designed closer to the data collection date, below we have illustrated some data collection instruments used on past studies which could be compatible here.

• **Direct observation**: Direct observation involves the study of particular events, spaces and behaviours directly and in 'real time', meaning the researcher becomes part of the environment he or she is studying. Notes from this exercise will describe in concrete terms what has been observed or discussed in as neutral a way as possible, without ascribing any interpretation or value judgements.

It is expected that this tool will test the condition of the toilet, check for signs of use (if it appears to be used for storage, etc), presence of other materials that indicate use (eg: bucket) and provide a platform to ask the questions in interviews or group discussions.

• **Key informant interviews (KIIs)**: Key informants are individuals who may be in a position to have more information or a particular issue than others in the community. KIIs are useful to triangulate findings from other data sources, and to generate questions, since key informants are able to share information not known to most people. Data for KIIs will be collected adopting semi-structured interviews.

These interviews are expected to test implementation process, conduct of household visits and community meetings, knowledge around correct rates of pit filling, attitudes to pit cleaning and associated aversion, habit of toilet use amongst household members. Please note that all data collected will be stratified along the gender and age of the person interviewed.

• **Group Discussions**: Group discussions provide an opportunity for similar participants to discuss and contrast their perceptions and understandings of issues, events and processes. This can spark discussions on clearly defined topics that can produce a diversity of opinions and encourage participants to contrast their views. This process not only validates participants’ views through debating with their peers, but can also encourage them to articulate and defend their positions. Focus groups will, on average, consist of between 5-8 respondents.

These discussions are expected to test implementation process, conduct of household visits and community meetings, knowledge around correct rates of pit filling, attitudes to pit cleaning and associated aversion, habit of toilet use amongst household members. Please note that all data collected will be stratified along the gender and age of the person interviewed. We have noticed in the past that homogenous focus groups tend to work better and it is expected that this will be followed in this study also.

Each of these approaches to data collection presents opportunities and challenges in relation to the core research questions, and are therefore most effective when used all together, and aligned with the quantitative research.

* + 1. What is the hypothesised list of interviewees (i.e. key actors who will be interviewed, anticipated interview formats and expected number of respondents)? You may wish to present this information in a table.

**Household surveys:** We will be interviewing household heads (presumably predominantly male) and primary caregivers. Households heads will be interviewed on toilet infrastructure, prior investments in the toilet, subsidies, incentives received from the government or non-government sources, their own sanitation behaviour, knowledge and perceptions on pit filling and pit emptying. Primary caregiver will be interviewed on sanitation practices and behaviour of other household members, water availability and use, and other demographic information on the household roster.

**Community surveys:** These will be administered in common public places in the villages included in our sample and all respondents will be listed including the head of the gram panchayat and other prominent community members.

**Qualitative Study**: In sampling for the qualitative it would be crucial to stratify by demographic characteristics of participants and ensure diversity amongst respondents. The table below outlines the expected sample for the qualitative study. However, this is merely indicative and may vary depending on the quantitative assessment and initial inputs from the field.

|  |  |
| --- | --- |
| Instrument | Expected Sample |
| Interviews with community members | 30 (6 villages and 5 interviews per village) |
| KIIs with stakeholders (eg: village sarpanch, community facilitator, etc) | 12 (6 villages and 2 KIIs per village) |
| Group Discussions | 12 (6 villages and 2 discussions per village) |

* + 1. What (groups of) indicators will each instrument cover?

This is detailed in 4.1.1.

* + 1. How will each instrument be developed?

The household survey has been developed to ensure that all measures of reported and self-reported toilet-use and toilet observation check-lists are in line with the 3ie recommendations and SQUAT surveys developed by r.i.c.e.

We have developed specific questions (especially on the listed intermediate outcomes and hypotheses) keeping in mind each component of the intervention. For instance, one of our interventions demonstrates pit filling rates for each family size – we have included questions to measure each household members current knowledge of pit filling rates as well as aversion to pit emptying. These intermediate outcomes are likely to change before toilet use in the causal chain.

* + 1. Please comment on the validity and reliability of each instrument, including any anticipated validation checks.

We will be carrying out extensive pretesting of our tools and will compute indicators through values generated during field testing to ensure measurement validity and reliability of indicators. Any missing data, skip patters, respondents’ inability to understand and respond to questions will be reviewed, revisited and altered or dropped from the survey questionnaire.

* 1. **Secondary data sources**

Please describe the anticipated secondary sources of data, if any, which will be used for this study.

We have used the census primary abstract[[10]](#footnote-10) and WVIs own program monitoring data for:

* Identifying eligible villages located in the program intervention areas of WVI and have more than 12 households with functional twin pit latrines
* The above information will be validated using household listing exercise that we will be carrying before the baseline data collection.

## Analysis

* 1. **Outcome Variables**
     1. Your primary outcome is latrine use. Please describe the primary and secondary outcome variables of interest using the following table:

|  |  |  |  |
| --- | --- | --- | --- |
| **Outcome & Description** | **Indicators** | **Hypothesis** | **Level** |
| Toilet Use  (Final outcome) | |  | | --- | | % of households where at least one person usually defecates in the open | | *H1a* | *Household* |
| % of households where at least one person defecated in the open the last time they defecated | *H1a* | *Household* |
| % of adult males that are using latrines within each household | *H2a* | *Individual* |
| % of adult males that used a latrine the last time they defecated | *H2a* | *Individual* |
| % of adult females that are using latrines within each household | *H2b* | *Individual* |
| % of adult females that used a latrine the last time they defecated | *H2b* | *Individual* |
| % of adult males who use a latrine "every time" in the last three occasions | *H2a* | *Individual* |
| % of adult females who used a latrine "every time" in the last three occasions | *H2b* | *Individual* |
| % of households where the latrine is used for other purposes (as per direct observation of the interviewer) | *H1a* | *Household* |
| % of households where the latrine is not used (as per final judgement of the interviewer) | *H1a* | *Household* |
| % of households where latrine has slippers, bucket, water container, feces marks, squatting pan, is not clogged and other markers of toilet use | *H1a* | *Household* |
| Safe disposal of child faeces | % of children under the age of 5 years whose (last) stools were disposed of safely. | *TBD* | *Individual* |
| Knowledge on the correct rates of pit filling (Intermediate outcome) | % of respondents who can correctly estimate the year their pit is likely to fill up | *IH1* | Household |
| % of respondents who can correctly estimate how long a standard pit takes to fill up | *IH1* | Household |
| Aversion to pit emptying (Intermediate outcome) | % of households where the household head correctly estimates the time required for fecal matter to decompose | *IH2* | Household |

* + 1. If you plan on including covariates in your analysis, please provide a list of covariates that may be included.
* Education levels
* Health and disability status
* Socio-economic status: Caste, Religion, income status, sources of livelihood
* Poverty status: Ration card/NREGA cards
* Water availability and accessibility
* Surveyor’s observation of the toilet in the household:
  + 1. If you plan to aggregate multiple variables into an index, which variables will you aggregate and how?

Toilet observation check-lists include both observations around the toilet infrastructure and observations that signify use. We will be computing indices for toilet infrastructure, and condition of the toilet. We will be computing average scores for the indicators below based on the questions listed below. We will also be computing correlations with of Indicator 2 with the overall judgement on toilet use made by the interviewer.

|  |  |  |  |
| --- | --- | --- | --- |
| **No.** | **Domain** | **Question** | **Q. No. in HOUSEHOLD Tool** |
| 1 | Toilet Infrastructure | Latrine is located inside house, or attached to home | *K.1* |
| Latrine is not made with kacchha materials | *K.2, K.3, K.5 is bricks, cement, ceramic tiles, other pucca materials* |
| Latrine has a door that can be locked from inside | *K.6=Yes & K.7=Yes* |
| Latrine is ventilated | *K.8=Yes* |
| 2 | Toilet Use from Direct Observation | There is a water container (for washing after defecation) like lota, mug, or coke bottle, in or near (within 1 meter) to latrine | *K.16=Yes* |
| Latrine is not used for storage purposes | *K.15= No* |
| There is an arrangement to store large quantities of water | *K.17=Yes* |
| Slippers inside/near latrine | *K.23 = Yes* |
| There are cleaning supplies (such as brush, cleaning fluid, harpic or acid) visible in the latrine | *K.18= Yes* |
| 3 | Deterrents to toilet use | Odour inside latrine | *K.20= Yes* |
| Flies inside latrine | *K.21= Yes* |
| Mosquitos inside latrine | *K.22= Yes* |
| 4 | Correlation of use index 1 with K.24 | From seeing the latrine, can you say that the latrine is being used? |  |

* 1. **Qualitative Analysis**

What questions will be analysed using qualitative methods? Please also describe the qualitative methods that will be used (e.g. content analysis with criteria for codification).

The qualitative data collection for the impact evaluation will take place only at the endline, and will be guided by the findings from the quantitative baseline, quantitative endline and the process evaluation. Thus, the research approach will adopt a **sequential explanatory design**, by which collection and analysis of quantitative data is followed by collection and analysis of qualitative data. The main purpose will be to use qualitative results to assist in explaining and interpreting the findings of the quantitative study.

However, it is important to note that the qualitative analysis has been used in development of the Theory of Change and the Evaluation Matrix. A sequential design does not mean the triangulation and cross-fertilization of quantitative and qualitative approaches are limited to analysis. Outline below is an indicative list of the mixed methods approach being used by this study:

• **Methodological stage** – Qualitative framework has already helped devise the theory of change and evaluation matrix. These documents have been used to guide the design of the baseline quantitative tools. Quantitative data and analysis will inform the development of qualitative sampling and tools;

• **Analytical stage** – Quantitative findings will identify data gaps and unexplained trends for qualitative research to explore; qualitative findings will be eventually combined with quantitative analysis (see below);

• **Inferential stage** – Quantitative and qualitative findings and inferences will be analysed through each other’s lenses and discussed during meetings/workshops. Both quantitative and qualitative teams will jointly write the endline report; ensuring cross-pollination of results and tends from both arms of the evaluation;

• **Meta-inferential stage** – Meta-inferences on the impact and effectiveness of the sudy design will be discussed and agreed by both teams. Combined meta-inferences will give rise to joint policy recommendations.

Please find below an indicative list of issues that the qualitative study will attempt to explore. However, please note that this is merely indicative as the qualitative study does not take place till the endline and will be guided in large part by the initial field assessments/ findings of the quantitative study. This is not intended to be an exhaustive list   
  
Indicative list of themes to be explored in the qualitative study:

* Toilet Attributes: what does the toilet contain? How do toilet attributes affect people’s use/perception of toilet use? What else would like they like as part of the toilet? What is missing that prevents them from using the toilet?
* Test perceptions related to toilet use: specifically perception that latrine is for women's safety and honour and perception that the latrine is for emergency use only. Both these perceptions emerged strongly in the formative study.
* Knowledge of correct rates of pit filling
* Atttiude to pit emptying: especially the caste purity implications of the same; also explore the prevalence of pit emptying practices in the area
* Changes in Habit formation related to toilet use, if any
* Any difference related to gender/caste/age in answers to the issues listed above will need to be explored in the qualitative study
  1. **Quantitative Analysis**
     1. **Balance Checks**
        1. How will you check balance between treatment and control groups?

The fact that this intervention is being implemented as a cluster RCT raises confidence that there will be balance between the treatment and control groups. Yet even with an RCT there remains the risk that even after randomisation, systematic differences between treatment and control groups still exist. This can occur simply by chance. The existence of such differences re-introduces bias into the model, meaning that the difference in outcomes between treatment and control groups at endline no longer isolates the impact of the intervention.

To assess whether this is likely to be the case, we would run a series of checks on the baseline data during the analysis stage. In particular, we would assess balance between our treatment and control groups before the intervention begins by comparing average outcomes across all the variables collected. We would also conduct an F-test of joint significance to understand whether and to what extent the two groups may be different. Even if an F-test returns a positive coefficient (meaning that the set of baseline covariates taken together are jointly found to be related to treatment assignment) we would propose to include the baseline values of variables that are associated with the greatest differences as additional control variables in the model specification used to assess impact at endline.

* + - 1. What is the specification that you will run and what variables will you include?

This entails running the following specification:

where y is the outcome of individual i; α is a constant; β is the coefficient on the treatment dummy T; and ε are cluster-robust standard errors. We will be reporting the coefficient β in a table for all the variables that will be included.

We can include the following variables at the individual/household level (not an exhaustive list):

* Proportion of BPL households (who hold BPL ration cards)
* Proportion of households with NREGA cards
* Proportion of Scheduled Caste households (self-reported)
* Proportion of households where the household head has completed schooling in the village
* Proportion of households where at least one household member migrates for work
* Proportion of households with at least one household member who defecates in the open
* Proportion of individuals who practice open defecation
* Proportion of male adults who practice open defecation
* Proportion of children aged 0-59 months with diarrhoea in last two weeks

Literature on baseline balancing suggests that in the case of cluster RCTs, baseline balance is required both at the level of the individual and at the cluster level.[[11]](#footnote-11) Therefore, we will be carrying out these tests at both the levels.

* + - 1. If there is an imbalance (between treatment and control groups) in one or more baseline covariates, how do you plan to address this?

Any imbalance in terms of covariates despite randomization will be included in additional specifications where estimates conditional on covariates will be generated.

* + 1. **Contamination**

How will you detect and manage any potential differential contamination between treatment and control groups?

Cluster randomized control trials like the one we are going to implement reduces the possibility of contamination to a large extent. Our project suffers from operational constraints which require that the clusters are at the ward level or tola level (see above). This is likely to increase the probability of contamination (compared to a village cluster design). Contamination can also take place if there are similar projects underway in our program blocks, including if there is any intensive SBM drive. We will be using our monitoring tools and end-line tools to capture contamination:

* Our monitoring questionnaires (draft version attached) track intervention participation/fidelity of implementation to design
* End line tools will include questions on whether they heard about sanitation programs in general and pit filling rates/pit emptying demonstrations/ from neighbors/friends in particular.
  + 1. **Attrition**
       1. What is your anticipated attrition rate and what evidence is this prediction based on?

We anticipate minimal attrition in our sample as only resident households will be included in the study. Migration can potentially lead to attrition. However, even in the case that male household heads migrate, the study will attempt to capture end-line responses from the primary caregiver. We will also be carrying out the end-line study exactly one year after the baseline to ensure that any seasonal fluctuations such as seasonal migration are adequately captured.

Random attrition will only reduce the power of the study, but Systematic Attrition can bias the impact estimates. Migration related attrition is not likely to be systematic and related to our treatment status. Households who participate in community meetings and receive household visits are no more likely to migrate than those in the control villages.

Differential attrition can take place if the attritors in our sample differ significantly from those who don’t drop out of the sample. One potential way through which this might happen is if households who are averse to our intervention (multiple household visits) also refuse to be resurveyed for the end-line survey. We have detailed the approaches we would take in case of differential attrition below.

While our monitoring tools will capture and track households in the treatment villages, end line tools will capture attrition among households in both treatment and control villages and enable a comparison of attrition rates across treatment and control village households.

* + - 1. What can you do to prevent or remedy sample attrition?

We will be ensuring the following to prevent attrition:

* Our control and treatment households will consist of only resident households to limit attrition due to migration
* We will be carrying out the baseline and end-line in the same season in 2018 and 2019 where the endline is carried out exactly after one year of the baseline. This will ensure that attrition due to seasonal migration is the minimum possible.
* We will be interviewing primary caregivers and other household members even if the male household head is unavailable during the end-line survey[[12]](#footnote-12) in 2019. This will ensure that the sanitation practices of household members other than the head are adequately captured in the endline.
* We will include questions on migration, occupation and sources of livelihood in our survey to be able to control of these and compare attritors with non-attritors along these characteristics.

One possible way to remedy random attrition is to follow a stringent tracking protocol to maximise our ability to successfully identify all sampled households at end-line even in the event that they have moved. We can then use their origin ward of residence as their treatment status. However, this will need to be discussed and carried out keeping in mind the costs of tracking households that have moved from their original residence.

* + - 1. How does expected attrition change your power calculations?

A significant loss of sample may reduce the power of impact estimation to detect significant results. In view of this risk, we have ensured that the study is adequately well powered even in the event that some attrition does occur. We assume an attrition rate of 10-20% in each cluster. While we require 10 households per cluster, we are randomly selecting 12 households per cluster.

* + - 1. How will you check balance between attritors and non-attritors? What is the specification that you will run and what variables will you include in these balancing checks?

We will be reporting attrition levels in the treatment and comparison groups and additionally comparing attritors with non-attritors using baseline data to see if they differ systematically, at least along observable dimensions to be able to report on systematic or random attrition[[13]](#footnote-13) (Duflo et al 2007).

We will conduct general and differential attrition analysis by analysing baseline means for two samples: the panel sample and attrited sample and test for significant differences between the two groups.

We will also test for differential attrition analysis. Significant differences across treatment and comparison groups will be analysed for both the panel sample and the attrited sample. In addition, we can provide linear probability estimates of the probability of attrition as explained by individual and household characterises, and interacting these observable characteristics with the treatment dummy. If the interacted variable is significant, then that would imply that the probability of attrition as explained by that particular variable is higher for treatment group compared to the comparison group.

* + 1. **Missing Data**

How will you deal with incomplete or missing data?

If there is any missing data for covariates at baseline, we will use the average for that particular ward for the household/individual for whom this data is missing for the impact specifications. However, missing outcome data cannot be imputed in the manner suggested and therefore we will specify our strategy for missing data for each variable required for testing primary and intermediate hypotheses in later drafts.

* + 1. **Treatment Effects**

*Note: Many studies may have awareness campaigns where one may not be able to know whether a household participated or heard the message or not. In these cases, it may not be possible to estimate a Treatment on the Treated (TOT) effect. We therefore do not expect that all studies will provide estimates of TOT.*

* + - 1. **Intent to Treat**
         1. How will you estimate the (causal) effect of the offer of the treatment?
         2. What is the specification that you will run and what controls will you include in your specification?

Our basic impact assessment specification is:

where y is the outcome of individual i in cluster j; α is a constant; β is the coefficient for the intent-to-treat estimate; T is the treatment indicator; X is a set of covariates; and ε is an error term. Standard errors clustered at the Ward level. The impact of the intervention will be estimated both at the household and individual level.

A panel sample will have the added advantage of the ability to control for time invariant characteristics of the individual in estimating impact. We will also therefore run the following specification:

where is the outcome of interest for household at time *t* in Ward *j* and Strata *s*. The dummy variable captures the differences between the treatment and control groups. It equals ‘1’ if the individual is residing in a treatment Ward. The time period dummy variable 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* even in the absence of an intervention. The interaction term, , represents the observations which received the intervention (i.e. treatment group) by the endline. Xi is a vector of individual and household they reside in characteristics, which include: household size; household composition; age, gender, education level, religion, and caste of the household head; and household poverty line status. Strata refer to district-specific fixed effects. Estimation is via Ordinary Least Squares (OLS).

* + - 1. **Treatment on the Treated**
         1. How will you estimate the (causal) effect of the receipt of the treatment?

We will infer Treatment on the Treated (TOT) by applying the take-up rate of the treatment package on the ITT effect. Take-up rate will be determined by participation in community meetings. As per program fidelity, the offer for participation in community meeting will be made to all households in the treatment areas. However, household members can choose to not attend the community meetings. We will track participation rate in the community meetings. In addition, see below section on heterogeneous treatment effects, where we propose to analyse the subgroup of households that participated in the community meetings with those that did not. We will be asking households whether they participated in the community meetings in the end line tools.

* + - * 1. What is the specification that you will run and what controls will you include in your specification?

Controls will be included in our specifications only if we find that they unbalanced in tests for imbalance specified above.

* 1. **Heterogeneous Effects**

*Note: Since behaviour change interventions require village-level clustering to prevent spillovers, studies will likely not be adequately powered to conduct subgroup analysis, and subgroup analysis is not expected. Proposals to do subgroup analysis should be accompanied by an explanation of how studies will be able to detect differences between subgroups.*

* + 1. Which groups do you anticipate will display heterogeneous effects?
    2. What is the broad theory of action that leads you to anticipate these effects?

A detailed theory of change is attached in Annexe 1.

1. At the individual level we anticipate differences between how the intervention impacts the sanitation behaviour of adult males and adult females, and between young women and older women. Our intervention is targeted to one or more members in the household with functional latrines that continue to practice open defecation and therefore it would be important to test for heterogeneous effects between male and female members.
2. We anticipate heterogenous effects between households who attend both the community meetings (self-selection into participating into the community meeting at the tola level) and receive the full schedule of household visits, and those who only received the full schedule of the household visits. While our implementation team can ensure intervention compliance in terms of carrying out household visits for all eligible households within the treatment villages, participation in the community meetings is finally at the volition of the household members in question. Sub-group analysis will enable comparison between the two groups of households. Our end line tool will include questions on whether at least member in the household participated in the community meeting as well as which household members participated in community meetings.
3. Households with initial high toilet use by household members and households with initial low toilet use by household members are likely to display different treatment effects. Households where household members are predisposed to using the latrine might benefit more from the intervention that serves to only reaffirm their latrine use and sanitation behaviour.
   1. **Standard Error Adjustments**
      1. How will you address clustering in your data?

Since assignment to treatment is randomized at the Ward level, we will need to cluster standard errors at the ward (tola) level.

* + 1. How will you address false positives from multiple hypothesis testing?

We can use the Bonferroni correction, which is an adjustment made to P values (dividing the familywise error rate by the number of comparisons made) when several statistical tests are being performed simultaneously on a single dataset. The Bonferroni correction compensates for that increase by testing each individual hypothesis at a significance level of α⁄m where α is the desired overall alpha level and m is the number of hypotheses.

* + - 1. If you plan to adjust your standard errors, what adjustment procedure will you use? (e.g., Family Wise Error Rate, False Discovery Rates, etc.)

Not Applicable

* + - 1. How will you deal with outcomes with limited variation? For instance, one option could be to decide in advance that outcomes that vary below a certain threshold will be omitted from the analysis.

Questions for which 95 percent of observations have the same value within the relevant sample will be omitted from the analysis and will not be included in any indicators or hypothesis tests.

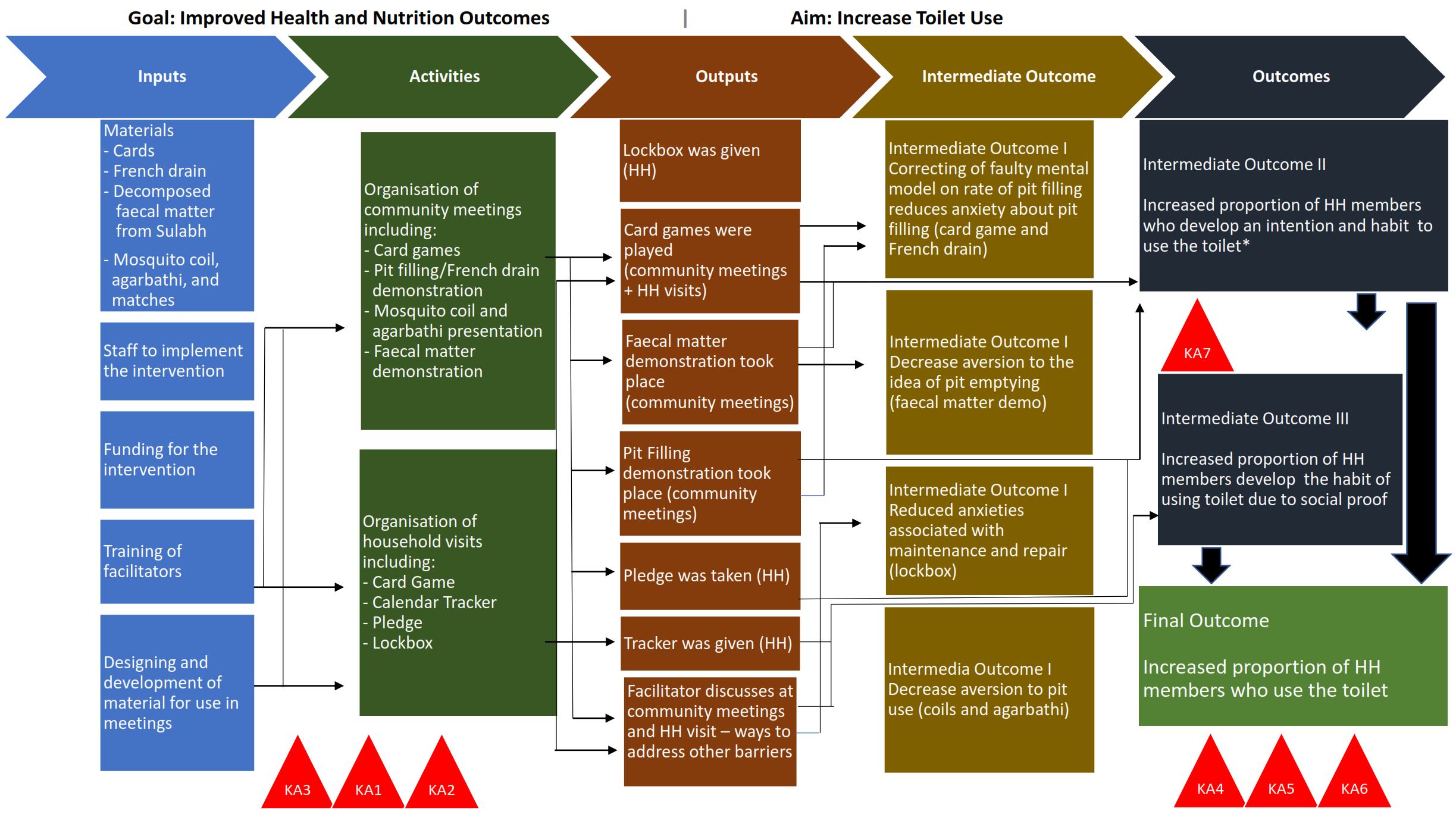
## List of optional attachments

**Data Collection Tools (Optional)**

Quantitative data collection tools have been sent as separate attachments via email

## Annexe 1: Theory of Change

Please note that the silo-ed version of the ToC is for visual representation purposes only. We understand that the actual ToC will not be in silos.



Key Assumptions

* KA 1: Facilitators are trained properly and delivery the programme with fidelity
* KA 2: Attendance at community meetings
* KA 3: Presence of HOUSEHOLD members during HOUSEHOLD visits
* KA 4: Increase in the intention to use (given correction of mental models) is not hampered by other barriers to intention
* KA 5: HOUSEHOLD are committed enough to put money regularly in the lock box and the amount is sufficient to serve the purpose of allaying anxiety
* KA 6: HOUSEHOLD put into practice the discussion on addressing some of the barriers to use: allowing for the developing of the habit amongst those who have the intention
* KA 7: Increase in the translation from increased intention to habitual use is not hampered by other barriers to use

1. Neal, David; Vujcic, Jelena; Burns, Rachel; Wood, Wendy; Devine, Jacqueline. 2016. *Nudging and habit change for open defecation : new tactics from behavioral science (English)*. Water and sanitation program. Washington, D.C. : World Bank Group. <http://documents.worldbank.org/curated/en/905011467990970572/Nudging-and-habit-change-for-open-defecation-new-tactics-from-behavioral-science> [↑](#footnote-ref-1)
2. Royte, Elizabeth. “Nearly a Billion People Still Defecate Outdoors. Here's Why.” *National Geographic*, 4 Aug. 2017, www.nationalgeographic.com/magazine/2017/08/toilet-defecate-outdoors-stunting-sanitation/. [↑](#footnote-ref-2)
3. Abhijit S Gadkari[Email author](mailto:abhijit_gadkari@merck.com) and Colleen A McHorney. *BMC Health Services Research*2012**12**:98. <https://doi.org/10.1186/1472-6963-12-98> [↑](#footnote-ref-3)
4. This notion of the latrine becoming a limited resource came up repeatedly in interviews conducted in Phase 1 and has been discussed in the report submitted therein. [↑](#footnote-ref-4)
5. The criteria for a functional latrine is: 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. [↑](#footnote-ref-5)
6. See http://squatreport.in/ [↑](#footnote-ref-6)
7. See http://mospi.nic.in/sites/default/files/publication\_reports/Swachhta\_Status\_Report%202016\_17apr17.pdf [↑](#footnote-ref-7)
8. These findings were present in Phase 1 of this study. [↑](#footnote-ref-8)
9. Most measures of latrine use include self reporting, this measure brings with it social desirability bias which may tend to upwardly bias estimates. <http://www.3ieimpact.org/media/filer_public/2017/08/18/sp8-latrine-use-india.pdf> [↑](#footnote-ref-9)
10. Census of India (2011) [↑](#footnote-ref-10)
11. Ivers NM, Halperin IJ, Barnsley J, et al. Allocation techniques for balance at baseline in cluster randomized trials: a methodological review. Trials. 2012;13:120. doi:10.1186/1745-6215-13-120. [↑](#footnote-ref-11)
12. Duflo et al (2007) suggest including names of neighbors and relatives that can be interviewed if the respondent cannot be found as possible ways of preventing attrition [↑](#footnote-ref-12)
13. Duflo, Esther, Rachel Glennerster, and Michael Kremer (2007) “Using Randomization in

    Development Economics: A Toolkit”, CEPR Working Paper No. 6059. [↑](#footnote-ref-13)