2017

Review of health data in selected ODF and non-ODF districts under the SBM

(Report of Findings)

Ministry of Drinking Water and Sanitation (MoDWS),
Government of India

BILL & MELINDA GATES foundation

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KANTAR PUBLIC

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Abbreviations	Full form
AWW	Anganwadi Worker
BCG	Bacillus Calmette Guerin
BMI	Body Mass Index
CAPI	Computer Assisted Personal Interviewing
CHAID	Chi-square Automatic Interaction Detector
CHC	Community Health Centre
DPT	Diphtheria, Pertussis and Tetanus Toxoid
GoI	Government of India
HoH	Head of the household
ISO	International Organization for Standardization
MCP	Mother and Child Protection
MoDWS	Ministry of Drinking Water and Sanitation
NBA	Nirmal Bharat Abhiyan
OBC	Other Backward Caste
ODF	Open Defecation Free
OPV	Oral Polio Vaccine
ORS	Oral Rehydration Salts
PHC	Primary Health Centre
PPS	Probability Proportional to Size
SD	Standard Deviation
SBM	Swachh Bharat Mission
TSC	Total Sanitation Campaign
VHSC	Village Health and Sanitation Committee
WASH	Water, Sanitation and Hygiene
WHO	World Health Organization
MRSI	Market Research Society of India
ESOMAR	European Society for Opinion and Market Research

Executive summary

This was a preliminary observational study which aimed to examine whether there are any early observed differences in the health outcomes of the children from the selected ODF villages vis-à-vis. the selected non-ODF villages of the five Indian states - Karnataka, Madhya Pradesh, Rajasthan, Uttar Pradesh and West Bengal. The study hypothesized that the children belonging to the ODF areas would have an improved health status (lower prevalence of the disease) and would also be nutritionally better off (lower prevalence of underweight, stunting and wasting) as compared to the ones from non-ODF areas. To test the hypothesis, quantitative data collection by using a structured questionnaire was done with randomly selected respondents (woman with a child in the age group of 0-59 months) by using the CAPI (Computer Assisted Personal Interviewing) technique. Primarily, the information was collected around the key indicators related to the diarrhoea prevalence and nutrition. Anthropometric measurements were done of mothers and children to access the nutritional status. Additionally, in each of the selected village, one village interview was conducted with a key informant (village head/ PRI member/ Anganwadi Worker (AWW)/ school teacher etc.). Overall, a total of 4000 household interviews and 200 village level interviews were conducted, equally spread across the states and the respective selected villages.

Key findings:

The study fact sheet provided on the ensuing page shows the data trends corresponding to the key study indicators at an overall level. The likely clustering effect at the district level means that this sample was not sufficiently large to enable a full statistical analysis to be carried out. For analysis, significance testing and Chi-square Automatic Interaction Detector (CHAID) analysis was done. Nutritional data was analyzed with the help of WHO ANTHRO software. CHAID is a means of analyzing data commonly used in market research and is used to generate decision tree models for understanding the key predictors behind various independent variables. Other methods more commonly used in public health (such as CART) were not used due to the small and non-representative nature of the sample and the limited amount of purely observational data available at this early stage of the ODF process.

The data indicates that the children and mothers who were from ODF areas demonstrated better health and nutritional indicators than those who were from the non-ODF areas. Significance testing indicated that statistically significant differences (p-value < 0.05) exists in the values of the corresponding indicators in the ODF and non-ODF areas, a summary of which is as below:

- *Significantly lower prevalence of diarrhoea*
- *Significantly better nutritional indicators (Low Wasting and Low Underweight)*

However, since health data are largely self-reported, there are likely to be significant recall and courtesy biases which means that results should be treated cautiously. Though CHAID analysis helps us firm-up the hypothesis that the differences can be mainly due to the ODF status of the geography, the evidence from this research is insufficient to draw a direct causality and attribution of the differences directly to the ODF status. Research for conclusions on attribution and causality need to be based upon methods such as Factorial Evaluation Design using Quasi-Experimental Design.

Study Fact Sheet

Key Indicators		ODF areas		Non-ODF areas		
1	**Total children covered#**		2437		2548	
A.	**Health status – Morbidity**					
		N	%	***N***	%	**p value***
1	Prevalence of diarrhoea in the last 2 weeks preceding the survey	***2437***	9.3	***2548***	13.9	0.0006
2	Prevalence of diarrhoea in the last one month preceding the survey	***2437***	15.1	***2548***	22.1	0.0001
B.	**Nutritional status - Anthropometric**					
1	Children who were stunted (Height for age below -2SD WHO standard)	***2393***	33.7	***2518***	39.6	0.2595
2	Children who were wasted (Weight for height below -2SD WHO standard)	***2380***	21.7	***2498***	34.3	0.0000
3	Children who were underweight (Weight for age below -2SD WHO standard)	***2433***	28.3	***2546***	41.2	0.0001
4	Women whose Body Mass Index (BMI) was below normal (BMI < 18.5 kg/m2)	***1989***	19.6	***1997***	29.0	0.2247

** p value less than 0.05 denotes significant difference at 95% confidence interval*

 # The total children covered were from 2000 ODF and 2000 non-ODF households

Chapter 1: Introduction

1. Background

1.1. Introduction

Undernutrition manifests itself as stunting (low height-for-age), wasting (low weight-for-height) and underweight (low weight-for-age). Undernutrition is a critical concern as it can adversely affect the children especially under the age of 24 months - damage can be permanent and therefore irreversible. Apart from impairing human stature, undernutrition can lead to diminished mental capacity, poor performance at school which in turn can have negative implications on human capital and production. UNICEF's 2015 report[1] indicated that undernutrition accounts to nearly half of all deaths in children under the age of five years. This becomes critical for a country like ours where close to four out of ten children (39%) are stunted and which has the highest number of stunted children in the world (End of Childhood index, Save the Children)[2]. In fact, statistically, in terms of proportion of total stunted children, we are worldwide amongst the top four countries, lagging only Yemen (47%), Pakistan (45%) and the Democratic Republic of Congo (43%) – a situation which is highly deplorable.

It is highly plausible that there is a link between nutrition and sanitation. Observational studies seem to confirm this, but there have been very few experimental trials and in those that have been published the effect has not been conclusively proven (Schmidt et al). This suggests that the links are complex and strongly context specific and may be difficult to isolate. The nutritional effects may be affected by a range of additional factors including food supplies, maternal health and availability/ accessibility of health services.

Since traditionally, focus has been on food quantity and food quality to improve nutrition amongst children and that the WASH had been a 'blind spot' of the nutrition sector (Chambers and Medeazza, 2013), strong policy initiatives are required to address the correlation between sanitation and nutrition to tackle the covert and not-so-apparent determinants of poor nutritional outcomes. The Indian Government is attempting to crystallize this effort through the 2014 Swachh Bharat Mission.

1.2. Swachh Bharat Mission

The first comprehensive nation-wide rural sanitation program launched by the Government of India was the Central Rural Sanitation Program in 1986. It included expanded aspects of sanitation such as personal hygiene, home sanitation, waste water disposal, garbage disposal and excreta disposal to improve the quality of life of rural people and the privacy and dignity of women. Unfortunately, it could only achieve low success because of minimal community participation. The failure of the Central Rural Sanitation Program led to its restructuring into India's Total Sanitation Campaign (TSC) in 1991, which was later renamed as *Nirmal Bharat Abhiyan* (NBA) in 2012. According to the reports tabled in Parliament in 2015 by the Comptroller and Auditor General (CAG) based on the audit covering the TSC and NBA between 2009 and 2014, there were planning-level weaknesses in the implementation of TSC and later NBA. The report stressed the need for an improvement of overall governance at the grassroots level else, more deployment of resources would not have a significant impact. Furthermore, it was suggested that implementation must be based on realistic planning and backed by large-scale Information-Education-Communication campaigns to bring about behavioural changes in the target population. It was in this context that the sanitation program was revamped into the Swachh Bharat Mission in 2014.

[1] UNICEF, *Progress for Children Beyond Averages: Learning from the MDGs,* New York, 2015
[2] Save the Children, *End of Childhood Report*, 2017

Launched on 2nd October 2014, the Swachh Bharat Mission (SBM) is the Government of India's (GoI) nation-wide flagship program ideated with an objective to advance the country's sanitation agenda. Its main aim is to reduce and subsequently eliminate open defecation through the construction of individual, cluster and community toilets and establish reliable mechanisms to monitor the latrine usage. SBM aims to achieve an open defecation free[3] India by 2nd October 2019.

While the central idea of achieving, a universal sanitation is not very different from the previous initiatives, the SBM has some novel features. The Swachh Bharat Kosh has been set up to encourage Corporate Social Responsibility and accept contributions from private organizations, individuals and philanthropists. Use of information technology and social media is imperative to this program as it allows citizens to keep a check on the construction, maintenance and usage of toilets through various platforms viz. website, social media etc. Many mobile applications have been launched by not only the government but also by few citizens. These applications direct the municipal corporations' attention to certain areas in their neighborhoods by allowing the users to geo-tag pictures of unclean areas. Sanitation solutions are empowered by innovations in technology and these applications allow the citizen to be part of the solution. Finally, the implementation of the program is being carried out separately in urban and rural areas. While the Ministry of Urban Development (MoUD) is responsible for carrying out the provisions of the Swachh Bharat Mission in urban areas, the Ministry of Drinking Water and Sanitation (MoDWS) is responsible in rural areas.

1.3. Objectives of the Study

This was a preliminary observational study which aimed to examine whether there are any early observed differences in health outcomes in ODF villages when compared to non-ODF villages in selected states. The study aimed to identify potential areas for future follow up and monitoring.

The specific objectives of the study were:

1. To assess the impact of sanitation (ODF status) on children's (0-59 months) health by measuring the prevalence of *Diarrhoea*
2. To assess the current nutritional status of children by analyzing the prevalence of:
    - ***a.*** *Stunting (Height for age below -2SD WHO standard)*
    - ***b.*** *Wasting (Weight for height below -2SD WHO standard)*
    - ***c.*** *Underweight (Weight for age below -2SD WHO standard)*
3. To assess the body-mass index (BMI) of mothers/caregivers of the children

Research Hypothesis

The study hypothesized that the children belonging to the Open Defecation Free (ODF) areas would have an improved health status (lower prevalence of various diseases) and would also be nutritionally better off (lower prevalence of underweight, stunting and wasting) as compared to the ones from non-ODF areas.

[3] ODF is the termination of faecal-oral transmission, defined by a) no visible faeces found in the environment/village; and b) every household as well as public/community institutions using safe technology option for disposal of faeces. – Guidelines for ODF verification, Ministry of Drinking Water and Sanitation, Government of India (2015)

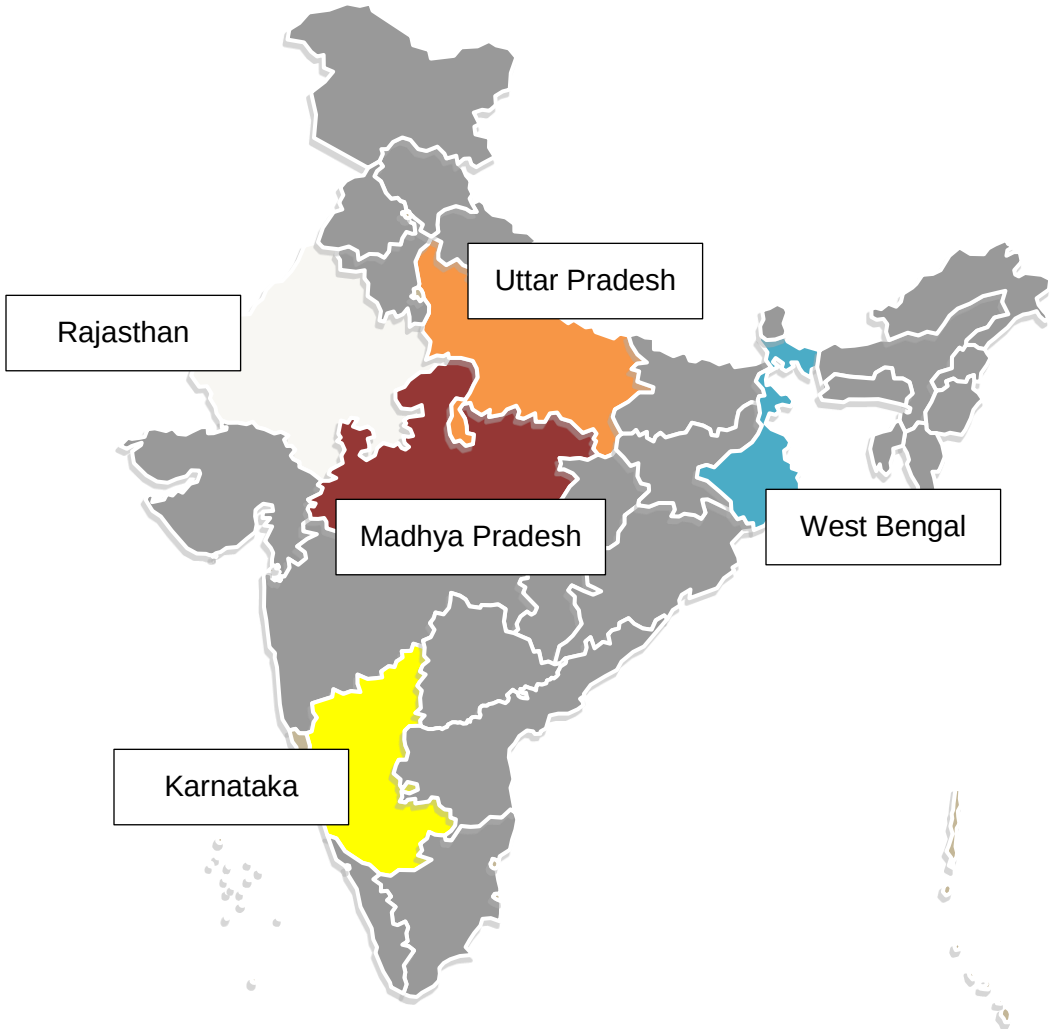
2. Research design and sampling

2.1. Research design

As indicated above, this was a preliminary observational study, envisaged to examine if there is an existence of any observational differences in the health outcomes within the selected ODF and non-ODF villages. **Quantitative method** of data collection was adopted to undertake structured interviews with randomly selected respondents by using the CAPI (Computer Assisted Personal Interviewing) technique. To access the nutritional status, anthropometric measurements were also done of mothers and children. Additionally, in each of the selected village, one village interview was conducted with a key informant (village head/ PRI member/ Anganwadi Worker (AWW)/ school teacher etc.).

2.2. Geographical coverage

Geographically, the study was conducted in the selected rural areas of the five Indian states – Karnataka, Madhya Pradesh, Rajasthan, Uttar Pradesh and West Bengal.



2.3. Sample selection and sampling method

The study examined a sample of indicative health and welfare outcomes in the selected districts (one ODF and one non-ODF) of each of the five states. While the ODF district had self-declared themselves as ODF in the preceding 24 months, the non-ODF had not yet declared themselves to be ODF. The state level sample size was 800, equally spread across both the districts. The sample was chosen pragmatically to enable some preliminary comparisons to be made. The likely clustering effect at district level means that this sample is not sufficiently large to enable a full statistical analysis to be carried out. In each of the selected district, 20 villages were randomly selected for data collection.

Table 1 State wise list of selected districts

State	ODF district	Total number of sampled villages	Non-ODF district	Total number of sampled villages
Karnataka	Udupi	20	Chitradurga	20
Madhya Pradesh	Harda	20	Dewas	20
Rajasthan	Churu	20	Alwar	20
Uttar Pradesh	Shamli	20	Saharanpur	20
West Bengal	Nadia	20	Birbhum	20

A multi-staged sampling method was used in this study comprised of various sampling stages as illustrated in the ensuing paragraphs.

Stage 1: Selection of the Districts

In each of the selected state, first, a list of ODF declared districts was extracted from the MIS of the MoDWS. From this list, one ODF district was **randomly selected**. The selection of a non-ODF district was done with an objective of ensuring a socio-cultural and regional similarity across geographies within the state. Thus, in all the states, one neighboring district to ODF district was selected to the extent possible as the non-ODF district, provided it was not ODF declared.

Table 2 When were the selected ODF districts were declared ODF? *

State	ODF district	ODF declared on (Month/YYYY)
Karnataka	Udupi	November 2015
Madhya Pradesh	Harda	December 2016
Rajasthan	Churu	July 2016
Uttar Pradesh	Shamli	May 2017
West Bengal	Nadia	November 2015

**: Shamli, the selected ODF district of UP was not ODF declared at the time of start of the survey. However, considering an associated importance of inclusion of Uttar Pradesh state, we selected Shamli districts. During the selection of villages, an inclusion of villages only from the areas which were declared ODF one year prior to the survey date were ensured (to understand the process of village selection, please refer village selection provided below).*

Stage 2: Selection of the blocks

In each of the selected districts, two blocks were chosen by using the **Probability Proportional to Size (PPS) sampling technique.** Thus, overall, 20 blocks were selected for the study – 10 from ODF districts and 10 from non-ODF districts.

Stage 3: Selection of the villages

In each of the blocks, 10 villages were selected by using **PPS sampling technique** for the data collection.

Village selection in ODF districts:

Previous research [Chakma et.al. (2008)] has indicated that for sanitation to have an impact on health, at least one year of ODF environment might be required. Therefore, before selecting the ODF villages, a sampling frame was developed within the selected blocks of the ODF districts containing the details of the villages which were declared as ODF at least one year before the project start date of 25th April 2017. The source of the information was the MoDWS's MIS. The selection of the required number of ODF villages was done from the same sampling frame by using the PPS sampling technique, as indicated above.

Village selection in non-ODF districts:

Only those villages which were not declared as ODF till the start of the study were included in the sampling frame for the non-ODF village selection. Next, as done in the ODF village selection, 10 villages were selected from each of the block by using the PPS sampling technique from this sampling frame.

Step 4: Selection of the respondents

In each of the selected village, a screening exercise was undertaken to generate a sampling frame of eligible households i.e. the ones with woman having children in the age group of 0-59 months. By using the **systematic random sampling**, in each of the village, 20 households were selected for the main survey. From each of the selected household, one eligible respondent was identified for being interviewed. In case, multiple eligible respondents were found in a household, **Kish grid method** was used to select the respondent for interview.

Segmentation of large villages

In each village where the total number of households were less than or equal to 300, screening exercise was conducted with all the households. In case the selected village had more than 300 households, referred to as a large village, segmentation exercise, as explained below was undertaken. Among all the segments formed, two segments were randomly selected to carry out the screening exercise.

The details of the district wise targeted and achieved samples has been presented in the below grid.

Table 3 Planned versus achieved sample size

State	District	Type	Total number of sampled villages	Targeted sample size	Achieved sample size
Karnataka	Udupi	ODF	20	400	400
Karnataka	Chitradurga	Non-ODF	20	400	400
Madhya Pradesh	Harda	ODF	20	400	400
Madhya Pradesh	Dewas	Non-ODF	20	400	400
Rajasthan	Churu	ODF	20	400	400
Rajasthan	Alwar	Non-ODF	20	400	400
Uttar Pradesh	Shamli	ODF	20	400	400
Uttar Pradesh	Saharanpur	Non-ODF	20	400	400
West Bengal	Nadia	ODF	20	400	400
West Bengal	Birbhum	Non-ODF	20	400	400

3. Project implementation and data collection

3.1. Team recruitment and training

Recruitment:

Across all the states, the fieldwork was done by the interviewers who were local to the study state. This was helpful during the data collection as the interviewers carried with themselves an understanding of the local dialects and topography. All the interviewers belonged to our internal pool and possessed considerable experience in conducting social studies, specifically in the domain of WASH. To confront rejections and drop-outs, 10% buffer resources were trained. The following criterion served as the basis for recruitment:

- *Educational Qualification (graduates or above were preferred)*
- *Experience in the field of social research, especially on WASH issues*
- *Experience of conducting interviews in rural areas*
- *Experience of working in surveys which were conducted on CAPI*
- *Respect for ethics*

The final selection of the interviewers and supervisors was done based on their understanding of the sampling techniques, questionnaires and exhibition of interviewing skills including CAPI usage during the training days. Keeping in view the timelines of the study, a total of 10 teams with a composition of 5:1 (4 investigators, 1 health investigator and 1 supervisor) were deployed for the study across all the states.

Trainings:

To make interviewers well acquainted with the tools and the study protocols, a three days training was undertaken prior to the launch of the fieldwork, parallelly in each of the study state. Each of these trainings were led by the Kantar Public's state field executive who imparted training in the local language. To ensure a standardization in the instructions across all the states and an adherence to the quality standards and norms, the research team members also participated in each of the trainings. The participants were trained on the study questionnaire, key terminologies, protocols and process of doing the anthropometric measurements by using a study manual which contained relevant explanations. To train the health investigators on anthropometry, a separate session was undertaken in which the usage of the anthropometric instruments was demonstrated by the research team members. The training agenda followed during the trainings has been provided as annexure.

The following table indicates the details about the state wise trainings organized.

Table 4 Details about the state wise trainings

S. No.	State	Training Date	Total number of participants
1.	Karnataka	11th May to 13th May 2017	14 interviewers and 2 supervisors
2.	Rajasthan	11th May to 13th May 2017	14 interviewers and 2 supervisors
3.	Madhya Pradesh	11th May to 13th May 2017	14 interviewers and 2 supervisors
4.	Uttar Pradesh	10th May to 12th May 2017	14 interviewers and 2 supervisors
5.	West Bengal	10th May to 12th May 2017	14 interviewers and 2 supervisors

3.2. Data collection and analysis

The research questionnaires for this study were finalized in consultation with the MDWS and immediately post the state trainings, the field work was launched in all the states. The final translated versions of the questionnaires were transferred on the CAPI application for utilization during the fieldwork. The field work of the survey was launched on 15th May 2017 and was completed after a month on 22nd June 2017. Throughout the duration of the survey, a real-time data uploading of the interviews on the cloud server was ensured.

As a part of data analysis, the research team did significance testing and run the Chi-square Automatic Interaction Detector (CHAID) analysis to develop the decision tree models. CHAID is a means of analyzing data commonly used in market research. CHAID uses an algorithm which determines how continuous and/or categorical independent variables best combine to predict a binary outcome based on "if-then" logic by portioning each independent variable into mutually exclusive subsets based on homogeneity of the data. Other methods more commonly used in public health (such as CART) were not used due to the small and non-representative nature of the sample and the limited amount of purely observational data available at this early stage of the ODF process. SPSS software was used for running the CHAID analysis and the associated findings have been presented in the later section of report.

Anthropometric data analysis was done with the help of WHO ANTHRO software[4] which generated the necessary data points for the computations of the nutritional indicators. Standard anthropometric indices viz. % children who are stunted (height for age below -2SD WHO standard), % children who are wasted (weight for height below -2SD WHO standard) and % children who are underweight (weight for age below -2SD WHO standard) were calculated from the datasets for generating the anthropometric trends.

However, since health data are largely self-reported there are likely to be significant recall and courtesy biases which means that results should be treated cautiously.

Means between the ODF and Non-ODF districts have been compared using T-Test to measure the significance of difference between two independent variables. As it can be observed in the findings, the difference is also significant at the cluster levels (at the state level page-26) which establishes that the impact of sampling on the outcome of the significance test might not necessarily change. Also the findings that come from the CHAID (Chi-square Automatic Interaction Detection) analysis also establishes the hypothesis that the study could potentially draw. However, it could be advised that additional analysis using various other statistical tests like Cluster Significance Tests etc. can be conducted for further academic understanding.

3.3. Ethical consideration and confidentiality

Ethical protocols were laid down and followed throughout the course of this study. Entire project team working on the project (including all the staff and freelancers) maintained integrity and confidentiality of the data collected. Informed oral consent was taken from every participant, wherein the purpose of the assessment was explained. Their willingness to participate was asked and interview was conducted only if the respondent gave verbal consent for the same. The respondents were also informed about the risks and benefits for participating in this assessment. It was also clearly mentioned that they could decide anytime during the interview not to respond or discontinue the interview. Confidentiality of the identification details of the respondents was maintained and hence information collected cannot be linked to any individual respondent.

- *An informed approval was taken from all the respondents before the interviews were conducted*

[4] http://www.who.int/childgrowth/software/en/

- *The name, and the contact details of the respondents were kept anonymous and no information about their responses was released to a third party*
- *To not infringe upon the work schedules of the respondents, the field team made multiple visits, so that they can take interviews when the respondents were not preoccupied*

The study has been reviewed by the competent authorities and also has been done confirming the MRSI/ESOMAR code of conduct. No separate IRB approval has been sought due to paucity of time and this being a study of rapid in nature.

3.4. Quality control and monitoring

Field department of Kantar IMRB has obtained ISO Certification after developing conformance standards over the years. The field teams comprised of three levels of staff who were involved in the data collection and monitoring of the data collection process – field supervisor, field executive and field manager. At the central level, research team consisting of research director and research manager, closely monitored the entire process of data collection.

At the state level, all aspects of fieldwork were supervised and controlled by the field executive - the officer in charge of the field who was responsible for maintaining the overall quality of data collection. Field executive was on field throughout the fieldwork and coordinated with the research team regularly. Each team of field investigators was led by a supervisor who supervised the fieldwork for his/her team. The key role played by supervisor was to see if the investigators were comfortable with the flow of the questionnaire, were canvassing the questions as they should be and were recording the responses correctly. Supervisors back-checked/ accompanied 25% of all interviews to ensure that data was collected as per the study requirements. They also carried out on-field spot checks, to ensure data quality.

Spot checks, in this context, refer to making sure that the investigators were filling the research tools properly and conducting the interviews in identified locations/households. In an accompaniment, the supervisor accompanied the investigator to see whether the screening was done properly. Back checks were done after an interview was completed. The supervisor went to the same household and after ensuring that the household has indeed been covered, asked key questions from the questionnaire to ensure correct responses. The supervisors conducted the back checks during the time when the team was working in the same village, so that discrepancy if any were rectified in the village itself. The field updates were also shared regularly to client team for monitoring purposes.

Chapter 2: Socio Economic Characteristics

2. Socio Economic Characteristics

This subsection presents demographic and socioeconomic characteristics of the surveyed respondents. As a part of this study, a total of 4000 households were approached for interview across the five study states – Karnataka, Madhya Pradesh, Rajasthan, Uttar Pradesh and Tamil Nadu. The basic demographics relating to which the information was captured and has been presented in this subsection comprises of child age, respondent's education, economic category, social category, type of household, family size etc., categorized under four broad heads: children, mother, household and village characteristics.

2.1. Children characteristics

The key criteria of undertaking an interview in a household was the presence of at least one child in the age group of 0-5 years (i.e. 0-59 months). At an overall level, in the 4000 households which were covered in the survey, a total of 4985 children were found, 2645 boys (53.1%) and 2340 girls (46.9%). The distribution of children was nearly equal in ODF and non-ODF areas *[ODF: 48.9% and non-ODF: 51.1%]*. The mean age of the children (in completed months) was 27 months. The distribution of the child age indicates that most of the children were more than two years old (55.3 %) i.e. more than 24 completed months. The statistics of distribution of child age were close to the Census 2011 figures, as shown below.

Table 5 Distribution of the child age (a comparison with Census 2011) (%)

Category	Census 2011	Sanitation Health Impact Assessment Study
Proportion of children < 2 years	*36.9%*	*44.7%*
Proportion of children >= 2 years	*63.1%*	*55.3%*

2.2. Respondent characteristics

All the women interviewed as a part of the study were 'currently married' and principally belonged to the 25-34 years' age group (57.9%). The adjacent figure categorizes respondents among different age groups. The mean age of the respondents, upon calculation, came out to be 26.2 years (SD=±4.43). The age distribution of the respondents, as shown in the adjacent figure, indicates that most (57.9%) of the respondents were in the age group of 25-34 years followed by the ones who were in the age bracket of 15-24 years (36.2%). Analysis of the data as per the type of the village (ODF and non-ODF) also indicated similar trends and no major deviation in the respondent characteristics was observed between the two categories.

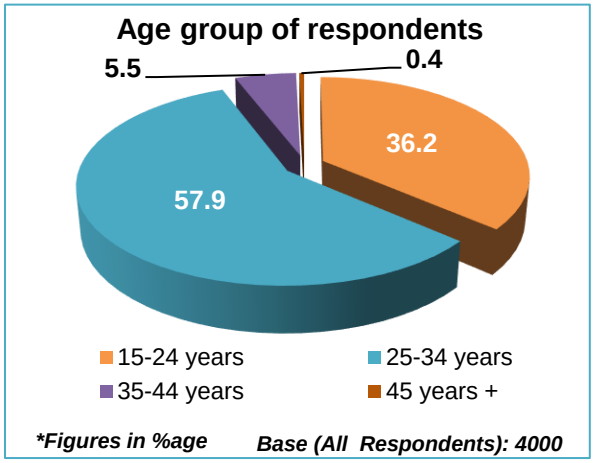


Figure 1 Age group of respondents

In terms of literacy levels, close to three-fourth respondents reported that they could read and write (73.2%). The literacy levels in Karnataka were observed to be more than the other states. More than half of the respondents from Karnataka (53.2%) had completed education up to secondary. Amongst the ones who were illiterate (26.8%), majority belonged to Rajasthan (42.9%) and Uttar Pradesh (40.8%). To access the employment status, respondents were asked if they had worked for money at any point of time during the last 12 months preceding the survey. The data indicated that close to nine out of ten respondents (88.5%) did not do any paid work in the past 12 months. The corresponding percentages were equally spread across both the ODF (88.9%) and non-ODF areas (88.0%).

2.3. Household characteristics

2.3.1. Size of the household

The calculations indicated that the mean family size was six (SD=±2.6). The households belonging to Madhya Pradesh and Uttar Pradesh were larger than the other states and the mean family size in both these states came out to be seven.

2.3.2. Religion and social category of the households

The Census 2011 data showed that across the five study states, the proportion of Hindu households was high (85.5%). The population proportions of the households covered as a part of the current study also indicated a similar trend and it was observed that primarily, the households practiced Hinduism (84.4%) followed by Islam (15.4%). State wise trends indicated that while in almost all the states, Hinduism was predominantly followed, in Uttar Pradesh (29.1%) and West Bengal (26.6%), the proportion of households following Islam was also high (more than one-fourth).

Table 6 Religion of the household (%)

Particulars	Total	Karnataka	Madhya Pradesh	Rajasthan	Uttar Pradesh	West Bengal
Base (All)	***4000***	***800***	***800***	***800***	***800***	***800***
Hinduism	84.4	91.6	95.5	90.8	70.9	73.4
Islam	15.4	7.5	4.5	9.3	29.1	26.6
Others	0.2	0.9	0.0	0.0	0.0	0.0

Social category wise analysis indicated that at an overall level, more than one-third (34.9%) were Other Backward Caste (OBC) households. General (29.2%) and Scheduled Caste (22.5%) were the other two predominant social categories to which the households belonged. State wise variations were seen corresponding to this indicator and while in Uttar Pradesh, the proportion of OBC households was high (54.1%), in West Bengal and Karnataka, higher proportions of the households belonged to the general category, as could be seen in the below table.

Table 7 Social category of the households (%)

Particulars	Total	Karnataka	Madhya Pradesh	Rajasthan	Uttar Pradesh	West Bengal
Base (All)	***4000***	***800***	***800***	***800***	***800***	***800***
Other Backward Caste	34.9	26.5	46.4	42.3	54.1	5.1
Scheduled Caste	22.5	8.0	21.1	28.3	27.9	27.0
Scheduled Tribe	12.3	18.9	14.0	14.4	6.9	7.4
General Caste	29.2	46.4	18.4	14.0	10.9	56.4
Don't Know/Can't Say	1.1	0.0	0.1	1.1	0.1	3.9
Refused	0.1	0.3	0.0	0.0	0.1	0.3

2.3.3. Type of households

To classify a house as pucca, semi-pucca or kachha, the material used for constructing walls, roof and floor was observed. All the houses where all three viz. walls, roof and floor were made of high quality materials viz. burnt bricks, cement bricks, metal/asbestos sheets, stones (duly packed with lime or mortar) and concrete were classified as pucca houses. The ones where all of them - walls, roof and floor were made of low quality materials viz. grass, leaves, reeds, bamboo, mud, unburnt bricks, wood were classified as kachha houses. All the remaining houses where a mix of low and high-quality materials was utilized for constructing walls, roof and floor were classified as semi-pucca houses. The assessment of the type of construction material and thereby the type of house was based upon investigator's observation. *Overall, majority of the households were semi-pucca (45.7%) followed by the ones who were pucca (33.7%) and kachcha (20.6%). The distribution was similar across the ODF and non-ODF areas.*

2.4. Village characteristics

As written earlier, as a part of the survey, one village interview was conducted in each of the village. These interviews were undertaken by the team supervisors and they interviewed a key informant (village head/ PRI member/ Anganwadi Worker (AWW)/ school teacher etc.) with the help of a structured questionnaire. Primarily, as a part of interview, information was collected around village profiling viz. the total number of households, the main drinking water sources being used by the villagers, the connectivity of village to different health facilities and the presence of different committees and functionaries in the village.

Overall, close to two-third village (61.0%) were large villages i.e. had more than 300 households. To understand the access to health services, connectivity of a village to the following health facilities was asked: Sub-centre, Primary Health Centre (PHC), Block PHC, Community Health Centre (CHC)/Rural hospital, District hospital. Majority of villages (62%) were connected on an average to 4-5 facilities. Connectivity to only one health facility was reported in one-fourth villages (25.5%). At an overall level, it was seen that the ODF villages had better connectivity in all seasons to the health facilities via an all-season road. Village Health and Sanitation Committee (VHSC) was functional in close to half of the villages (46.5%). However, a difference was observed among ODF and non-ODF villages in this context and VHCs were more present in ODF villages (59.0%) than non-ODF (41.0%). At an overall level, the presence of NGOs remained low (8%) across all the villages.

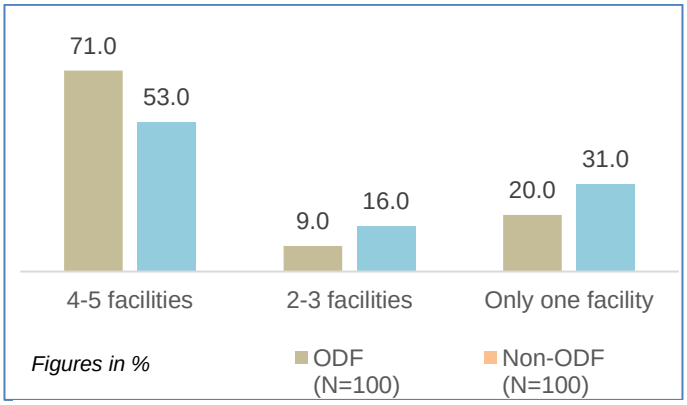


Figure 2 Connectivity of villages to health facilities

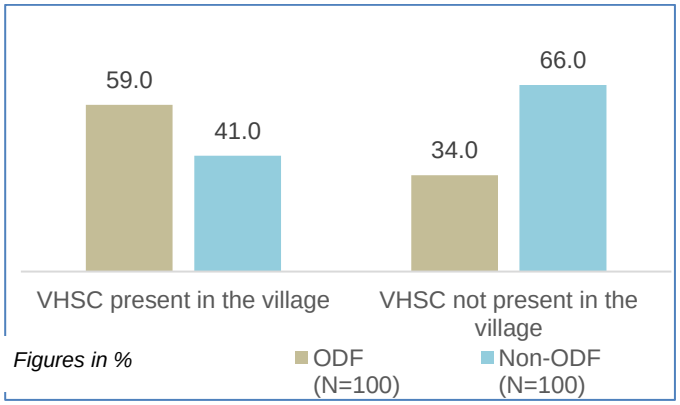


Figure 3 Presence of VHSC in the villages

However, considering that the period since when the villages were declared ODF is short (refer table 2) hence the results should be taken as preliminary.

Table 8 Summary of the demographic indicator (%)

State and type of area	Karnataka			Madhya Pradesh			Rajasthan			Uttar Pradesh			West Bengal		
	Total	ODF	Non ODF	Total	ODF	Non ODF	Total	ODF	Non ODF	Total	ODF	Non ODF	Total	ODF	Non ODF
Respondent level indicators															
Respondent's age (%)															
BASE: All respondents	***800***	***400***	***400***	***800***	***400***	***400***	***800***	***400***	***400***	***800***	***400***	***400***	***800***	***400***	***400***
15-24 years	26.0	11.3	40.8	40.5	41.8	39.3	36.3	39.0	33.5	25.6	31.0	20.3	52.8	46.3	59.3
25-34 years	65.9	77.8	54.0	56.5	55.5	57.5	56.1	54.0	58.3	67.0	60.8	73.3	43.8	48.5	39.0
35-44 years	8.1	11.0	5.3	2.6	2.5	2.8	6.9	6.8	7.0	6.5	6.8	6.3	3.4	5.3	1.5
45+ years	0.0	0.0	0.0	0.4	0.3	0.5	0.8	0.3	1.3	0.9	1.5	0.3	0.1	0.0	0.3
Mean age	27.3	28.9	25.8	25.7	25.8	25.7	26.2	26.0	26.4	27.3	27.0	27.5	24.7	25.7	23.7
Respondent's education (%)															
BASE: All respondents	***800***	***400***	***400***	***800***	***400***	***400***	***800***	***400***	***400***	***800***	***400***	***400***	***800***	***400***	***400***
Illiterate	5.8	4.5	7.0	26.5	26.8	26.3	42.9	37.0	48.8	40.8	42.0	39.5	18.3	8.3	28.3
Below primary	2.9	0.8	5.0	4.1	6.0	2.3	1.9	2.8	1.0	1.4	1.3	1.5	12.5	8.8	16.3
Completed primary (up to Class V)	14.3	11.5	17.0	19.6	17.8	21.5	15.6	17.0	14.3	15.6	14.0	17.3	18.8	19.3	18.3
Completed middle (up to Class VIII)	10.9	10.0	11.8	28.0	26.8	29.3	13.8	12.5	15.0	18.4	14.5	22.3	21.1	22.8	19.5
Completed secondary (up to Class X)	53.3	55.8	50.8	17.9	17.3	18.5	15.5	15.5	15.5	13.9	14.8	13.0	24.0	32.0	16.0
Completed higher secondary and above	13.0	17.5	8.5	3.9	5.5	2.3	10.4	15.3	5.5	10.0	13.5	6.5	5.4	9.0	1.8
Household level indicators															
Mean family size	5.4	4.5	6.2	6.7	6.6	6.8	5.7	5.6	5.8	6.8	7.2	6.4	4.9	5.0	4.8
Religion (%)															
BASE: All households	***800***	***400***	***400***	***800***	***400***	***400***	***800***	***400***	***400***	***800***	***400***	***400***	***800***	***400***	***400***
Hinduism	91.6	84.0	99.3	95.5	97.8	93.3	90.8	98.5	83.0	70.9	74.0	67.8	73.4	76.5	70.3
Islam	7.5	14.3	0.8	4.5	2.3	6.8	9.3	1.5	17.0	29.1	26.0	32.3	26.6	23.5	29.8
Others	0.9	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

State and type of area	Karnataka			Madhya Pradesh			Rajasthan			Uttar Pradesh			West Bengal		
	Total	ODF	Non ODF	Total	ODF	Non ODF	Total	ODF	Non ODF	Total	ODF	Non ODF	Total	ODF	Non ODF
Social caste (%)															
BASE: All households	***800***	***400***	***400***	***800***	***400***	***400***	***800***	***400***	***400***	***800***	***400***	***400***	***800***	***400***	***400***
Other Backward Caste	26.5	35.3	17.8	46.4	40.3	52.5	42.3	42.3	42.3	54.1	67.8	40.5	5.1	6.0	4.3
Scheduled Caste	8.0	0.8	15.3	21.1	17.5	24.8	28.3	30.5	26.0	27.9	17.3	38.5	27.0	24.8	29.3
Scheduled Tribe	18.9	1.5	36.3	14.0	20.8	7.3	14.4	10.5	18.3	6.9	7.3	6.5	7.4	3.0	11.8
General Caste	46.4	62.0	30.8	18.4	21.5	15.3	14.0	16.3	11.8	10.9	7.5	14.3	56.4	62.3	50.5
Don't Know/Can't Say	0.0	0.0	0.0	0.1	0.0	0.3	1.1	0.5	1.8	0.1	0.3	0.0	3.9	3.5	4.3
Refused	0.3	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.3	0.3	0.5	0.0
Type of house (%)															
BASE: All households	***800***	***400***	***400***	***800***	***400***	***400***	***800***	***400***	***400***	***800***	***400***	***400***	***800***	***400***	***400***
Kachha	2.0	2.8	1.3	38.1	31.3	45.0	10.0	6.8	13.3	3.6	1.8	5.5	49.3	29.8	68.8
Semi-pucca	97.3	95.8	98.8	31.0	37.3	24.8	32.3	29.8	34.8	43.3	42.8	43.8	24.8	32.5	17.0
Pucca	0.8	1.5	0.0	30.9	31.5	30.3	57.8	63.5	52.0	53.1	55.5	50.8	26.0	37.8	14.3
Village level indicators															
Size of the village (%)															
BASE: All villages	***40***	***20***	***20***	***40***	***20***	***20***	***40***	***20***	***20***	***40***	***20***	***20***	***40***	***20***	***20***
Small village (no. of HH <= 300)	52.5	70.0	35.0	57.5	50.0	65.0	35.0	20.0	50.0	20.0	25.0	15.0	30.0	10.0	50.0
Large village (no. of HH = 300+)	47.5	30.0	65.0	42.5	50.0	35.0	65.0	80.0	50.0	80.0	75.0	85.0	70.0	90.0	50.0
Connectivity of villages to health facility (%)															
BASE: All villages	***40***	***20***	***20***	***40***	***20***	***20***	***40***	***20***	***20***	***40***	***20***	***20***	***40***	***20***	***20***
One facility	40.0	10.0	70.0	15.0	5.0	25.0	7.5	0.0	15.0	40.0	45.0	35.0	25.0	40.0	10.0
Two-three facilities	20.0	10.0	30.0	0.0	0.0	0.0	15.0	5.0	25.0	5.0	0.0	10.0	22.5	30.0	15.0
Four-five facilities	40.0	80.0	0.0	85.0	95.0	75.0	77.5	95.0	60.0	55.0	55.0	55.0	52.5	30.0	75.0
VHSC presence in the villages (%)															
BASE: All villages	***40***	***20***	***20***	***40***	***20***	***20***	***40***	***20***	***20***	***40***	***20***	***20***	***40***	***20***	***20***
Yes	70.0	80.0	60.0	47.5	75.0	20.0	32.5	35,0	30.0	45.0	35,0	55,0	37.5	70.0	5.0
No	30.0	20.0	40.0	52.5	25.0	80.0	67.5	65.0	70.0	55.0	65.0	45.0	62.5	30.0	95.0

Chapter 3: Key Findings

3.1. Child Health - Diarrhoea

As illustrated earlier, diarrhoeal diseases are the major causes of the child mortality in India. Diarrhoea prevention has been a priority of the Ministry of Health and Family Welfare, GoI in view of them being a leading cause of death beyond the neonatal period. Efforts include ensuring availability of Oral Rehydration Salts (ORS) solution and zinc at all sub-centres and with all frontline workers, promotion of the use of zinc along with use of ORS for treating the diarrhoea cases among the small children. As a part of the current study, the questions were asked primarily on the diarrhoea treatment seeking behaviour, its diagnosis and the frequency. During the analysis, to gauge the relationship between the illness and its determinants, we did the CHAID analysis. As a part of this sub-section, the findings on the key indicators (including the CHAID findings) have been separately presented for each of the illness.

WHO has defined diarrhoea as the passage of three or more loose or liquid stools per day (or more frequent passage than is normal for the individual)[5]. This standard definition of diarrhoea was used during the survey to gauge its prevalence among the children. The mothers were first asked if their child had suffered from diarrhoea during the last 2 weeks preceding the survey. If child had diarrhoea, the information was further collected on its severity, whether medical treatment/advice was sought, diagnosis received and what was administered to the child as a part of the treatment.

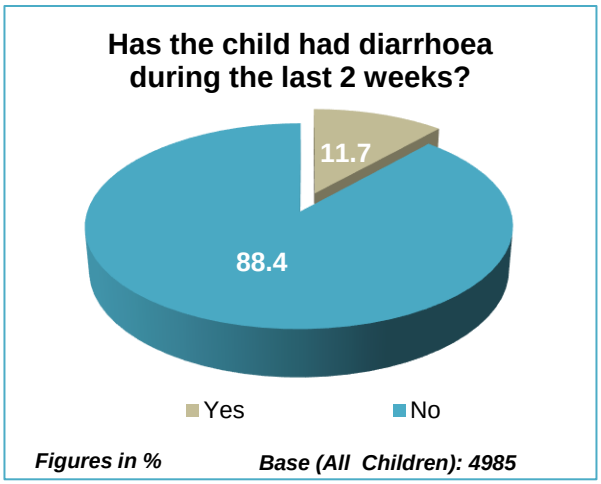


Figure 4 Prevalence of diarrhoea during the last 2 weeks preceding the survey

The proportion of children who had diarrhoea during the two weeks prior to the survey has been presented in the adjacent figure. **At an overall level, the occurrence of diarrhoeal cases within the last 2 weeks preceding the survey was reported for one in ten children, giving an overall prevalence of 11.7%**. The distribution of prevalence was nearly equal among the boys (11.8%) and the girls (11.5%).

Diarrhoeal morbidity was significantly higher in the non-ODF areas compared with ODF areas during the last two weeks preceding the survey. This was evident from the fact that comparatively lesser instances of diarrhoea were reported among the children belonging to ODF areas (9.3%) than the ones who were from the non-ODF areas (13.9%). The differences were tested for significance using two tailed T-test at 95% confidence level.

A comparison of the state wise diarrhoea prevalence rates along with the corresponding split across the ODF and non-ODF areas, both at an overall level and the state level has been presented in the below table. An analysis of the state wise trends indicated that barring Karnataka, prevalence of diarrhoea was nearly same in the other states. In Karnataka, the prevalence of diarrhoea among children remained low (4.7%) while it was maximum among the children of Madhya Pradesh (16.1%). Across all the states, as written above, the children belonging to ODF areas had lesser diarrhoea than their non-ODF counterparts.

[5] http://www.who.int/topics/diarrhoea/en/

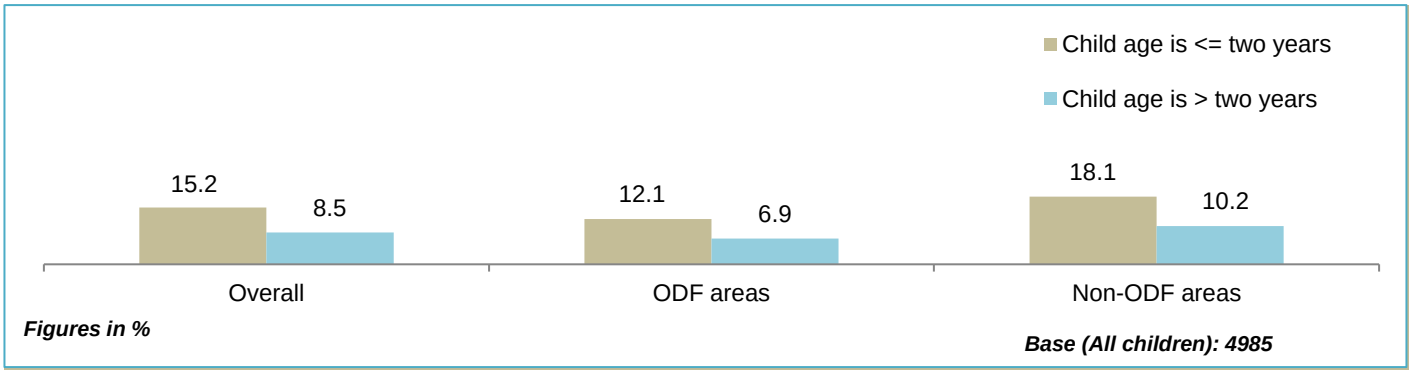
Table 9 Prevalence of diarrhoea (State wise comparison of ODF and non-ODF areas) (%)

Particulars		Base (All children)	Has the child had diarrhoea during the last two weeks? (Yes %)	p-value
All	Overall	***4985***	11.7	
	ODF areas	***2437***	9.3	0.0006
	Non-ODF areas	***2548***	13.9*	
Karnataka	Overall	***838***	4.7	
	ODF areas	***401***	2.2	0.0015
	Non-ODF areas	***437***	6.9*	
Madhya Pradesh	Overall	***1025***	16.1	
	ODF areas	***523***	13.4	0.0158
	Non-ODF areas	***502***	18.9*	
Rajasthan	Overall	***1134***	11.5	
	ODF areas	***541***	9.2	0.0249
	Non-ODF areas	***593***	13.5*	
Uttar Pradesh	Overall	***1112***	12.4	
	ODF areas	***560***	10.2	0.0230
	Non-ODF areas	***552***	14.7*	
West Bengal	Overall	***876***	12.4	
	ODF areas	***412***	9.7	0.0209
	Non-ODF areas	***464***	14.9*	

**: Results of significance test between ODF and non-ODF values at 95% confidence level*

Cross tabulation of diarrhoea instances with the different child age strata, revealed **a higher prevalence of diarrhoea during the first two years of a child's life** - 15.2% among the children in the age group of 0-24 months as compared to 8.5% among the children who were more than 24 months old. The trends remained similar across the ODF and non-ODF areas.

Figure 5 Prevalence of diarrhoea as per the age group



A high percentage of children [six out of ten children (61.8%)] did not report severe pain in abdomen or rectum when they had the illness, less than 10% of the ones who had diarrhoea (9.3%) mentioned about the presence of blood in the stool during the episode.

A high treatment seeking behaviour was prevalent among the respondents in the study area. More than seven out of ten respondents (71.6%) mentioned that they had sought an advice or treatment from any source for the treatment of diarrhoea from which her child had suffered during the last two weeks. The corresponding percentages were higher in ODF areas (76.6%) than non-ODF areas (68.5%). In majority of cases, the illness was diagnosed as diarrhoea (68.8%). Diagnosis with cholera was also reported by a small proportion of respondents (5.1%).

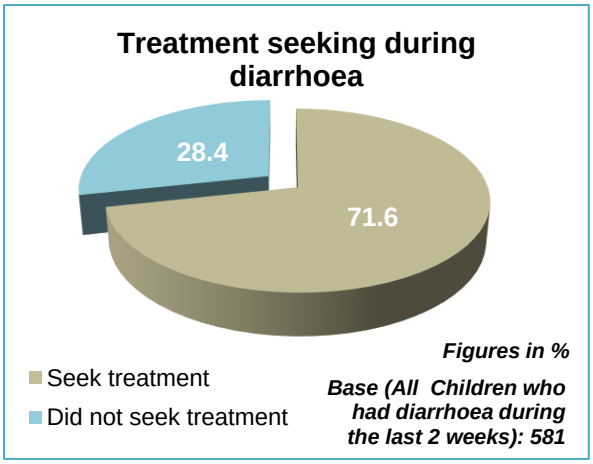


Figure 6 Did you seek advice or treatment for the illness from any source?

Children who suffered from diarrhoea were given multiple therapies. Administering ORS was the most common practice and close to four out of ten children who had diarrhoea (39.9%) were given ORS. One-fifth of the children (20.0%) were reportedly given homemade sugar and salt mix. This was followed by the proportion of the children who were given zinc tablets (14.1%), ORS plus zinc tablets (11.4%) and herbal remedies (6.5%). Nearly 18% respondents reported anything other than these options, either a syrup or a medicine but did not report the name of the medicine as such. Close to one-fifth children were not given anything at all (19.3%). Use of ORS for diarrhoea treatment remained higher in the ODF areas (42.3%) than the non-ODF areas (38.0%).

Table 10 Liquids/fluids given as a part of diarrhoea treatment (%)

Particulars	Total	Karnataka	Madhya Pradesh	Rajasthan	Uttar Pradesh	West Bengal
Base (All children who had diarrhoea in last two weeks)	***581***	***39***	***165***	***130***	***138***	***109***
Homemade sugar and salt mix	20.0	15.4	7.9	10.8	11.6	61.5
ORS	39.9	33.3	43.0	29.2	25.4	68.8
Zinc tablets	14.1	10.3	27.9	20.8	2.2	1.8
ORS and Zinc tablets both	11.4	41.0	12.1	11.5	10.9	0.0
Herbal	6.5	5.1	6.7	8.5	9.4	0.9
Nothing	19.3	7.7	22.4	17.7	25.4	12.8
Other	17.9	0.0	4.9	24.6	25.4	26.6

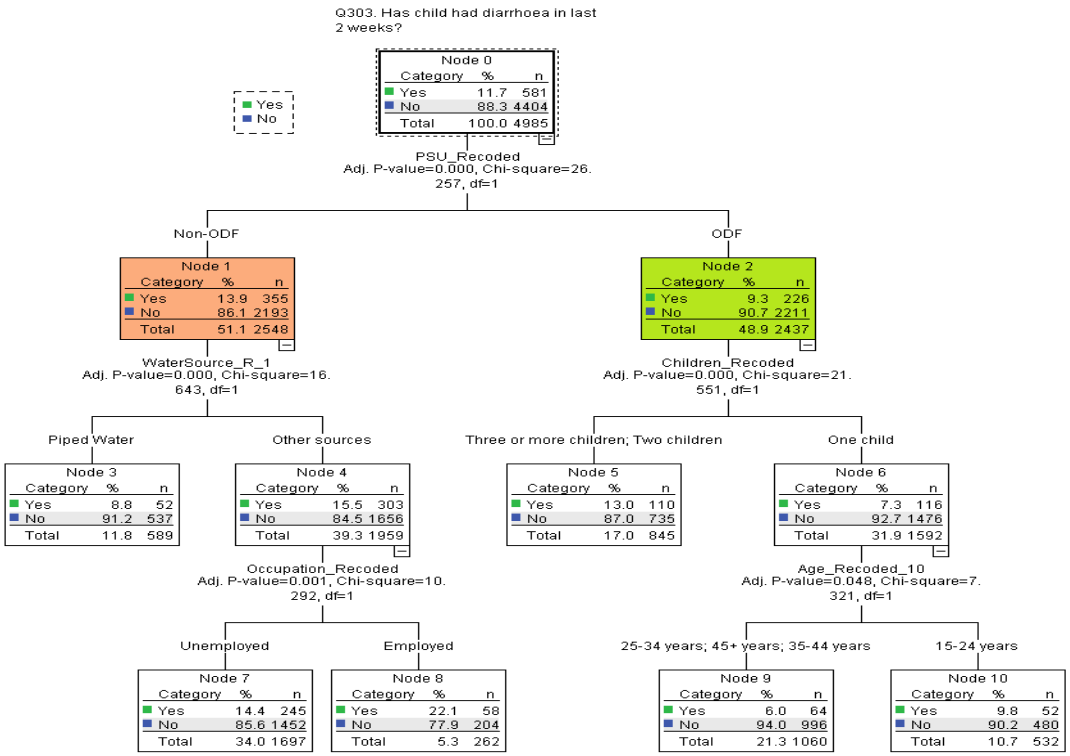
Results from the CHAID analysis (diarrhoea prevalence)

As written earlier, the CHAID algorithm analysis was used to develop the decision tree models. CHAID decision trees are nonparametric procedures that make no assumptions of the underlying data. This algorithm determines how continuous and/or categorical independent variables best combine to predict a binary outcome based on "if-then" logic by portioning each independent variable into mutually exclusive subsets based on homogeneity of the data. The response variable for diarrhoea CHAID model was whether the child had diarrhoea during the last two weeks. It was analyzed on the three different categories of the predictor variables, as shown below:

Table 11 CHAID analysis – Diarrhoea prevalence

Model	Dependent Variable	Predictor Variable Category	Independent Variables (Predictor variables)
Diarrhoea	Prevalence of diarrhoea (reported) in the last 2 weeks preceding the survey (%)	**Category 1:** Demographic characteristics	• Respondent's education • Respondent's age • Respondent's occupation • Respondent's religion • Respondent's caste • Total number of children • Gender of the children
		Category 2: Child nutrition and WASH	• Nutritional status of children: Stunted, Wasted and Underweight • Main source of drinking water in the household
		Category 3: Type of area	• ODF/Non-ODF

Figure 7 CHAID output – Diarrhoea



The tree analysis provided a 3-leveled CHAID tree with a total of 10 nodes, out of which 6 were terminal nodes. The first split in the tree was on the type of the area, indicating that becoming ODF is the most important predictor of diarrhoea. The associated p-value (0.000), indicated a high significance of the type of area with the prevalence of diarrhoea. Out of the 226 cases of diarrhea in ODF villages, the breakdown was almost equal among those children who were the only child of their mother compared to the children who had multiple siblings. Analyzing the data of diarrhoea prevalence among the sub-set of women of ODF areas with one child showed that children of close to 10% of the women who were in age group of 15-24 years reportedly had suffered from diarrhoea during the last two weeks as against a comparatively lower proportion (6.0%) of the ones from higher age brackets. In the total cases of diarrhoea from a non-ODF area, 85.3% of cases were found in the households which used “other sources” of drinking water, while only 14.7% of cases were found in the households with piped water. Among the cases of diarrhoea who were from a household using sources other than the piped water, 80.6% were among the children of women who were unemployed. The CHAID analysis did not identify any significant difference in diarrhoea prevalence based on the gender of child, their nutritional status, religion of head of household (HoH) or the caste of HoH.

3.2. Child Health – Nutrition

3.2.1. Child Nutrition

In developing countries, children and adults are vulnerable to malnutrition because of low dietary intakes, infectious diseases, lack of appropriate care, and inequitable distribution of food within the household. Child survival and development has been the focus of India's policy makers for a long time. However, despite several policy initiatives of the Government including a National Policy for Children 2013, India accounts for the highest number of under-five child (U5) deaths in the world. The statistics become dire in case of neonatal deaths, where India's global share shoots up to more than 25%. Malnutrition limits development and the capacity to learn. Malnourished children are less likely to perform well in school and more likely to grow into malnourished adults, at greater risk of disease and early death.

Anthropometric measurements in the survey:

To assess the nutritional status, as a part of the survey, an anthropometric component was included under which each child was weighed and measured. Each interviewing team included one health investigator who did the anthropometric measurements. Each health investigator carried a scale and a measuring board. The digital salter scale was used for weight measurement. The length of children below two years of age was measured using an infantometer and the height of children aged two to five years was measured using a stadiometer. In cases where the child or infant was not able to stand on the scale on her own, then a differential method of capturing weight of the child/infant was used. The mother/caregiver of the child was asked to hold the child and stand on the scale. The combined weight of the mother/caregiver and child was recorded. Once this was done the mother was asked to stand on the scale without the child/infant and the weight of the mother/caregiver alone was recorded. The difference in the two weight recordings was the actual weight of the child.

Assessment of nutritional status of children[6]:

For the assessment of nutritional status of children WHO child growth standards[7] were used. The nutritional status of children was assessed using three indicators; (1) height for age (stunting), (2) weight for height (wasting) and (3) weight for age (underweight). The data on height, weight and age in months was converted into Z scores using WHO's ANTHRO software.

Stunting is associated with chronic malnutrition. Children whose Z score for height for age below minus three standard deviations (-3 SD) from the median of the reference population are considered as severely stunted or too short for their age. Children with Z score between minus three standard deviation (- 3SD) and minus two standard deviation (- 2SD) are considered as moderately stunted.

Wasting is the result of acute malnutrition in the recent period. Children whose weight for height Z score below minus three standard deviation (-3 SD) from the median of the reference population are considered as severely wasted or too thin for their height. Children with Z score between minus three standard deviation (- 3SD) and minus two standard deviation (- 2SD) are considered as moderately wasted.

The weight for age or underweight is a composite index of height-for-age and weight-for-height. It considers both acute and chronic malnutrition. Children whose weight for age Z score below minus three standard

[6] RSOC National Report, Ministry of Women and Child Development, Government of India (2014)
[7] WHO Child Growth Standards: Methods and development, WHO, Retrieved from - http://www.who.int/childgrowth/standards/technical_report/en/

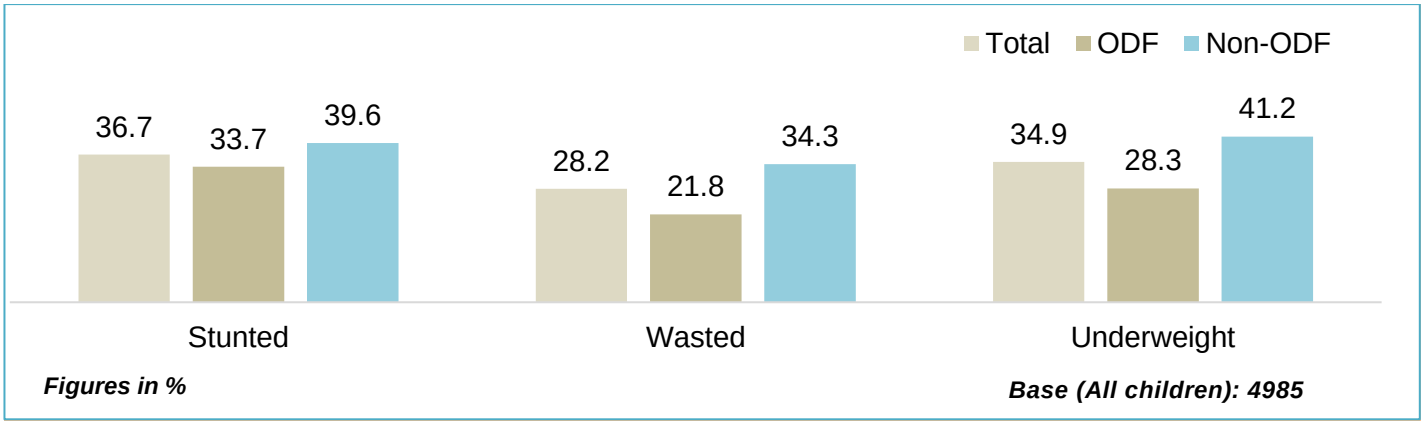
deviation (-3 SD) from the median of the reference population are considered as severely underweight or too light for their age. Children with Z score between minus three standard deviation (-3SD) and minus two standard deviation (-2SD) are considered as moderately underweight.

Key findings – Child nutrition

At an overall level, the proportion of children (from ODF areas and non-ODF areas) who were stunted, wasted and underweight have been illustrated in the below figure. Analysis showed that a little more than one-third children (36.7%) were stunted i.e. they were short for their age. Amongst them, a half were categorized as severely stunted (18.1%) while the remaining half (18.6%) fell into the category of moderate stunting. More than one-fourth (28.2%) children were wasted i.e. they were thinner for their height with the proportion of severely wasted and moderately wasted children being equal. Among all the children, one third (34.9%) were underweight. The proportion of moderately underweight was one-fourth (21.6%) while the remaining (13.9%) of the underweight children were found to be severely underweight.

Comparison of the values of the anthropometric indices across ODF and non-ODF areas suggested that better nutritional status prevailed among the children of the ODF areas than non-ODF areas.

Figure 8 Nutritional indices among the children (comparison of ODF and non-ODF areas) (%)



The state wise trends of child nutrition, categorized as per ODF and non-ODF areas are shown below.

Figure 10 Child stunting

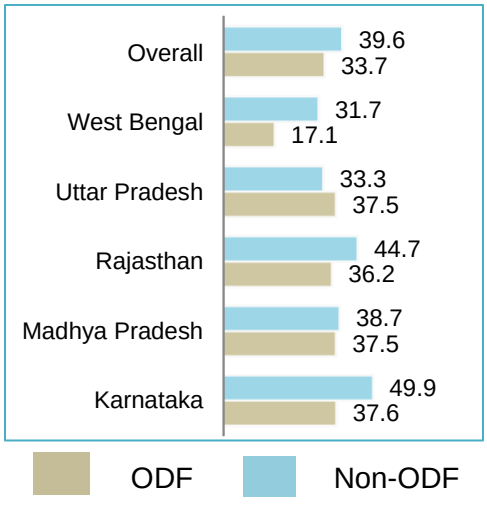


Figure 11 Child wasting

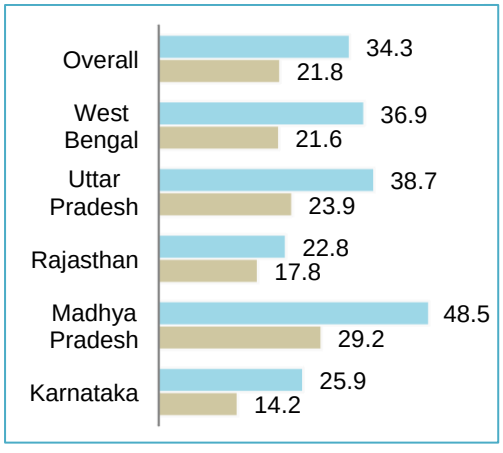
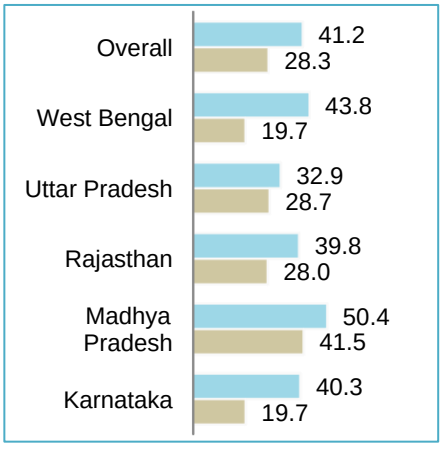


Figure 9 Child underweight



Figures in % ***Base (All children): 4985***

A noticeable state wise variations exists in the prevalence of stunted, wasted and underweight children. However, **uniformly across all the states, the children of ODF areas were nutritionally better than the ones from the non-ODF areas, an indicative of the fact that becoming ODF improves child nutrition.** Further analysis of the nutritional indicators showed significant difference in percentages of wasted and underweight children between ODF and non-ODF areas at an overall level which was not found to be statistically significant in case of stunted children. The impact of ODF on stunting is likely to take many years to manifest so these preliminary data should be taken with extreme caution.

3.2.2. Nutritional status of mothers

Ensuring high standards of mother's health is of paramount importance as behind every healthy child is a healthy mother[8]. As quoted by the researchers, a healthy mother starts a cycle of intergenerational health[9]. To access the prevailing health status of the mothers, as a part of the survey, information was collected on their height and weight. The measurements provided an estimate of the body mass index (BMI), a measure of nutritional status of the adults which was historically developed as a risk indicator of disease.

For computing the BMI, the following standard formula was used.

$$BMI = Weight / (Height)^{\wedge 2}$$

Here, the unit of weight was kilograms while height was taken in meters.

The BMI values thus arrived at were grouped into different categories by referring the standard cut-off points[10]. All with BMI below 17.0 and BMI between 17.1 and 18.49 belong to the category of 'severe thinness to mild thinness 1'. Similarly, the ones with BMI above 25 falls under the 'pre-obese and obese'. BMI values between 18.5 to 24.99 are categorized as 'normal' by WHO. The results of BMI of mother have been presented in the adjacent figure while the categorization of the different BMI categories and their cut-off points have been elucidated in the below table.

Table 12 BMI categorization

BMI Category	Norms (cut-off points)	Category
Severe Thinness to Mild Thinness 1	0 – 18.49	Underweight
Normal Range 2 to Normal Range	**18.50 - 24.99**	**Normal (Healthy weight)**
Pre-Obese and Obese	25.00 – 30+	Obese

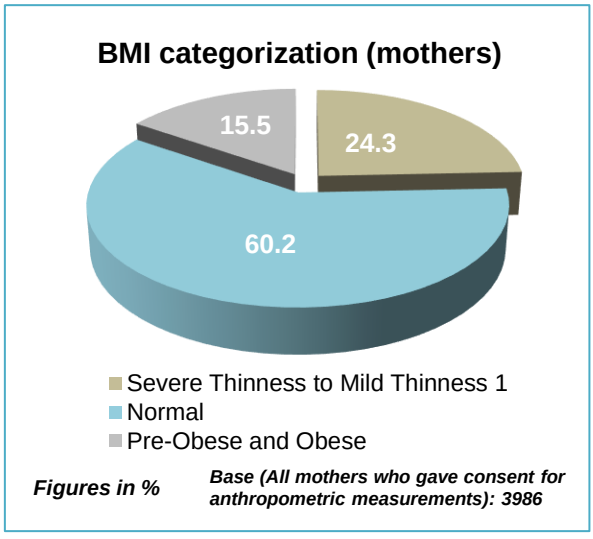


Figure 12 Distribution of nutritional status (BMI) of mothers

[8] Linkages Between Maternal Health, Family Planning, and Child Survival, Save the Children; Retrieved from: http://www.savethechildren.org/atf/cf/%7B9def2ebe-10ae-432c-9bd0-df91d2eba74a%7D/reproductive_health.pdf

[9] A healthy world starts with a healthy mother, The Conversation; Retrieved from: http://theconversation.com/a-healthy-world-starts-with-a-healthy-mother-12740

[10] World Health Organization, "Body Mass Index-BMI"; Retrieved from: http://www.euro.who.int/en/health-topics/disease-prevention/nutrition/a-healthy-lifestyle/body-mass-index-bmi

To understand the nutritional status of mothers across the two types of study areas viz. ODF and non-ODF, the data was extracted and analysed for each of the BMI category (presented in the below table). As could be seen, more than one-fourth (29.0%) of women in non-ODF areas have a BMI below 18.5 indicating chronic nutritional deficiency. A higher proportion of mothers of ODF areas in the 'normal' BMI category (62.9%) than mothers of non-ODF areas (57.5%) shows that not only children but mothers were also healthier in the ODF areas. Although the differences in the percentages were not statistically significant at an overall level.

Table 13 BMI of mothers (State wise comparison of ODF and non-ODF areas) (%)

Particulars		***Base (All mothers who gave consent for anthropometric measurements)***	**Severe Thinness to Mild Thinness 1**	**Normal Range 2 to Normal Range**	**Pre-Obese and Obese**
All	Overall	***3986***	24.3	60.2	15.5
	ODF areas	***1989***	19.7	62.9	17.5
	Non-ODF areas	***1997***	29.0	57.5	13.5
Karnataka	Overall	***790***	17.3	58.7	23.9
	ODF areas	***390***	16.4	66.2	17.4
	Non-ODF areas	***400***	18.3	51.5	30.3
Madhya Pradesh	Overall	***800***	32.5	58.8	8.8
	ODF areas	***400***	26.3	62.8	11.0
	Non-ODF areas	***400***	38.8	54.8	6.5
Rajasthan	Overall	***799***	29.0	62.6	8.4
	ODF areas	***400***	26.8	64.8	8.5
	Non-ODF areas	***399***	31.3	60.4	8.3
Uttar Pradesh	Overall	***797***	12.9	68.4	18.7
	ODF areas	***399***	12.8	63.7	23.6
	Non-ODF areas	***398***	13.1	73.1	13.8
West Bengal	Overall	***800***	29.8	52.5	17.7
	ODF areas	***400***	16.0	57.3	26.8
	Non-ODF areas	***400***	43.5	47.8	8.8

3.3. Child Health – Other Important Determinants

3.3.1. Drinking water and its storage

Worldwide interventions are being undertaken to motivate and mobilize people to improve healthy behaviour. As per UNICEF, an access to improved water and sanitation facilities lead towards healthier families and communities[11]. Washing hands with soap at certain times viz. after defecation, before eating or preparing food has also been found to increase health benefits significantly. Regular hand washing with soap at these critical times along with proper sanitation practices reduce incidences of diarrhoea, the second largest cause of deaths among children under five years of age[12].

Respondents were asked about the main source of drinking water, its storage and the practice involved during its handling. At an overall level, majority of households (90.4%) were using an improved drinking water source. For the calculations, a source was categorized as an improved source if it was among - piped water into dwelling/yard/plot, public tap, public hand pump/tube well, tube well/ borehole/ hand pump in dwelling/yard/plot, protected well in dwelling/yard/plot, protected public well, protected spring and rainwater. The most common source of drinking water was 'public hand pump/ tube well' and three out of ten households (29.4%) reported it as the main drinking water source. 'Tube well/borehole/ handpump (in dwelling or in yard/plot)' was the next most common drinking water source reported by one-fourth households (25.2%). Two households out of ten (19.2%) used 'public tap' as the main drinking water source.

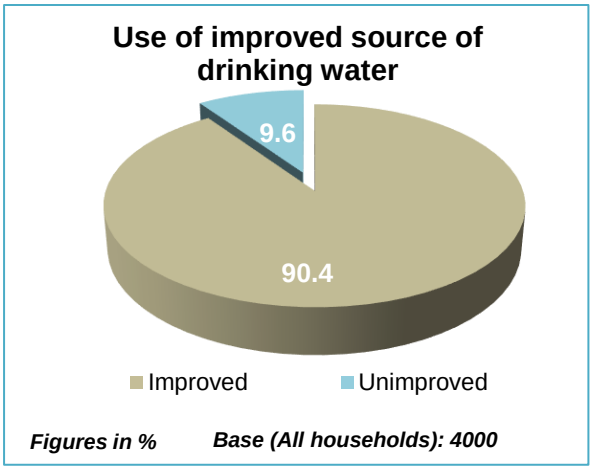


Figure 13 Households using an improved source of drinking water (%)

Four out of ten households (40.9%) reportedly treated drinking water before using. When enquired about the most common treatment method, "straining through a cloth (e.g. sari)" (48.7%) and "boiling of water" (43.0%) were primarily reported.

3.3.2. Handwashing

Hand washing if properly followed, has many important health benefits in community settings. Hand washing with soap ensures that transmission of germs is restricted, especially among children who are prone to diarrhoea. Using a soap for washing hands, particularly after contact with excreta, can reduce diarrhoeal diseases by over 40 percent. The government of India through various public awareness programmes promotes hand washing with soap which is among the most effective and inexpensive ways to prevent diarrhoeal diseases[13].

During a typical day, the respondents primarily engaged in hand washing 'before eating' (94.8%), 'after defecation' (89.8%) and 'before cooking or preparing food' (86.6%). Majority of respondents (69.0%) washed hands with soap (including liquid soap or shampoo or detergent). Close to one-fourth (24.3%) respondents also mentioned handwashing using 'plain water'.

[11] UNICEF, "Hygiene promotion"; Accessed from: http://www.unicef.org/wash/index_43107.html
[12] UNICEF, "Importance of hygiene"; Accessed from: http://www.unicef.org/wash/index_hygiene.html
[13] RSOC National Report, Ministry of Women and Child Development, Government of India (2014)

3.3.3. Child Immunization

Universal immunization of children against the six vaccine-preventable diseases (namely, tuberculosis, diphtheria, whooping cough, tetanus, polio, and measles) is crucial to reduce the infant and child mortality. In rural India, the record of child vaccination is generally maintained through the Mother and Child Protection (MCP) card which is given to the pregnant mothers at the time of their Antenatal care registration. Hence, prior recording the vaccination details, mothers were first asked if they had the MCP or immunization card of their child. The ones who had a card were requested to show it and in all such cases, the details about the vaccination was referred from the card. Under the scenario wherein the card was unavailable, the vaccination details were reported based on the recall of the mother.

The survey captured information regarding administering of the following vaccines:

- *Polio 0 vaccine*
- *BCG (Bacillus Calmette Guerin) vaccine*
- *Pentavalent vaccine - (first dose, second dose and third dose) **
- *DPT (Diphtheria, Pertussis and Tetanus Toxoid) vaccine - (first dose, second dose and third dose)*
- *OPV (Oral Polio Vaccine) - (first dose, second dose and third dose)*
- *Hepatitis B vaccine - (first dose, second dose and third dose)*
- *Rotavirus vaccine - (first dose, second dose and third dose)*
- *Measles*
- *Vitamin A*

**The children who received pentavalent vaccine were considered to have received the corresponding dosage of both DPT and hepatitis vaccines.*

WHO guidelines consider the children as fully immunized if they have received a vaccination against tuberculosis (BCG), all three doses of DPT, three doses of OPV and one dose of measles by the age of 12 months. The same guidelines were referred to undertake the associated computations.

Out of the 4985 children covered as a part of the survey, MCP card was available for 3854 children [more than three-fourth (77.3%)]. In 86% of such cases, our interviewers could record the vaccination details by seeing the card.

The below table presents the percentage of children in the age group of 12-23 months who were fully vaccinated at the time of the survey. The age group of 12-23 month has been chosen for analysis because both international and Government of India guidelines specify that children should be fully vaccinated by the time they complete their first year of life. As could be seen, seven out of ten children (69.3%) were fully immunized with the immunization percentages being highest in Rajasthan (79.2%) followed by Karnataka (78.9%) and West Bengal (75.8%). In the remaining two states, viz. Madhya Pradesh and Uttar Pradesh, the full immunization percentage was comparatively low and was nearly equal (Madhya Pradesh: 58.3%; Uttar Pradesh: 57.6%).

Table 14 % children (12-23 months) who were fully immunized

Particulars	Total	Karnataka	Madhya Pradesh	Rajasthan	Uttar Pradesh	West Bengal
Base (All children in the age group of 12-23 months)	***1119***	***199***	***230***	***255***	***257***	***178***
Full immunization	69.3	78.9	58.3	79.2	57.6	75.8

Chapter 4: Recommendations

1.1. Recommendations based on preliminary findings

The data trends (preliminary findings) was observed to be positively supporting the research hypothesis i.e. the children belonging to the ODF areas would have an improved health status (lower prevalence of diarrhoea) and would also be nutritionally better off (lower prevalence of underweight, stunting and wasting). However, since the overall sample selected for the study did not make it representative of all ODF areas in the country nor the sample was representative at state level, generalizing the findings at a state or a national level is not possible through this study. The study of the links between ODF status and health present numerous challenges and should be undertaken with caution. The causal pathways are complex and isolating effects can be difficult. Though CHAID analysis helps us firm-up the hypothesis that the differences can be mainly due to the ODF status of the geography, the evidence from this research is insufficient to draw a direct causality and attribution of the differences directly to the ODF status. Research for conclusions on attribution and causality need to be based upon methods such as Factorial Evaluation Design using Quasi-Experimental Design.For the future rounds, the following are the key recommendations:

- **A study that is nationally representative, representative among priority states**
    - Considering the government's objective of achieving ODF India by 2019, it becomes important that a nationally representative study is undertaken. It gains criticality in view of the findings of the current study which indicated that the children from ODF areas reported lesser diarrheal incidences and were nutritionally better off than the ones from non-ODF areas
- **Studying changes in health indicators with various degrees of open defecation practices**
    - Presently, the study was undertaken in the areas which had self-declared themselves as ODF. In the future rounds, stratification of the study areas could be done based on varying levels of ODF. This would enable us to attribute the impact concretely
- **Studying changes in health indicators with different durations since declaring as ODF**
    - Previous research has shown that for ODF to have an impact, at least a year of ODF environment is required. In line with the same, the current study selected the areas which were declared ODF at least a year before start of the survey. In future rounds, including the time which has elapsed since the area was declared as ODF as a criterion would be interesting to visualize the impact more concretely