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STUDY OF WATER QUALITY IN RELATION TO DRINKING WATER, SANITATION AND HYGIENE OF BAGMATI RIVER, SHEOHAR, BIHAR

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Abstract : In the context of Bihar, as per the report published by NSSO 69th round, in rural Bihar 924 per 1000 households have 'improved source' and 976 per 1000 households having 'sufficient' drinking water during 2012, which was far better as compared to all India (855). This clearly spells out sufficiency of improved and sufficient drinking water in rural Bihar. However, due to frequent breakdown of old assets, lack of repairs and maintenance, and irregular power supply prevents the sustainability of various technologies in rural Bihar for the provision of safe drinking water (State draft water policy of Bihar). In the context of district Sheohar, although the district has abundance of both surface and groundwater resources, erratic rainfall, siltation, water logging and riverbank erosion are among the issues that affect water quality and availability. In the aforementioned backdrop, the present study was undertaken to understand the utilization of improved water sources in Sheohar district and level of iron, arsenic, fluoride and zinc, E Coli and MPN contamination in different water sources through ground water testing. Both quantitative and qualitative data was collected under the study to understand knowledge, attitude and practice of communities in relation to drinking water, sanitation and hygiene.

IndexTerms - Drinking water, Availability, Quality, Sanitation, Hygiene, Sheohar.

I. INTRODUCTION

Water for People and One Drop initiated Project Sheohar in 2014, an initiative aimed at driving lasting solutions to widespread problem of access to water and sanitation across the Sheohar district. The main project objective was to improve the living conditions of people in Sheohar by providing a sustainable access to safe drinking water to all, increasing access to sanitation to 60% of the population and developing livelihood models that could replicated for the benefits of 2% of the population by 2018. The water related component of Project Sheohar is being implemented in 13 Gram Panchayats in the district. The focus of WFP work has been to develop at least one deep safe drinking water source per hamlet/ habitation of 250 people so as to ensure that the distance from all households to a safe source is less than 500 meters. WFP is also working to reduce open defecation through awareness activities at school and community level, formation of women Joint Liability Groups (JLGs), credit provisions and linkages, establishment of Points of Purchase (PoPs) of toilet construction materials and strengthening agriculture based livelihoods.

II. METHODOLOGY

The multistage cluster sampling was used to select the PSUs and target groups as well as water points for the study. For water testing purpose, total 75 water points were selected from all five blocks of Sheohar district, which included 15 water samples from each block. Water points included India Mark-II &III as government sources, private hand pumps such as Singoor and Tara hand pumps and third type of water points set up in the project area of each gram panchayat by Water for People (WFP). Priority was given to the water points installed by WFP followed by government and thirdly to

private hand pumps. Of the total water points covered (675) the sample constituted of 56.9% government water points, 32.6% private and 10.5% WFP water points. The sampled hand pumps selected for water testing were from depths within 100ft, 100-200ft and more than 200ft.

Water samples for water testing component were collected, preserved, coded and transported by well qualified and trained field personnel. The analysis for chemical contamination was conducted at the NABL accredited water testing lab at Patna, whereas biological contamination was analyzed using portable kits and lab test validations. Sampling, preservation, storage, transportation of water sample was undertaken as per the American Public Health Association (APHA) standard methods and handed over to the lab for proper analysis.

III. Scope/Limitation/Constraints of the Study

- Keeping in view the study objective and design, it provides the status of water quality and KAP of community on WASH for district Sheohar as a whole. The comparisons for indicators for intervention and non-intervention areas of Project Sheohar may not be much significant under the study.
- The study only gives the present status of water quality and KAP indicator for community on WASH thus serves as baseline status which will provide basis for planning the future strategies and activities in the district.
- The water testing study was carried out in winter season. The bacterial contamination level may change increase in the summers.
- The water testing was not carried out in institutional water points such as schools, health centers etc.

IV. Study Findings

Water Quality Testing (Chemical and Biological):

The chemical parameters i.e. Arsenic, Fluoride, Iron and Zinc and Bacteriological parameters are MPN and E. Coli were tested in water sample collected from selected water points under the study. The results of the tests are as follows: Although Iron contamination does not have any direct short term impacts on health, in the long term it causes gastroenteritis and unpleasant taste to drink. It also discolors any item it comes in contact with causing stains. Of all the water points, 67% were found to have iron level above permissible limit. All the GPs of all the five blocks showed iron contamination more than 0.3mg/l. Iron contamination above permissible range was observed in 268 government water points, 156 private hand pumps and 34 water points set up by WFP.

Arsenic contamination causes arsenicosis, a kind of skin lesions. The presence of arsenic in drinking water calls for regular monitoring as it is imperative to prevent arsenic contamination and consequent health hazards. 99% of samples were tested under permissible limit for arsenic However in Piprahi and Purnahiya blocks the arsenic level was found above permissible limits in 5 GPs viz., Belawa, ParsauniBaij, Kuama, Adouri and Basant Jagjiwan (ranging 0.059mg/l to maximum 0.35 mg/l). Water samples were also tested for fluoride content which was found to be within the permissible limit of 1-1.5mg/l as per BIS standards. More than 99% of the treated water points were safe for fluoride level, except for a few pockets (only 5 out of 675 sampled and tested water points had presence of fluoride above permissible limit) of Jehangirpur GP of Dumri Katsari block and Belahiya GP of Purnahiya block. Based upon the study findings, continuous monitoring of fluoride is suggested to check any rise above permissible levels.

In terms of Zinc almost all the water points of all GPs of all five blocks were under permissible limit. About 23% water points had Zinc concentration less than 5mg/l; whereas, the 77% water points having 5-15 mg/l. Presence of Zinc was reported in some of the samples, which is a matter of concern. This requires continuous monitoring of the drinking water. Implication of zinc on human health is still being researched but excess of zinc may cause enzyme copulation in the human body.

On bacteriological parameters based on the Multiple Fermentation Tube method, MPN was detected in all samples as per BIS standards. E. Coli was also found to be present in more than 2% of water samples from 8

GPs out of the selected 15 GPs. About 98% samples were safe from fecal matter contamination in drinking water. However it may be noted that bacteriological contamination may vary with change in climate. It is more likely to increase in summers and decrease in winter depending on the other factors such as sanitation status of the water source.

As per the Uniform Drinking Water Quality Monitoring Protocol, sanitary inspections should be carried out for all new sources of water before they are used for drinking water and on a regular basis. For the purpose of sanitary risk assessment of water points covered under the study, a standard sanitary inspection form was used by the study team. The questions were structured as 'yes' or 'no'. Yes answers scored one point and each no answer scored zero.

The overall sanitation risk score showed 65.3% of water points in the High Risk category while 7.9% in the Very High Risk category. The overall sanitation risk assessment was carried out on 10 parameters as per the format and guidelines prescribed by Government of India under the 'Uniform Drinking Water Quality Monitoring Protocol'. The information was collected through onsite observation and group interaction with community living around the water point. The source wise contamination risk score results showed 9.1% of government water points at a Very High Risk score while, only 1.4% of WFP water points were at Very High Risk. Similarly about 74% of the government water points were at high risk compared to 66.8% of private and 12.7% of WFP water points.

Water Access and Supply:

Hand pumps were the source of drinking water for almost 92% of households across the blocks. These were used across house types, education, religion, caste and living standard index. Tube well/bore well were present only in three households which belonged to HH falling in the wealthiest category of the SLI index. In about three-fourth of the households, the location of water source was within their own dwelling across the blocks, with Tariyani block having the highest percentage and Purnahiya block the least. Only 17% of the households accessed water from some plot or yard other than their own. More pucca and semi-pucca houses had water source in own dwelling compared to kaccha houses. It is interesting to note that around 71% households living below the poverty line had water source within their own dwelling.

One fourth of the total respondents fetched water from hand pump having less than 100ft depth, among them 85.5 % had water source within their own dwelling. The depth of the hand pump was greater than 100ft in case the head of household had higher education (60.6%) and for households falling in wealthiest standard of living index bracket (54.9%). In HH where water was fetched from outside, the primary responsibility of fetching water lied with women in 81% of the households surveyed across the blocks. The average distance for fetching drinking water was less than 200mtrs for 83% of the households across the blocks. Majority of HHs made three to six trips per day to fetch water per day. At least one in four households made at least two trips to get sufficient drinking water in a day. Average time taken to fetch drinking water was half an hour for around 45% households.

About 93-99% (95.8% across blocks) of households in the different blocks reported that the available quantity of water was satisfactory. Households water tariff only for hand pumps (4.9%) and public taps/standpipes (5.3%). Purnahiya block had the highest number/ percentage of households paying water tariff and Sheohar had the least number of households (2.9%) paying water tariff.

Other than drinking, water was also used for cooking, cleaning and washing purposes by households. Hand pumps were again the primary source for all the aforementioned activities. Fetching water for other purposes was also a woman's job ranging between 75-87% households across the blocks, compared to 11-20% of adult men reported across the five blocks. The distance of external source was less than 200 meters for 82-100%. In terms of issues faced in availing drinking water, conflicts at water source; community or common water resources was reported as places of conflict, for ex, public tap and standpipes were reported by 45.7% of households where they faced violence while fetching water. In case of hand pumps only 18.3% of households reported conflicts. Illiterate respondents (23%) faced more violence in comparison to their educated counterparts.

Perception of Respondents on Drinking Water Quality:

Overall, 76% of respondents were satisfied with drinking water quality. When asked to rate the quality of drinking water on 3 point scale, 71% of respondents said the water quality was good and 22% households said the quality was average. Further, households were asked to score the water based on its clarity, colour, smell, taste, healthiness, etc. 78.4% of households said the quality of water was good in terms of clarity, 68% of households said the colour and same percentage of HH said smell was good. The overall quality of water based on taste (71.1%), healthiness (69.3%), stability of service (72.4%), convenience (72.1%) was reported to be good.

Average frequency of hand washing was reported 4-6 times in a day across respondent categories that cuts through education, religion, caste and wealth index. Education status did not influence hand washing as almost equal number of respondents who were illiterates (52.3%) and those who had higher education (50%) washed their hands 4-6 times in a day. About 26% of respondents washed their hands 7-10 in a day across different backgrounds.

A good practice was reported with about 94% of respondents saying they washed hands before eating, 85% of respondents reported washed hands after defecation or using the toilet. Nearly half of the population washed their hands before preparing a meal. 18.7% & 17.1% of respondents washed their hands after touching an animal and after cleaning child feces respectively.

Overall, about 72% of respondents washed their hands with soap and water, while only 8.8% used only water for washing hands. About `4% of respondents washed their hands with mud/dust and water and a small percentage of 5% respondents used ash and water to clean their hands. Practice of hand washing with soap and water improved with improvement in education level. While 63.4% illiterate respondents reported hand washing with soap and water, around 88% respondents with higher level of education reported this practice. Hand washing practice improved with improved standard of living. While 85% respondents who were in wealthiest category reported hand washing with soap and water, only 63% poorest practiced it.

Sanitation:

Percentage of households with toilet facilities shows correlation with education level of HH head across the blocks. Presence of toilets improved with the house type, caste and APL/BPL status. Number of households having toilet facility at home was less than half (37.4%, 592 HHs) of the total sampled households. Of these majority of the households (83%) had improved sanitation facilities of three types i.e. presence of flush to sewer/septic tank/pit, pit toilet and twin pit or composite toilet. Among those HHs where toilet facility was not available, poverty was reported as the main reason for not constructing toilet by 94% of respondents.

Reasons given for constructing toilets at home included safety of women (77.8%) followed by financial support in the form of government incentive received for construction of toilets (21%) and for use by visitors at HH(16.4%). Out of those households where toilet facility was available the overall toilet usage by all family members was 94.4%, which was above 90% usage in all the blocks with Sheohar block leading at 97.1%. When asked about reasons for not using toilets (in 33 HHs) respondents across categories (adults & adolescents) have said they ‘like to defecate in the open’ (45.5%), followed by non-functional toilets mostly due to O&M issues (42.4%).

V. CONCLUSION

The central role of access to water and sanitation for sustainable development is now even more confirmed with the formal adoption of the 17 Sustainable Development Goals (SDGs) in September 2015 by the United Nations (UN) General Assembly. Among these, Goal 6 is to ensure availability and sustainable management of water and sanitation for all by 2030. This presents a great challenge for India, because according to WHO/UNICEF (2014), India was in the group of only 45 countries where sanitation coverage was less than 50% and home to largest population lacking sanitation. As per NFHS 4 (2015-16), 89.3 per cent rural households had access to improved drinking water sources. According to Ministry of Drinking

Water and Sanitation there are total 63968 habitations in India which suffers from water contamination issues.

Thus, over the last decade, water and sanitation coverage has captured increasing policy attention and is now exemplified in the national initiatives like Swachh Bharat Mission, National Water Quality Sub Mission and Strategic Plan for Ensuring Drinking Water Security in Rural India 2022. These missions provide strategy and milestone to achieve the national goals in water and sanitation components.

Since the water testing and sanitary risk assessment was carried out in winter season, therefore, the chances of increased bacteriological contamination may be ruled out in summers especially considering that 73% of water points were falling under either very high or high risk categories. Status of sanitation and hygiene in Sheohar is defined by economy and intent. Most of the households reported lack of money as the major impediment towards constructing toilets. People mentioned convenience of open defecation but also spoke about various challenges faced by them during open defecation, all in the same breath. Even when households had the ability to construct toilets they lacked intent to construct. This is evident from the findings as about half the household having APL status did not have toilets.

The findings of the study lead us to conclude that in district Sheohar there is a high dependency on hand pumps for drinking water and other purposes. While people are aware about the aspects of safe drinking water such as depth of the hand pump and drinkability of water, there is a need for increased awareness on issues related to water handling and water treatment.

VI. RECOMMENDATIONS

Based on data analysis, field observations, and interactions with partners, staff, community and key stakeholders the key recommendations area presented below. The recommendations have been grouped in to three categories i.e. suggestions related to program planning and implementation, recommendations at the level of WFP India Core Team and emerging opportunities :

- The existing water points installed by Water for People have wider acceptance among community as reflected through FGDs with community and IDIs with stakeholders, however the contamination risk was found high or very high at some of the water points. WFP team can plan for technological interventions to bring down the contamination risk at these water points.
- As per the findings of the study, the role of government health service providers seems miniscule in relation to water borne diseases. As per IPHS guidelines, responsibilities of ANMs also include increasing awareness about public health issues in the community including water borne diseases. WFP and partners should involve government health and ICDS functionaries in their work to ensure they provide health counseling to families including component on water borne diseases.
- One of the major recommendations given by community was that government should increase the depth of existing hand pumps WFP team may advocate with government for the same.
- All the water points having water contamination beyond permissible limit should be marked and a display board stating that “Water not Safe for Drinking” fixed at it.
- Government is focusing on the provision of piped water scheme to every households as per its program and policy. However the scheme would be implemented in phases. Thus WFP can map the areas/ locations which are likely to be covered in the last phase of the existing piped water scheme and focus on providing technical support on sustainability of existing sources on pilot basis or may also install new water points (if required).
- Considering the focus of government on ward level planning and implementation of water and sanitation programs in Bihar; WFP team can also work out the strategy to support government in priority Panchayat wards identified by them for implementing the water and sanitation activities. Considering the focus of government on ward level planning and implementation of water and sanitation programs in Bihar; WFP team can also work out the strategy to support government in priority Panchayat wards identified by them for implementing the water and sanitation activities.

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