

Effect of Poor Sanitation on Rural Water Supply: Review of Water Supply Scenario of Villages in Solapur District

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Abstract—Two main water problems are affecting the sustainability of human settlements in different regions: the lack of access to water and sanitation, and increasing water-related diseases. This paper tries to highlight the effect of improper and insufficient sanitation on the water supply scenario of through a case of villages in the Solapur District of Maharashtra. The study presents a holistic view of water supply and sanitation – considering water supply and sanitation as an integrated issue.

1. INTRODUCTION

Individual Health and hygiene is largely dependent on adequate availability of drinking water and proper sanitation. [Therefore](#), there is a direct relationship between water, sanitation and health. Consumption of unsafe drinking water, improper disposal of human excreta, improper environmental sanitation and lack of personal and food hygiene have been major causes of many diseases in developing countries.

International monitoring of drinking water and sanitation [was](#) carried out in response to international development policies, also generating knowledge that informs the development as well as facilitates the implementation of those specified policies [1]. Monitoring programmes track global, regional, and national progress on expanding access to drinking water and sanitation, and highlights the gaps and opportunities for accelerating that progress.

2. WATER AND SANITATION INTERNATIONAL SCENARIO

International monitoring of drinking water and sanitation has been on-going since the 1930s, when such monitoring was carried out by the League of Nations Health Organization; subsequently by the World Health Organization (WHO), and now jointly by WHO and The United Nations Children's Fund (UNICEF) through their Joint Monitoring Programme (JMP). In recent decades, this monitoring has been conducted in support of global targets established under the UN system through the second United Nations' (UN) Development

Decade (the 1970s); the International Drinking-water Supply and Sanitation Decade (the 1980s); the World Summit for Children [2]; and the Millennium Development Goals (established in 2000 for the period 1990–2015) [3]; as well as the International Decade for Action: Water for Life (2005–2015) [4] and the International Year for Sanitation (2008) [5].

Table 1: Timeline of international targets and actions related to drinking water and sanitation

Year	International Actions and Targets
1960	Beginning of UN led Monitoring
1970	nd 2 UN Development Decade
1980	rd 3 UN Development Decade International Drinking Water Supply and Sanitation Decade
1990	th 4 UN Development Decade Nominal Start of MGD Period World Summit for Children Formation of JMP
2000	Millennium Development Goals International Decade for action water for Life 2005.
2010	Sustainable Development Goals

Data Collection methods JMP

From the 1960s until 2000, data collection was through distribution of questionnaires to national authorities. In some cases, one person would complete and return the questionnaire, in others, ministries and departments would cooperate to compile responses; in some cases, support was provided by UN agencies and in others not.

The JMP now compiles and analyses data on all UN Member States, and UN-recognized countries and territories for which data is available. The principal data sources used by JMP are national censuses and nationally representative household surveys. It typically collects the information on the country's entire population, through questionnaires and/or interviews. It

normally include far fewer questions in total than household surveys and may or may not address drinking water and sanitation. [1]

3. SANITATION IMPROVEMENTS IN INDIA

India has the largest number of people who practice open defecation (626 million) and the highest number of child deaths due to poor water, sanitation and hygiene conditions compared to the rest of the world [6].

The Central Rural Sanitation Programme, which was started in 1986, was one of India's first efforts to provide safe sanitation in rural areas. This programme focused mainly on providing subsidies to people to construct sanitation facilities. However, a study done by the government in 1996-97 showed that it was more important to raise awareness about sanitation as a whole rather than to just provide subsidies for construction. This understanding marked the first shift in the programme. In 1999, a restructured Total Sanitation Campaign (TSC) was initiated to create supply-led sanitation by promoting local sanitary marts and a range of technological options [7].

The rural sanitation campaign has the following as its objectives [6]:

- Accelerate sanitation coverage in rural areas.
- Generate a push from the people to get facilities rather than expect the Government to do it (demand-led promotion).
- Focus on intensive education and awareness campaigns to ensure that people understand the need for safe sanitation.
- Take the scheme beyond rural households to rural schools and nursery schools. Here again, the emphasis was placed on promoting good hygiene practices.
- Promote cost-effective and appropriate technologies.
- Through all the above, improve the health and quality of life in rural areas.

In 2012 the scheme was restructured and renamed as the *Nirmal Bharat Abhiyan*. With an intent to transform India to "*Nirmal Bharat*", the scheme's revised target for reaching total sanitation was changed from 2012 to 2022. Its goal is not only universal toilet coverage by 2022, but also improving health and providing privacy and dignity to women, with the overall goal of improving the quality of life of people living in rural areas.

Table 2: A Timeline of National Schemes and targets related to drinking water and sanitation

Year	India Actions and Targets
1986	Central Rural Sanitation Programme
1999	Total Sanitation Campaign
2000	Millennium Development Goals Target 7C: Halve, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation

Year	India Actions and Targets
2001	2001 Census and TSC Baseline Census was done with a household toilet count to create a baseline
2003	<i>Nirmal Gram Puraskar</i> prizes to Gram Panchayats who achieved open defecation free status
2008	TSC Coverage of Rural School Sanitation Deadline to cover sanitation in rural schools across India
2011	2011 Census collected data regarding access to sanitation facilities and HH sanitation facilities
2012	TSC was restructured as <i>Nirmal Bharat Abhiyan</i> (NBA) Revised Rural Sanitation Baseline 2012 the sanitation programme undertook a new country wide baseline of access to rural sanitation.
2014	NBA structured into <i>Swacha Bharat</i> Mission – Gramin (SMB-G)
2019	Target to make India open defecation free

The move towards a more outcome focused approach to sanitation delivery came in the wake of Census 2011 findings that only 30.7 percent of rural households in India have access to any toilets. Further, a recently released UNICEF and WHO report [8] found that in 2008 a mere 21 percent of rural India uses improved sanitation facilities¹.

In recognition of these constraints, the NBA launched the Baseline Survey 2012 to assess the current status of sanitation facilities including parameters such as functional and defunct toilets. This survey was meant to provide revised data on HH and institutional coverage in the villages. It also tried to bring out the percentage of Defunct toilets in the survey. But the baseline 2012 still does not give any estimate on toilet usage. In the absence of usage data, it is unclear how Baseline 2012 will improve the planning process under NBA for it to achieve its goal.

The SBM has taken an important step in expanding the goal to one of achieving sanitation outcomes. In terms of implementation, this requires,

- regular access to data to monitor and measure outcomes and,
- flexibility to enable local challenges (such as initiating changes in household behaviors) to be met in a manner that is conducive to the local environment.

4. MAHARASHTRA WATER AND SANITATION SCENARIO

The responsibility of provision water and sanitation lies with the State Governments, however Government of India (GoI)

¹The Joint Monitoring Programme defines "improved sanitation" as facilities that are used and ensure hygienic separation of human excreta from human contact. They include a flush or pour-flush toilet/latrine to piped sewer system, septic tank, pit latrine, ventilated improved pit (VIP) latrine; a pit latrine with slab; and a composting toilet.

provides support in policy development and also meet financial requirements to implement programmes. The Accelerated Rural Water Supply Program (ARWSP), launched in 1972, has resulted in significant improvements in the water supply. The ARWSP, which was aimed to provide water supply coverage to all habitations by the end of Eighth Plan (1992-97), continues to provide the basis for rural water supply [9].

The rural water supply and sanitation programs are being coordinated through Reform Support and Management Unit (RSMU) and the Water Supply & Sanitation Organization (WSSO) which was formed by dissolving the earlier Communication & Capacity Development Unit (CCDU). Maharashtra *Jeevan Pradhikaran* (MJP) and Groundwater and Survey Development Agency (GSDA) are the technical wings functioning under the department.

Water Supply Scenario

The State Water and Sanitation Mission, plays important role in developing policies and guidelines and strengthen inter-departmental coordination. Similarly, the implementation and monitoring role of water supply and sanitation programmes at the district level is coordinated by the *Zilla Parishads* (ZP), and at the Block level by the *Panchayat Samitis*. The District Water Sanitation Missions and Block Resource Centres support the implementation of programmes as per the directives of the *Zilla Parishad* and *Panchayat Samitis* respectively. At the *Grampanchayat* (GP) level, Village Water Supply and Sanitation Committees (VWSCs) are created to perform the role of implementation and monitoring. The VWSCs, which are standing committees of the GPs, are responsible for planning, design, execution and maintenance of the drinking water and sanitation schemes.

Maharashtra has developed a protocol for water quality testing under the National Rural Drinking Water Quality Monitoring and Surveillance Programme (NRDWQMSP) which is currently merged with the National Rural Drinking Water Programme of the MDWS [10]. Accordingly, all three concerned departments of water and health such as Rural Development, Public health and Water Supply & Sanitation are involved in this programme. The protocol Water quality testing is carried out by District Public Health Laboratories functioning under the Public Health Department. According to the protocol adopted in the State, a minimum of 4 bacteriological tests and 2 chemical tests are to be conducted annually [10].

HH Sanitation

The household level toilet coverage has always been a contentious issue. As per the IMIS, the current coverage of household toilets in the State is reflected to be 57%. An increase of around 6% has been reported in the State after the baseline survey was conducted in 2012. However, the household toilet coverage was only 44% in the state as per the census 2011 data. The State has the highest number of NGP

awarded GPs in the country. Maharashtra has around 35% of GPs of the 28,589 GPs who have received the award in India (NGP, 2013). The evaluations of both the SGBSA² & NGP³ awarded villages also show that many households in these villages reverting back to open defecation.

5. CONCEPT OF ECO VILLAGE

The Concept of an Environment Development Plan (EDP) was primarily focused to identify and support areas for social-cultural-ecological development in select villages with the active participation of targeted communities and integrating relevant ongoing government programmes.

Eco village concept promotes a conservation of natural habitat and a lifestyle that has minimal ecological impact. ecological planning, sustainable waste management practices, alternate agriculture practices and use of renewable energy sources are some of the aspects that need to be adopted for development of eco village communities (GoM, 2010).

The Eco Village Project Mobilised professional expertise from various government departments such as Agriculture, Health, Public Work Department, Irrigation Department, etc in the selected villages. This Technical manpower worked with the project implementing agency and the village level committees to prepare a comprehensive development plan for the village.

The villages were selected on basis of reform oriented guideline laid down by Maharashtra Pollution Control Board (MPCB) and Rural Development Department. Few reforms related to water and sanitation sectors are given in the Table 3

Table 3 Guidelines for Selection of Villages for preparation of EDP [11]

Reforms	1st year	2nd Year	3rd Year
Open Defecation Free Ratio	60%	75%	100%
Sant Gadge Baba Scheme²	Action plan	50% Marks	60% Marks
Solid Waste Management	Action Plan	Collection of 100% waste 50% of the waste converted to Compost	Collection of 100% waste 75% of the waste converted to Compost
Waste Water Management	Action Plan	Treatment of 50 % of the waste water	Treatment of 75 % of the waste water

² SGBSA-Sant Gadge Baba Swachhata Abhiyan a clean village competition launched to improve sanitation conditions of villages. The central idea of the campaign was to mobilise people around the issue of sanitation.

³ Nirmal Gram Puraskar (NGP), a national level clean village award which is modeled on the lines of SGBSA, was launched by Government of India in 2005.

The reforms were laid so that the GPs which were selected would have basic infrastructure in place. The consultants selected for preparation of the EDP would focus on development of Infrastructure that was not possible to plan at the GP level for lack of technical knowhow. Under this project around 250 villages varying from 5000-35000 populations were selected from almost every district in Maharashtra.

In the Solapur District EDP was prepared for 17 villages in the first phase and 27 villages in the second phase. Of these 44 villages whose EDP was prepared village data for 16 villages have been analysed and presented below.

Methodology adopted

The preparation of the EDP report required 4 major activities, 1-Collection of Secondary data, 2-Village level assessment and Participatory Rural Appraisals (PRA), 3-Preparation of GIS based Maps, 4-environmental sampling of the village [12].

- Secondary data from various government agencies like Gram Panchayat, Primary Health Care Centres for disease patterns, water purity data was collected.
- Through PRA qualitative data was collected to understand various sanitation related problems in the villages.
- With the help of GIS based maps these issue areas were superimposed on maps. This gave a proper understanding of Open defecation areas, source of water, disposal location of waste water, etc.
- Third step involved examining water sources for physico-chemical, and bacteriological parameters. The samples were collected and analyzed as per the procedures specified in 'Standard Methods for the Examination of Water and Wastewater' published by American Public Health Association (APHA). Selected physico-chemical and bacteriological parameters have been analyzed for projecting the existing drinking water quality status in the village.

Although data regarding water sampling data was available from secondary sources under the NRDWQMSP additional water samples were collected from each village. Number of water samples collected from each village based on the different type of sources that the village depended on for its water.

So in Villages like Malinagar where the primary source of water was from the surface water tank filled by water taken from the canal; water samples were collected from the tank and the tap connections. This was to assess the quality of water pre and post treatment.

In villages like Hattur where Piped Water Supply System is nonexistent and majority of population depend on wells and bore wells samples were taken from one Handpump in one settlement. Hence no of samples for Hattur are the maximum.

The village wise number of samples collected is shown in the Table 4.

Table 4 Village wise number of water source tested

Village Name	Bore Well	Hand Pumps	OHT	Open Well	Pazar Talav	Tap Water	Grand Total
Aashti		1	2	2			5
Akluj		1	2	2			5
Bhandishegaon	1	5		3		1	10
fulchincholi		1		1	1	1	4
Gadegaon		1		1		1	3
Hattur	1	10		1		1	13
Kadabgaon		3		3		3	9
Malinagar	3		1	1		1	6
Mandave		1	1			1	3
Nazare		1				1	2
Sadashivnagar		1		1		1	3
Sarkoli	1	3				1	5
Velapur				3	1	1	5
Wagdari			1	2		1	4
Walsang				5	1	1	7
Yashwantnagar		1			1	3	5
Grand Total	6	29	7	25	4	18	89

6. FINDINGS OF THE STUDY

Sanitation Issues

To be eligible for the EDP project various reports were submitted by the villages which showed these villages as near open defecation free villages. However primary surveys and PRA study revealed that most of the villages lacked in basic sanitation facilities. As a 100% survey of the village was not in the scope of the project 2012 NBA baseline data was studied. The situation is presented below (Fig. 1).

In the study area, household toilet coverage of 54% was observed among the 16 Villages studied. Proportion of households with toilets was highest in Yashvantnagar (85%) followed by Malinagar (64%) in the Malshiras taluka of Solapur. Both these villages have a Sugar mills and enjoy treated water supply from the factory.

While Sadashivnagar, a village which also hosts a Sugar mill in the Malshiras taluka has only 42% of toilet coverage due to land ownership issues in the village. Due to the land ownership issues, gram panchayat is also unable to build community toilets in the village to cater to the unserved population.

In Hattur Village data suggests that all families have toilets but survey conducted confirms that only 24% of the HH have toilet facilities. The available public toilet facilities and their physical condition reveals that not many families use these

toilets and majority of them prefer to go out for open defecation.

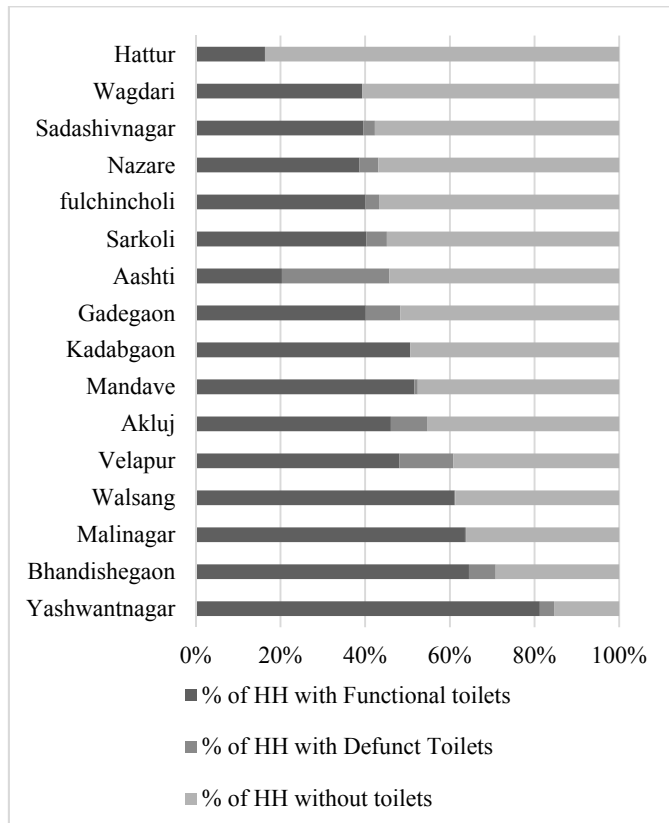


Fig. 1: Solapur District Nirmal Bharat Abhiyan baseline data 2012

Data for all village suggest that majority of the toilets are connected to pit toilets and a few are connected to septic tanks. The pits or the Septic tanks of these toilets have not been emptied so far, neither the GP (except Akluj) has any facility like suction trucks to empty them.

The usage of toilets by households was not assessed as it is always misleading.

Water Supply Issues in the selected villages

It is observed that, in villages which are primarily depended ground water sources, most of the samples show dissolved solids on higher side making the water unsuitable for drinking.

Water from the hand pumps have has higher amount of alkalinity, chlorides, sulphates and hardness and water softening is essential if it has to be used for drinking.

In almost 50 percent of the water samples collected Coliforms are present and tap water has E. coli i.e. the tap water is not disinfected properly and has fecal contamination. This can be attributed to two major reasons

The water in the water supply well is treated on with the addition of TCL powder. The dosage of the TCL powder depends upon the amount of water present in the well. At the GP level there is lack of technical manpower to ascertain the water level or to calculate the TCL dosage for the water. The tap water needs adequate disinfection using bleaching powder and protection from damaged pipes (leak repairs on time).

Household level water treatment is almost nonexistent. Few households reported the use occasional chlorination during rainy seasons. The actual finding of the survey is presented in the Fig. 2. For each village the number of samples that tested positive for E. Coli⁴ (fecal matter) are plotted against the percentage of HH without toilets. It was observed that the percentage of open defecation is directly proportional to the occurrence of water contamination.

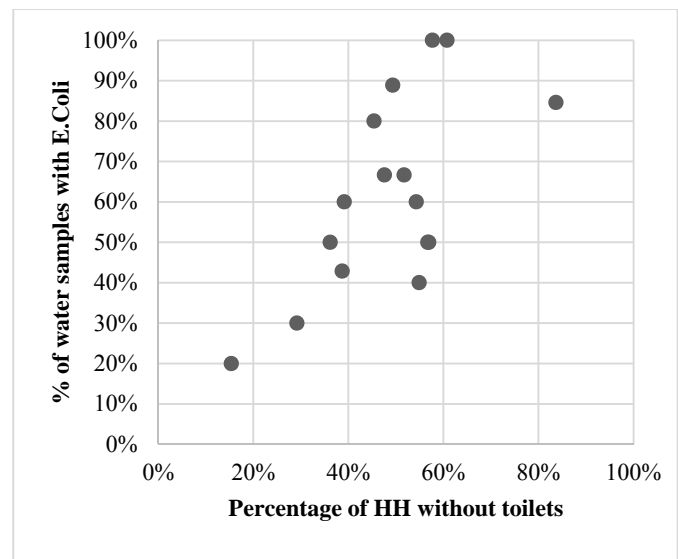


Fig. 2: Percentage of water samples where E.Coli is Present

7. CONCLUSION

The EDP program tries to replace the traditional scheme based development approach with a holistic plan based approach for village development but fails to achieve its objective as major finances are diverted to water and sanitation issues.

Functional household toilet coverage (48%) found in the study is comparable to the Census 2011 data (44%) for the State but contradicting to the basic selection criteria of the Village for preparation of an EDP. This point lacunas in the selection of villages for implementation of this scheme in the first place.

The general awareness among members of GPs and household survey shows low priority being according to water quality aspects. In view of this, there is a need for better coordination

⁴ Although samples were tasted for various parameters like TDS, as Cl, SO4, NO3, CaCO3, Residual Chlorine, Total Coliform, and pH only E.Coli values are considered for analysis

between health and water supply departments at the GP level. There is also a huge variation between the results of water samples tested by the public laboratories and those tested for this project.

This also brings to notice that water and sanitation based studies should focus more on quantitative analysis (water sampling) than on perception of qualitative survey (HH Surveys) which have been traditionally followed

There is also a need to modify the process of testing fixed no of water samples per village to source based water testing or season based water testing by the VWSC.

Absence of adequate funds for O&M is reported as one of the reasons for procurement of chlorination agents required in some GPs.

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