ORIGINAL RESEARCH ARTICLE

Effectiveness of a School-Based Intervention on WASH Infrastructure in Residential Schools of Wardha District, India

Sarika Uttamrao Dakhode[1*], Abhay Motiramji Gaidhane[2], Sonali Gajanan Choudhari[3]

[1]Department of Community Medicine, Dr Panjabrao Deshmukh Memorial Medical College, Amravati, Maharashtra, India
[2,3]Department of Community Medicine, Jawaharlal Nehru Medical Collage, DMIHER (DU), Sawangi, Maharashtra, India

DOI: 10.55489/njcm.160520255038

ABSTRACT

Introduction: Various WASH programs are running at the National level, however; coverage, barriers and challenges for WASH implementation in underprivileged sectors are rarely assessed. Aim & Objectives: To assess the effect of a school-based intervention on WASH infrastructure at the residential school level.

Methodology: This experimental study was conducted in eight ashram schools of district Wardha (Maharashtra) that were allocated to intervention and control groups. The intervention consists of providing a module for promoting safe drinking WASH practices and hands-on training of teachers and staff. Baseline and endpoint data were collected by using a checklist and questionnaire developed by WHO and UNICEF. The score for WASH practices was analyzed.

Results: Chlorination method was adopted in all beneficiary schools. All water samples collected from beneficiary schools were free from any micro-organisms. Score for availability, accessibility and maintenance of sanitation, hygiene facilities, and cleanliness improved up to 75% in intervention as compare to control schools. Basic services of hand washing facilities, i.e. availability of water and soap were, achieved by 75% intervention and 25% control schools.

Conclusions: Intervention was based on local engagement, which was found to be advantageous in promoting the school environment for safe WASH facilities at satisfactory level in beneficiary schools.

Key words: Water, Sanitation and Hygiene; WASH in Schools, WinS, WASH Intervention

ARTICLE INFO

Financial Support: None declared
Conflict of Interest: The authors have declared that no conflict of interests exists.
Received: 26-12-2024, **Accepted**: 07-04-2025, **Published**: 01-05-2025
***Correspondence:** Dr. Sarika U Dakhode (Email: sarikac31@gmail.com)

How to cite this article: Dakhode SU, Gaidhane AM, Choudhari SG. Effectiveness of a School-Based Intervention on WASH Infrastructure in Residential Schools of Wardha District, India. Natl J Community Med 2025;16(5):490-500.
DOI: 10.55489/njcm.160520255038

www.njcmindia.com | pISSN: 0976-3325 | eISSN: 2229-6816 | Published by Medsci Publications

INTRODUCTION

Safe drinking water, sanitation and hygiene have a positive impact on decreasing diarrheal diseases.[1-4] The Provision of safe WASH services in schools is one of the targets of post 2015 Sustainable Development Goals.[5] All India Education surveys reported in 2002 (VII survey) and 2009 (VIII survey) reports reflects 78% and 88% of schools had drinking water facilities.[6] Several experimental researchers acknowledged that lack of information and accountability for the functioning of the WASH service system, monitoring by teachers, less priority, and lack of clarity towards WASH responsibilities within the school environment are the barriers to safe WinS.[7,8]

In India, various programs and activities such as School Water and Sanitation towards Health and Hygiene, School Sanitation and Hygiene Education, Janshala Program, Swachh Vidyalaya Abhiyan, etc.[9-11] have been initiated under the leadership of UNICEF with an integrated approach. WHO and UNICEF jointly set the standards for WinS in 2009 for low and middle-income countries about availability, accessibility, quantity, and quality. Some of these are 1) Water: Quality- No coliform or bacteria detectable, Quantity-20 litter/person/day, and accessible; 2) Sanitation: Sufficient, accessible, private, secure, clean and culturally appropriate toilets: 1 toilet/per 25 girls or female staff,1 toilet plus 1 urinal (or 50 cm of urinal wall)/50 boys or male staff; 3) Hygiene: Participatory approach for hygiene education, included in school curriculum, facilities and resources enable staff and school children to practice behaviour.[12] In 2016, UNICEF and WHO recommended core questions to support synchronized monitoring of WinS as a part of the SDGs. The indicators given in this manual are useful in national or sub-national surveys and comparability over time and between countries. The core indicators define the basic services and services ladders to track the progress and its coverage.[5]

Throughout the literature review, it was observed that the impact of WASH intervention in schools improved facilities however there is a lack of evidence or assessment of WASH practices in schools meant for Adiwasi community children i.e. socially deprived community.[13-19] Implementation of the WASH module and its effectiveness among the ashram schools in remote settings need to be explored.

There is a need to find out the gap issue for adopting good practices or for behaviour change by the community. Once these issues are identified, there is a need to develop and apply or implement a community need-based model or program for behavior change. Hence this study is planned to reach the unreached schools meant for underprivileged sectors.

The objective of this study was to assess the effect of an intervention on school infrastructure for water, sanitation and hygiene practices at the Ashram (residential) school level.

METHODOLOGY

Study Design and Setting: This was school-based intervention study carried out in ashram (residential) schools of Wardha district during 2021-2023.

Sampling and allocation: There are total eight ashram schools meant for tribal communities in a district and all these were enrolled in the study by complete enumeration sampling technique. Out of eight ashram schools, out of which 50% (four) schools were allocated in intervention and the other half (four) schools in the control group by simple randomization.

Data Collection- Tools and Technique: The school Principal, teachers and staff were oriented by the project team about objectives, data collection methods and intervention (only for one group); and requested the authorities for needful cooperation. Baseline and endpoint data were collected by using a checklist and questionnaire which is adapted from the 'Monitoring package for WASH in schools in Low-cost settings' developed by WHO and UNICEF.[5] Core questions to assess the WASH services provided in schools are simple, clear and appropriate for survey at the school level. These tools include step-wise assessment methods such as 'availability', 'accessibility', 'functional', 'advance' 'basic' 'essential', 'improved' criteria of WASH facilities. All these criteria are well defined in guidelines and these are mentioned in respective result tables. Baseline data was collected in three months in ODK tool. Intervention was planned for nine months and the endpoint data was collected within three months after intervention.

Study duration: Research present in this draft is one the component of main research work i.e. WASH intervention at schools and students' level. Study duration was extended more than three years. However, the present research component was divided in time frame as follows- Formulation of study proposal & Ethical Clearance – 6 months, Baseline data collection- 3 months, preparation of intervention package- 3 months, Training of teachers and implementation of intervention- 6 months, Endpoint data collection– 3 months, Data analysis and report writing- 3 months. We tried to collect the water samples for microbiological analysis for the baseline and endpoint comparison in the similar season to avoid the seasonal confounding factors.

Intervention: Intervention for the period of nine months which consists of-

Step 1: Preparation of a booklet/module in the local language. (3 months)

Step 2: Providing booklet for promoting safe drinking WASH practices along with hands-on training of residential teachers and staff. This training was regarding storage practices and chlorination method of drinking water. (6 months)

Step 3: Chloroscope use: Chloroscope apparatus is to

conduct Ortho-toluidine test (OT) which is to be done out after chlorination to measure the free and residual chlorine. This apparatus is provided in schools. Teachers are oriented for utilization of instrument. (Duration is included in step 2)

Booklet for WASH practices at school level: *It consists of*

a] **Safe Drinking Water Practices**:

- Importance of safe WASH practices
- Water collection, purification, storage practices
- Water purification at large and small scale:
  - Physical methods: Boiling, Ozonation, U-V radiation, SODIS
  - Chemical methods: by using 1) chlorine - such as bleaching powder, high test hypochlorite, chlorine tablets, chlorine solutions; 2) Iodine and 3)Potassium permanganate
  - Mechanical Methods: Filtration- This consists of using the ceramic filters, such as -Pasteur-Chamberland fitter, Berkefeld filter, Katadyn filter, carbon and pad filter, acqua-guard and reverse osmosis treatment.
- Details of Hands-on training to School WASH Committee about water purification methods
- Acceptability parameters of safe drinking water: Physical, Chemical and Bacteriological parameters

b] Sanitation Practices:

- Importance of Sanitation at School level
- Promoting use of sanitary latrines and urinals
- Indicators for availability, functionality and maintenance of toilets in school - toilets designed for younger children and accessible to children with physical disabilities. Toilet and urinals facility must be separate for boys and girls in school and residential premises.

c] Hygiene Practices

- Availability of hand washing facility
- Functional indicators for hand-washing facility-availability of taps and soap at washing station

The booklet contains all these information in detail with various pictures.

Booklets also consist of some online video links which shows importance and demonstration safe WASH practices. These videos are publically available on You Tube platform; however, ashram school teachers were unaware of this video, hence we oriented them about this facility.

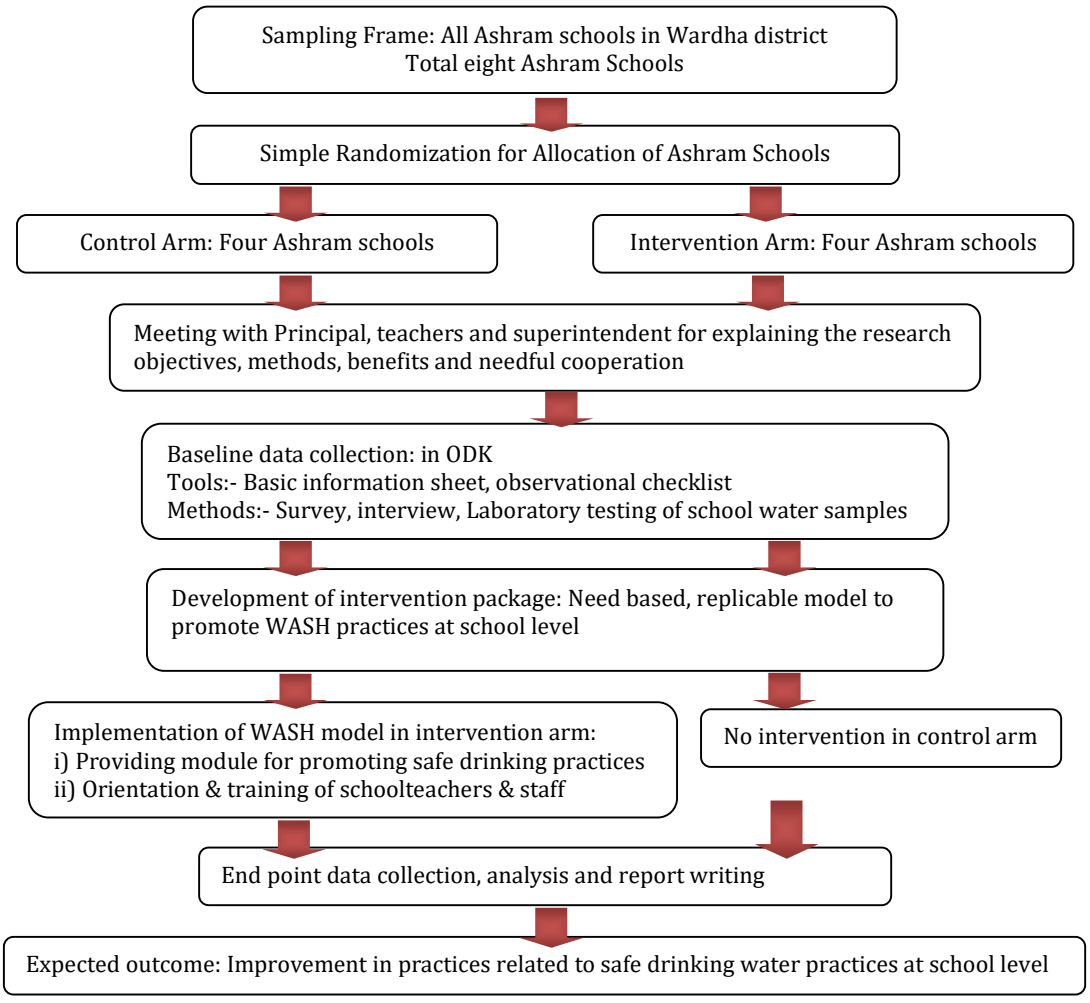

Figure 1: Conceptual framework for Intervention Design or package

***Training Session*:** During the period of six months project team visited the four intervention ashram schools as per the availability of teachers and school remain open. School WASH Committee which included teachers and other staff were trained by project team about water purification methods. One day hands on training was conducted in intervention group in respective school premises. School staff were oriented about safe WASH practices. Training consists demonstration of -

- Measuring the volume of water
- Chlorination method by using bleaching powder, chlorine drops, chlorine tablets, etc.
  [Disinfection materials were purchased by the schools and kept in the school for further periodic use]
- Test for chlorination (Orthotoluidine test - water testing for free and residual chlorine).
- Finding TDS and PH value of water

Drinking water samples from all studied schools were collected before and after intervention. Water samples were tested at the microbiology laboratory of the tertiary care institute in Wardha district to avoid the observer bias or reporting bias from school staff, and applied the blinding technique

Data Analysis: Information collected from schools at baseline and endpoint survey was analyzed by comparing to given standard scores in the WinS monitoring package by UNICEF. A multi-level service ladder for WinS is adopted to assess the achievement of ashram schools.

Ethical permission: It is obtained from the Institutional Ethics Committee.

RESULTS

Water Accessibility at school level: The main water source was functional in all Ashram schools and providing sufficient water as needed. All the surveyed Ashram schools had an acceptable alternative water supply, in case main source of water was non-functional.

At the baseline assessment, half of the schools (50%), two schools from the intervention and control group each were using chlorination to make water safe for drinking. The chlorination method was adopted by all four schools of the intervention group at the end point. Other schools in the control group which were not practicing the chlorination method were making water safe by filtration i.e. straining through cloth.

In interaction with the school team, various reasons were expressed by the school members for not treating the drinking water on regularly. The most common reason by seven (87.5%) schools was, that water is considered safe for drinking purposes for both types of sources; piped water or bore well. As per staff in half of the surveyed schools, they didn't have filters or sufficient purification chemicals in school because of lack of funds. It was also found that in some schools (50%), staff were unaware of the various water purification methods and the importance of water purification practices.

Intervention schools are labeled from I, II, III and IV and control schools are labeled as V, VI, VII, and VIII as shown in Table 1. A total of 16 water samples, two from each school were collected from sources meant for drinking and cooking purposes. On the baseline survey, four water samples (4 out of 8) from two beneficiaries and five water samples (5 out of 8) from three control schools reported positive for microorganisms. At the endpoint, all water samples collected from beneficiary schools were free from any micro-organisms, whereas water samples from all control schools were contaminated with microorganisms. Free chlorine was observed from 1.0-1.2 mg/l in three schools' water sample (two from the intervention group and one from control group).

Table 1: Microbiological test result of water sample collected from Ashram school

Ashram School	Water Sample Source	Baseline			Endpoint		
		Microbiological Test Result	Suspected Micro-organism	Free Chlorine	Microbiological Test Result	Suspected Micro-organism	Free Chlorine
I	Drinking	Negative	NA	1	Negative	NA	0.8
	Cooking	Negative	NA	1. 1	Negative	NA	0.7
II	Drinking	Negative	NA	0	Negative	NA	0.5
	Cooking	Negative	NA	0	Negative	NA	0.4
III	Drinking	Positive	E. Coli	0	Negative	NA	0.3
	Cooking	Positive	E. Coli	0	Negative	NA	0.3
IV	Drinking	Positive	Salmonella	1	Negative	NA	0.8
	Cooking	Positive	Salmonella	1. 2	Negative	NA	0.6
V	Drinking	Positive	Pseudomonas	1	Positive	Pseudomonas	1.5
	Cooking	Negative	NA	1. 1	Positive	Pseudomonas	0.5
VI	Drinking	Negative	NA	0	Positive	Salmonella	0
	Cooking	Negative	NA	0	Negative	NA	0
VII	Drinking	Positive	Pseudomonas	0	Positive	Pseudomonas	0
	Cooking	Positive	Shigella	0	Positive	Shigella	0
VIII	Drinking	Positive	E. Coli	0	Positive	E. Coli	0.2
	Cooking	Positive	E. Coli	0	Negative	NA	0.3

In other five schools water samples free chlorine was absent. However, at the endpoint survey all beneficiary schools (four) and two control schools had adopted chlorination practices. Range of free chlorine was observed in these schools was 0.2-1.5 mg/l (Table 1).

Sanitation Facility available and accessible at school level: Toilets were constructed in all eight residential schools. Commonly, the type of toilets were pit latrines with slab in 75% of schools.

On baseline assessment of toilet facilities in schools, it was observed that all schools (eight) had separate toilet facilities for girls and boys in school and residential premises. Only 50% of the schools had girl's toilet compartments lockable form inside. No schools had toilets for the disabled or designed for young children. Urinals were present in only 25% schools. Expected maximum score for better toilet facilities in the school is '8'; but studied schools had attained up to 3 or 4 score at the baseline assessment.

After intervention module has been implemented, three schools (75%) of the beneficiary group had attained the score up to '6' (75%) and one school had attained score up to '5' (68%) for the provision of better toilet facilities. However, only a single school in the control group had attained score up to '5' and the rest of the schools had attained score '3' or '4'(table 2).

Table 2: Availability of toilet facility as per requirement of WinS program of UNICEF

Availability of toilet facility [Score]	Ashram schools and Score															
	Intervention Group								Control Group							
	I		II		III		IV		V		VI		VII		VIII	
	B	E	B	E	B	E	B	E	B	E	B	E	B	E	B	E
Girls' toilet facilities separate from boys' toilet facilities [Yes-2, Partially-1, No-0]	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Are girls' individual toilet compartments lockable from inside? [All-3, some-2, Very few-1, none-0]	1	3	1	3	2	3	1	3	2	2	1	1	1	2	2	1
Toilets accessible to children with disabilities [Yes-1, No-0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Some toilets available in school designed for younger children. [Yes-1, No- 0]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Does school also have urinals? [Yes-1, No-0]	0	1	1	1	0	0	0	1	0	0	1	1	0	1	0	0
Max score-8	**3**	**6**	**4**	**6**	**4**	**5**	**3**	**6**	**4**	**4**	**4**	**4**	**3**	**5**	**4**	**3**

[Note: B- Baseline data, E- Endpoint data]

Table 3: Distribution of Functional toilet compartments in studied Ashram schools

Distribution of toilet compartments	Ashram schools [Score: Functional*- 2, Partially Functional †: 1, Not Functional‡: 0]															
	Intervention Group								Control Group							
	I		II		III		IV		V		VI		VII		VIII	
	B	E	B	E	B	E	B	E	B	E	B	E	B	E	B	E
Exclusively for girls	1	2	1	2	1	2	1	2	1	1	1	2	1	2	1	1
Exclusively for boys	1	2	1	2	1	2	1	2	1	1	1	1	1	2	1	1
Exclusively for female teachers and female staff*	2	2	1	1	1	2	1	2	2	2	1	1	1	1	2	2
Exclusively for male teachers and male staff*	1	2	1	1	1	2	1	1	2	2	2	2	1	1	1	1
For male or female teachers (communal)	1	1	1	2	2	2	1	1	1	1	1	1	1	1	2	2
Toilets that are for the use of anyone in the school (students or teachers, male or female)	0	0	1	1	0	0	1	1	0	0	1	1	1	1	0	0
Total Score (12)	**6**	**9**	**6**	**9**	**6**	**10**	**6**	**9**	**7**	**7**	**7**	**8**	**6**	**8**	**7**	**7**

Note[5]-* **Functional**: The toilet facilities are not physically broken and can be used.
† **Partially Functional**: The toilets can be used, but there are at least some problems with the physical infrastructure (e.g. some deterioration in concrete, doors/locks coming loose, roof deteriorating, etc.) and some repair is necessary.
‡ **Not Functional**: The toilets exist, but are so badly damaged or deteriorated it is no longer reasonably possible to use them (e.g. squatting plate broken, door missing, roof has holes, etc.)]

Table 4: Maintenance of toilets before and after intervention

Maintenance of toilets		No. of Ashram school and Score baseline (B) & endpoint (E) **Score- Cleanliness:** Clean-2, Somewhat clean-1, Not Clean-0 **Smell:** Dirty smell- No -2, Somewhat-1, Yes -0															
		Intervention Group								Control Group							
		I		II		III		IV		V		VI		VII		VIII	
		B	E	B	E	B	E	B	E	B	E	B	E	B	E	B	E
Student's Toilets	**Cleanliness**	1	2	1	2	0	2	1	1	1	0	0	1	0	1	1	1
	Smell	0	1	1	1	1	1	1	2	1	1	1	1	1	0	1	1
Teacher's Toilets	**Cleanliness**	2	2	2	2	1	2	2	2	1	1	1	1	1	1	1	1
	Smell	0	2	0	1	1	1	0	2	1	1	1	1	1	1	0	1
Total score	**8**	**3**	**7**	**4**	**6**	**3**	**6**	**4**	**7**	**4**	**3**	**3**	**4**	**3**	**3**	**3**	**4**

Table 5: Arrangement of functional indicators in student toilets on the day of survey

Functional indicators in toilets	Ashram Schools and Score															
	Intervention Group								Control Group							
	I		II		III		IV		V		VI		VII		VIII	
	B	E	B	E	B	E	B	E	B	E	B	E	B	E	B	E
Water supply as a cleaning material [Score: Tap water-2, bucket & mug-1, None-0]	1	1	0	1	1	1	2	2	1	1	1	1	1	1	0	1
Sufficient cleaning material available [Score: Always-4, Mostly time- 3, Sometimes-2, rarely-1, Never-0]	1	3	1	3	1	3	2	4	1	1	1	1	1	1	2	1
Functional lighting in student toilets on the day of survey [Score: All-3, some-2, Very few-1, none-0]	0	2	0	2	0	2	1	2	0	1	0	1	1	1	1	1
Total score – 9	**2**	**6**	**1**	**6**	**2**	**6**	**5**	**8**	**2**	**3**	**2**	**3**	**3**	**3**	**3**	**3**

Table 6: Arrangement of functional indicators for hygiene in Ashram schools

Functional indicators for hand-washing (HW)	Ashram Schools and Score															
	Intervention Group								Control Group							
	I		II		III		IV		V		VI		VII		VIII	
	B	E	B	E	B	E	B	E	B	E	B	E	B	E	B	E
Does school have HW facilities- Running water from a piped system/ tank? [Score: Yes-1, No-0]	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
At the time of the visit, was water available at HW facilities? [Score: Yes-1, No-0]	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
At the time of visit, was soap (or ash) available at HW facilities? [Score: Yes-1, No-0]	0	1	0	1	0	1	0	0	0	0	0	0	0	1	0	0
Total score – 3	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**3**	**2**	**2**

Ashram schools were assessed for the functional toilet criterion in terms of 'functional', 'partially functional' or 'non-functional'. Toilets are made 'exclusively for girls', 'exclusively for boys', 'exclusively for female teachers and female staff', 'exclusively for male teachers and male staff' or 'communal' were reviewed for its functionality.

All beneficiary schools achieved 50% score for the functional level of toilet compartments before intervention which was improved more than 75% at the endpoint assessment. Whereas all comparison schools achieved 60% score for the functional level of toilet compartments which was improved up to 65% when information was gathered at the endpoint of the project (table 3).

Maintenance of toilets was assessed by scoring in terms of cleanliness and bad odor in both student's and teacher's toilets. During the baseline survey, mean score for maintenance of toilets, was 3.5 for intervention group and 3 for control group out of maximum score-8. While endpoint assessment, toilet maintenance score was improved in schools of the intervention arm which was reached up to mean 6.5 whereas for control schools it was 3.5 (table 4).

Functional indicators in toilets were studied in terms of water supply as a cleaning material, sufficient cleaning material available and lighting on the day of the survey with the range of scores. Maximum score for altogether these indicators is '9'. At the baseline survey, schools in both arms remarked as mean score 2.5. After intervention, schools were reviewed for functional indicators in toilets and mean score among schools in intervention and control arm was observed to be improved up to 6.5 and 3 respectively (table 5).

Hygiene facilities available and accessible at school level

At the time of visit, hand washing facilities were available in all studied Ashram schools in the form of running water from water tap or tank; whereas soap or other hand washing material was not available in any of the schools before intervention. At the endpoint survey, soap was observed only in three schools (75%) out of four beneficiary schools and in single (25%) comparative schools (table 6).

DISCUSSION

Studies were conducted in public and private schools, rural and urban settings; however, ashram or residential schools meant for the adiwasi communities or low socio-economic strata remained apart from the interventions planning, assessment and evaluation. Such schools very rarely get attention for promotional activities. The present research work tried to cover the underprivileged sector to bring into focus future implications.

Water provision: In present study, all surveyed Ashram schools were observed in the rank of providing basic service for drinking water as these schools had improved source of water. So, first step was the making the drinking water available for 24 hours in schools and residential campuses which was achieved in present study setting. Next important is whether available water is safe to drink or not. Recently, 139 schools of Kathua, J&K surveyed (2019) for WASH practices by using similar questionnaire developed by WHO and UNICEF for Monitoring WASH in Schools in SDGs, where piped water supply with an improved drinking water source was noted

in 88% of schools.[20]

In current studied schools, water was considered safe for drinking purposes by the school staff. This school staff had ignored the chances of water getting contaminated while reaching to the consumer point. Half (50%) of the schools were following chlorination as a purification method but intermittently. Most of the schools didn't satisfy this criterion for safe drinking water. Their water sample recorded free residual chlorine very much less than 0.5 mg/l. In studied schools, disinfection methods for drinking water were applied very intermittently. All four beneficiary schools adopted chlorination process but only two schools had satisfied proper way of chlorination and no control school fulfil this criterion.

In Vijayapur, cross sectional survey (2016) conducted in rural area schools (n=7) revealed that 71% schools had piped water supply, though frequency of water supply was once in a 5 to 7 days but water was sufficient for the usage reported by teachers.[21] Schools of Kolam district (Kerala) surveyed and about 56% of the schools (n=75) were practicing the boiling or chlorination of water or small filters as a purification method and providing safe drinking water facility.[13]

In the Sindh province of Pakistan, 425 primary schools were surveyed for exposure of implementation of WASH related activities and National WASH Policy. This survey revealed that sufficient and improved water sources were observed in 81% schools. Purification methods were followed as filtration, boiling, and chlorination in 19%, 8% and 2.2% schools respectively, whereas 69% schools didn't adopt any single method of water purification. Provided drinking water was unsafe as TDS and total coliforms, were outside the permissible limit in 33.8%, and 80.7% schools respectively. WASH services such as basic drinking water, sanitation and hygiene services were available in 58%, 19.3% and 13.6% schools respectively.[22]

In present study settings, at the baseline assessment, 50% of the water samples in studied schools were recorded positive for micro-organisms. There may be source of contamination after disinfection, however schools were insincere in regards to drinking water purification practices. After intervention, all (100%) water samples from beneficiary schools were free from microbiological contamination.

In Kollam district (Kerala), 70 drinking water samples from 62 schools were surveyed for microbiological contamination and only two water samples showed heavy growth of E. coli. Well water was the source of drinking water in most of the schools, these wells were protected but chlorination practices were done in 30% schools only.[14] Provision of safe drinking water in schools reduces diarrheal diseases, absenteeism and improve the students' performance in schools.[19,20,23,24] There is the need for innovative intervention for the consistent provision of safe drinking water in ashram schools.

Sanitation at School: In present study setting, all studied schools had separate toilets for boys and girls. Score for maintenance of toilets such as cleanliness and smell has been improved in beneficiary schools (from 3.5 to 6.5) at the endpoint assessment than control schools (from 3 to 3.5). Also, score for functional indicators of toilets such as availability of cleaning material and lighting in toilets was assessed, which has been improved from 2.5 to 6.5 in beneficiary schools compared to control school where score remains same.

Similar findings, that is separate and adequate toilets for boys and girls reported in various studies across the country.[13,16] Conversely, in north Dumdum municipality of West Bengal, survey was pointed out that schools had inadequate number of toilets, there were no separate toilets for girls, boys and teachers.[25] In Vijaypur, (2016) separate toilet facilities for teachers were observed in only 14.3% of the schools.[21]

Across the country, common observation similar to present study, recorded that there were no schools which had toilets accessible to children with disabilities or any toilet in the school designed for younger children.[21,25] If the girl's toilet compartment would be lockable from inside then only girls would not hesitate for its utilization. Secured door facility for toilet compartments was improved in all schools of intervention arm at the endpoint assessment. Urban and rural variation for toilet facility was noted in a district of Karnataka, that all studied schools in urban areas had facility of lockable toilets whereas 80% schools had this facility and 5% schools had no roof on toilets in rural area.[16] In Pakistan, after the implementation of WASH policy and related interventions in 425 primary schools, improved sanitation facilities were viewed in 68.9% and only 32.5% schools maintained toilet facilities but culturally appropriate anal cleansing materials in all students' toilets were available in 17.4% schools only.[22]

Improvement in usable toilets after safe WASH intervention was observed in Philippines schools. Here, Sanitation Assessment Tool was utilized in schools for RCT and usable toilets were 32% higher in experimental than control schools. One of the reasons for this was an increase in cleanliness of toilets by 27% in beneficiary compared to those in control schools.[18] The proportion of schools with usable toilets was 40% in Kathua, J&K.[20]

Financial constraints are the constant barrier for LMICs in progress towards health and social sectors. Behavior change can be said if the practice once adopted remains sustained for a significant period of time. If obstacles occur, the process of behavior change gets hampered. Studies revealed that funding for maintenance and cleanliness is the prerequisite for sustaining the adopted WASH practices.[4,26] Packaged services adopted for operation and maintenance obtained to be resulted in increasing toilet utilization.[18]

Hygiene Facilities: Making hand washing facilities available is a common finding of most of the survey; however, presence of soap at the hand washing station was very rare. Survey in Kathua of J&K found, 57% rural schools had hand-washing facilities however soap and water were available in only 16% schools, water only in 22%, soap only in 7% and neither water nor soap in 11% schools at the time of visit.[20] A cross survey done in Vijaypur (2016), reported that 42.8% schools had soap which was always available at the site during the visit and all 100% schools had hand washing facilities.[21] In Pakistan, a survey for implementation of WASH program and policy observed that hand washing facilities in sufficient number were available in 23.5% schools (n=425).[22]

In the present study, hand washing facilities in the form of wash basin with tap water were available in all surveyed schools. However, soap or similar material was not available in any of the school at the baseline assessment. At the endpoint assessment, 75% schools in the intervention group were able to keep soap at the hand washing station and not in a single control school.

Many challenges came forward regarding availability of soap such as lack of funds, lack of motivation from teachers, blurred role and responsibilities of school staff, and stringent cultural attitude of disadvantaged community.[2,16,27,28] Impact on pupils' risk for hands contamination with E coli was examined by Leslie E. Greene, et al in public primary schools in four districts of Nyanza Province, Kenya through cluster RCT. This suggested that only the provision of infrastructure (sanitary latrines) is not sufficient, improvement in hand hygiene behavior among children is prerequisite to avoid diarrheal diseases. Contamination can be increased by using sanitary latrines without concurrently adopting hand hygiene practices after using them.[27]

Involvement of students playing role in maintaining cleanliness but to widen range of safe WASH practices teacher-led activities, considerable attention by principal & school administrators would be valuable, which is lacking in previous studies.[13,16,18,20]

Table 7: Achievement of surveyed schools for provision of drinking water facilities

Services for drinking water in schools*	Achievement by Schools in present study
Advanced service i) water is available when needed, ii) accessible to all, iii) free from fecal and iv) priority chemical contamination based on water quality testing (to be defined at national level)	**Beneficiary schools:** -Out of four criteria, achieved three criteria by all schools [improved up to 75%] **Control schools:** The first two criteria achieved by all schools.
Basic service Drinking water from an improved source is available at the school	- Cross this level by all surveyed schools
Limited service There is an improved source (piped water, protected well/ spring, rainwater, packaged or delivered water), but water not available at time of survey	-Cross this level by all surveyed schools
No service: No water source or unimproved source (unprotected well/spring, surface water source)	- Cross this level by all surveyed schools

*Source: UNICEF and World Health Organization, Core questions and indicators for monitoring WASH in Schools in the Sustainable Development Goals2016.

Table 8: Achievement of surveyed schools for provision of sanitation facilities

Services for sanitation facilities schools*	Achievement by Schools in present study
Advanced service May include: i) facilities are accessible to all, ii) sufficient quantity, iii) inspected for cleanliness & iv) appropriate facilities for menstrual hygiene management are provided (to be defined at national level)	**Beneficiary schools:** - -Two criteria achieved by all [improved up to 50%] -Third criterion achieved at some level. Max score=8, Score improved from 3.5 to 6.5. [improved up to 80%] **Control schools:** - -First two criteria achieved by all - Third criterion- score improved from 3 to 3.5 [fourth criterion is out of scope of the study]
Basic service Improved facilities, which are single-sex and usable at the school	**Beneficiary schools**: -Mostly achieved, score improved from 32% to 81%. **Control schools:** Not achieved, schools score remains near about same at baseline & endpoint (35%, 37%)
Limited service: There are improved facilities (flush/ pour flush, pit latrine with slab), but not sex-separated or not usable	-Cross this level by all surveyed schools
No service- No toilets or latrines, or unimproved facilities (pit latrines without a slab or platform, hanging latrines, bucket latrines)	-Cross this level by all surveyed schools

Table 9: Achievement of surveyed schools for provision of hygiene facilities

Services for hygiene facilities in schools*	Achievement by Schools in present study
Advanced service May include: i) hand washing facilities available at critical times, ii) accessible to all, iii) menstrual hygiene education and products provided (to be defined at national level)	Only second criterion achieved by all beneficiary and control schools [third criterion is out of scope of the study]
Basic service Hand washing facilities, which have water and soap available	**Beneficiary schools**: - Achieved by 75% schools **Control schools:** Achieved by 25% schools
Limited service: Hand washing facilities with water, but no soap	**Beneficiary schools**: 25% at this level. **Control schools:** 75% at this level.
No service: No hand washing facilities at the school or hand washing facilities with no water	- Cross this level by all surveyed schools

Shortage of teachers trained for safe water, sanitation and hygiene education was prominent in Indian rural setting.[16] This study attempted to involve teachers to make drinking water safe by using correct chlorination method.

Multi-level service ladders are given in manual for Monitoring Wins at different stages of development, as shown in tables 7, 8 and 9.[5] In this research work, the ladder is adopted to assess the achievement of ashram schools.

A review suggested that resources, information and accountability are necessary to implement sustainable WASH services but most countries fail to fulfill these requirements combine at optimal level.[29] Insufficient component of any of these hampers' sustainable delivery of WASH in schools. Barriers also identified during cross survey or RCT for adherence to WASH practices in schools such as poor monitoring by teachers[30], less priority was given to safe WASH by school staff and administration[28,31,32], lack of clarity about safe WASH in school environment. Recently, Irene Tudagbe, et al (2022) explored the main reason for the breakdown in continuity of WASH facilities that the failure of school administration and hence not available consistently for utilization by the students. The participatory role of community stakeholders is explained in maintenance of WASH in school. The study recommended that school administration should be strengthened to make rules and regulations to maintain the WASH services in school and share these guidelines with students as they the beneficiary of these facilities.[33]

In the present study, the intervention was low cost with local involvement which was observed to be effective in improving the WASH facilities at the school level. Principal and school administration should monitor the teachers' activities. Such intervention can be adopted in policy at the school level by education department of district level.

Strength

Strengths of the study were reached to unreached population in remote settings, underprivileged/ socially disadvantaged sector; the assessment tool was adopted from WHO standards for WinS Low-cost Settings & Monitoring Package by WHO-UNICEF JMP for WinS which is adaptable in developing countries and; capacity building of teachers was achieved through hands-on training which was found to be effective in maintaining the WASH facilities.

Limitations

This research work covered single district and residential schools only, hence its applicability to non-residential schools is limited.

Conclusion

Present study intervention was based on local involvement and community engagement. Study results found that there was significant improvement in WASH practices at the school level. Provision and availability of improved drinking water sources were reported in all beneficiary and control schools at the baseline. However, at the end-point assessment, there was substantial increase in score for water purification methods; sanitation facilities in terms of availability, accessibility, maintenance and functional indicators; availability of hygiene facilities with provision of soap in beneficiary schools as compared to control schools where limited services for hygiene facilities were noted. Although few challenge were reported for consistent availability of soap at wash basins in all the studied schools.

Many programs and policies are running in India for safe WASH in schools, however schools meant for Aadiwasi children get ignored from supervision and monitoring of program implementation. Provision of a safe WASH environment and facilities is the first step which is achieved to some extent, however quantitative achievement such as building infrastructure, number of tanks, taps, sinks or toilets in schools is not the target of any program. Whereas for the continuity of facility utilization, its maintenance at optimum standards is the key task which is found to be very challenging on various program evaluation. It is easy to provide funds for infrastructure but regular funding for maintenance of WASH facilities is

the responsibility of higher stakeholders. Monitoring and supervision plans should be developed at school and district level.

Local engagement plays a vital role in developing the culture of the tribal community. Overall, this WASH model was found to be advantageous in promoting school environment for safe water, sanitation and hygiene facilities at satisfactory level in beneficiary schools.

Recommendations

Teachers and staff in the schools should be oriented and trained for safe WASH practices and its implementation at school level. Training sessions for teachers can be planned at school level by the education sector in collaboration with the district health authority. If it is not feasible to reach the trainers at the peripheral level, then training can also be conducted at district level.

Such research and implementation model can be explored to other schools in urban, rural and remote settings.

Ceramic candle filters can also be used in schools for filtration, if advanced filters such as RO or UV filters couldn't afford.

Author Contribution: SD and AG conceptualized the WASH intervention model; AG designed the study, and SD framed objectives and methods. All contributed intellectually. SD prepared the manuscript, with data collection, analysis, and editing shared among AG, and SC.

Acknowledgement: We express our gratitude towards all the Head of the Ashram Schools, teachers & staff of Wardha district for their constant support, hearty involvement and coordination throughout the work.

References

1. Jasper C, Le TT, Bartram J. Water and sanitation in schools: a systematic review of the health and educational outcomes. Int J Environ Res Public Health. 2012 Aug; 9(8): 2772-87. DOI: https://doi.org/10.3390/ijerph9082772 PMid:23066396
2. Pandey DK, Pandey M, Dwivedi RK, Shrivastava AK. Impact assessment of WASH (water, sanitation and hygiene) interventions in schools. Indian Journal of Science and Technology 2020; 13(32): 3315-3318. DOI: https://doi.org/10.17485/IJST/v13i32.462
3. Tidwell JB, Gopalakrishnan A, Unni A, Sheth E, Daryanani A, Singh S, et al. Impact of a teacher-led school handwashing program on children's handwashing with soap at school and home in Bihar, India. PLoS ONE, 2020; 15(2): e0229655. DOI: https://doi.org/10.1371/journal.pone.0229655 PMid:32106240 PMCid:PMC7046199
4. Akudo I. Ejelonu, Huiran Feng, Thomas P. McKeon. Evaluating Water, Sanitation and Hygiene Interventions in Rural Schools of West Bengal, India. wH2O: The Journal of Gender and Water 2020; 7(1):17-25.
5. UNICEF and World Health Organization. Core questions and indicators for monitoring WASH in Schools in the Sustainable Development Goals. WHO Library Cataloguing-in-Publication Data, version June 2018. Available from: https://washdata.org/reports/jmp-2018-core-questions-and-indicators-wash-in-schools Accessed on April 11, 2025.
6. Eighth All India Education Survey Report, Educational Survey Division, National Council of Educational Research and Training, 2016. Available from: https://ncert.nic.in/pdf/ programmes/AISES/8th_AISES_Concise_Report.pdf Accessed on April 11, 2025.
7. Pu CJRui, Patel P, Hornsby G, Darmstadt GL, Davis J. Necessary conditions for sustainable water and sanitation service delivery in schools: A systematic review. PLoS ONE, 2022; 17(7): e0270847. DOI: https://doi.org/10.1371/journal.pone.0270847 PMid:35857721 PMCid:PMC9299385
8. Ramesh A, Blanchet K, Ensink JH, Roberts B. Evidence on the Effectiveness of Water, Sanitation, and Hygiene (WASH) Interventions on Health Outcomes in Humanitarian Crises: A Systematic Review. PLoS One. 2015 Sep 23; 10(9):e0124688. DOI: https://doi.org/10.1371/journal.pone.0124688
9. India@70: India's First Nationwide Sanitation Programme In 1986 Focused on Improving Rural Sanitation. NDTV, BANEGA SWASTH INDIA. Available from: https://swachhindia.ndtv.com/india70-indias-first-nationwide-sanitation-programme-in-1986-focused-on-improving-rural-sanitation-10640/
10. Mariëlle Snel, Sumita Ganguly and Kathleen Shordt. School Sanitation and Hygiene Education - India, Resource Book. UNICEF and IRC International Water and Sanitation Centre 2002 https://www.susana.org/_resources/documents/default/2-423-snel-et-al-2002-sshe-resource-book-irc-en.pdf
11. WaterAid. An assessment of School WASH infrastructure and hygiene behaviours in nine states. Status of School WASH two years after the Swachh Vidyalaya Abhiyan. WaterAid India, 2016. Available from: https://www.wateraid.org/in/sites/g/files/jkxoof336/files/an-assessment-of-school-wash-infrastructure-and-hygiene-behaviours-in-nine-states.pdf Accessed on April 11, 2025.
12. WHO Library. Water, Sanitation and Hygiene Standards for Schools in Low-cost Settings. Edited by John Adams, Jamie Bartram, Yves Chartier, Jackie Sims, WHO 2009. Available from: https://iris.who.int/bitstream/handle/10665/44159/9789241547796_eng.pdf
13. Rakesh P, Usha S, Subhagan S, Shaji M, Sheeja A, Subair F. Water Quality and Sanitation at Schools: A Cross Sectional Study from Kollam District, Kerala, Southern India. KMJ, 2014; 7(3): 62-5. [cited 4Mar.2023] Available from: https://www.keralamedicaljournal.com/index.php/KMJ/article/view/329
14. Gawai PP, Taware SA, Chatterjee AS, Thakur HP. A cross sectional descriptive study of hand washing knowledge and practices among primary school children in Mumbai, Maharashtra, India. Int J Community Med Public Health, 2016; 3(10): 2958-66. DOI: https://doi.org/10.18203/2394-6040.ijcmph20163391
15. Gomathi S, Samitha PC, Kanaka Nishanth B, Praveen Kumar N, Sireesha K. A study to assess the knowledge and practices regarding WASH among school children in selected school, Mangalagiri, Guntur district, Andhra Pradesh. Int J Community Med Public Health, 2018 Dec. 24 6(1): 253-7. DOI: https://doi.org/10.18203/2394-6040.ijcmph20185252
16. Malingu, Pallavi Sarji Uthkarsh, Gangaboraiah. Water, Sanitation and Hygiene Status in the Schools of a District in Karnataka. IJPHRD, 2022 Jun. 24 13(3): 151-5.. DOI: https://doi.org/10.37506/ijphrd.v13i3.18188
17. Singh Chouhan, N., Oledzka Nielsen, M., Singh, P., Manchikanti, S., Pandey, V., Walters, J.P., et al. A systems approach to improving access to water, sanitation, and hygiene (WASH) in schools in Odisha, India. H2Open Journal, 2022; 5(3): 395-411. DOI: https://doi.org/10.2166/h2oj.2022.044

18. Duijster, D.; Monse, B.; Marquez, M.; Pakes, U.; Stauf, N.; Benzian, H. Improving Toilet Usability and Cleanliness in Public Schools in the Philippines Using a Packaged Operation and Maintenance Intervention. Int. J. Environ. Res. Public Health, 2022; 19: 10059. DOI: https://doi.org/10.3390/ijerph191610059 PMid:36011699 PMCid:PMC9407854

19. McMichael C. Water, Sanitation and Hygiene (WASH) in Schools in Low-Income Countries: A Review of Evidence of Impact. Int J Environ Res Public Health, 2019 Jan 28; 16(3): 359. DOI: https://doi.org/10.3390/ijerph16030359

20. Sangra S, Razdan N, Choudhary N. Assessment of indicators on drinking Water, sanitation and hygiene (WASH) practices from rural schools of Kathua. J Family Med Prim Care, 2022; 11: 4619-23. DOI: https://doi.org/10.4103/jfmpc.jfmpc_1110_21 PMid:36352981 PMCid:PMC9638568

21. Rashmi Hullalli, M. R. Gudadinni, Shailaja S. Patil. Water sanitation and hygiene in the schools of rural field practice area of Shri B. M. Patil Medical College, Vijayapur. Int J Community Med Public Health, 2017 Nov; 4(11): 4307-09. DOI: https://doi.org/10.18203/2394-6040.ijcmph20174849

22. Ahmed J, Wong LP, Chua YP, Hydrie MZI, Channa N. Drinking water, sanitation, and hygiene (WASH) situation in primary schools of Pakistan: the impact of WASH-related interventions and policy on children school performance. Environ Sci Pollut Res Int, 2022 Jan; 29(1): 1259-1277. DOI: https://doi.org/10.1007/s11356-021-15681-w PMid:34355319

23. Victoria Trinies, Joshua V. Garn, Howard H. Chang, and Matthew C. Freeman. 'The Impact of a School-Based Water, Sanitation, and Hygiene Program on Absenteeism, Diarrhea, and Respiratory Infection: A Matched-Control Trial in Mali.' Am. J. Trop. Med. Hyg., 2016; 94(6): 1418-1425. DOI: https://doi.org/10.4269/ajtmh.15-0757 PMid:27114292

24. Bieri FA, Gray DJ, Williams GM, Raso G, Li Y S, Yuan L, et al. Health education package to prevent worm infections in Chinese school children. N Engl J Med, 2013; 368: 1603-12. DOI: https://doi.org/10.1056/NEJMoa1204885 PMid:23614586

25. Lopamudra Ganguly and Lakshminarayan Satpati. Sanitation and hygiene status among school students: A micro study on some selective schools of North Dumdum municipality area, West Bengal, International Research Journal of Public and Environmental Health, 2019; 6(6): 127-131.

26. Appiah-Brempong, E., Harris, M.J., Newton, S. et al. Examining school-based hygiene facilities: a quantitative assessment in a Ghanaian municipality. BMC Public Health, 2018; 18: 581. DOI: https://doi.org/10.1186/s12889-018-5491-9

27. Leslie E. Greene, Matthew C. Freeman, Daniel Akoko, Shadi Saboori, Christine Moe, and Richard Rheingans. 'Impact of a School-Based Hygiene Promotion and Sanitation Intervention on Pupil Hand Contamination in Western Kenya: A Cluster Randomized Trial.' Am. J. Trop. Med. Hyg., 2012; 87(3): 385-93. DOI: https://doi.org/10.4269/ajtmh.2012.11-0633

28. Garn JV, Trinies V, Toubkiss J, Freeman MC. The Role of Adherence on the Impact of a School-Based Water, Sanitation, and Hygiene Intervention in Mali. Am J Trop Med Hyg. 2017 Apr; 96(4): 984-993. DOI: https://doi.org/10.4269/ajtmh.16-0558 PMid:28093534 PMCid:PMC5392652

29. Pu CJ Rui, Patel P, Hornsby G, Darmstadt GL, Davis J. Necessary conditions for sustainable water and sanitation service delivery in schools: A systematic review. PLoS ONE, 2022; 17(7): e0270847. DOI: https://doi.org/10.1371/journal.pone.0270847. PMid:35857721 PMCid:PMC9299385

30. Buxton H, Dimaisip-Nabuab J, Duijster D, Monse B, Benzian H, Dreibelbis R. The impact of an operation and management intervention on toilet usability in schools in the Philippines: A cluster randomized controlled trial. BMC Public Health, 2019; 19(1):1-11. DOI: https://doi.org/10.1186/s12889-018-6343-3 PMid:30606151 PMCid:PMC6318918

31. Alexander K, Zulaika G, Nyothach E, Oduor C, Mason L, Obor D, et al. Do water, sanitation and hygiene conditions in primary schools consistently support schoolgirls' menstrual needs? A longitudinal study in rural western Kenya. Int J Environ Res Public Health, 2018; 15(8):1682. DOI: https://doi.org/10.3390/ijerph15081682 PMid:30087298 PMCid:PMC6121484

32. Booysen MJ, Ripunda C, Visser M. Results from a water-saving maintenance campaign at Cape Town schools in the run-up to Day Zero. Sustain Cities Soc., 2019; 50:101639. DOI: https://doi.org/10.1016/j.scs.2019.101639

33. Tudagbe-Obour, I. Appraisal of Challenges and Community Promotion in WASH Facilities in Senior High Schools in Ghana. Universal Journal of Social Sciences and Humanities, 2022; 2(2): 93-105. DOI: https://doi.org/10.31586/ujssh.2022.344