

Evaluating Water, Sanitation and Hygiene Interventions in Rural Schools of West Bengal, India

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KEY WORDS

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GLOSSARY

INR = Indian rupees, the currency of India.

(Conversion is approximately INR 67 to 1 USD at the time of the study)

Lakh = 100,000 INR

NGO = Non-Governmental Organization

ABSTRACT

Poor sanitation exacerbates adverse health outcomes such as infectious disease, diarrhea and childhood stunting. People of India suffer from disproportionately high rates of poor sanitation. Diarrheal diseases are preventable and better sanitation can reduce disease transmission through improved access to latrines, hygiene education and clean water. A significant concentration of behaviors related to poor sanitation occurring in India requires sustainability and an assessment of programs working towards improving water access, sanitation and hygiene (WASH). We assessed the health and environmental impact of Non-Governmental Organizations (NGOs) such as Sarboday Sangha and Water for People which implemented WASH projects in about 141 schools in the East Medinipur district of West Bengal, India. In addition, we evaluated 18 of these schools for their sustainability by collecting cross-sectional observational data by surveying school headmasters and photographing between December 29th, 2016 and January 2nd, 2017. The survey was divided into five sections: (1) Health behavior/knowledge; (2) Social-school hygiene education; (3) Hardware resources; (4) Costs; and (5) Governance tracking. Interviews were aided by a translator. Data were analyzed using summary statistics and ranking sustainability. All 18 schools reported zero open defecation and improved school attendance largely due to latrines and female sanitary napkins. All but one of the schools reported a hygiene education program. Monthly WASH maintenance costs ranged from 800 INR to 5000 INR. Maintenance funding was reported as the largest need. The school WASH interventions improved sanitation knowledge and behavior, but more funding is needed for maintenance costs to sustain the interventions.

1 INTRODUCTION

Sanitation can deteriorate when a community has inadequate wastewater management and poor access to clean drinking water (Patil et al., 2014). From 2014 to 2019, the government of India led a nation-wide campaign called Swachh Bharat Abhiyan (SBA) that aimed to improve the sanitation

of public spaces. One of these sanitation objectives included eliminating open defecation through the implementation of household and community-owned toilets and latrines, with a goal of achieving “open-defecation free” by October 2019. At the start of the SBA campaign, the country suffered from particularly high rates of poor sanitation. In 2014, India’s population was approximately 1.25 billion people; 800 million living without adequate sanitation, 700 million who

practiced open defecation, and about 375,000 annual deaths from diarrheal diseases (Clasen et al., 2014). This is a huge proportion of not only India's population but also the global population. A third of the global population that regularly practiced open defecation and a quarter of those who die annually from diarrheal diseases lived in India during this time (Clasen et al., 2014). In 2019, the Indian Government's Department of Drinking Water & Sanitation claimed near success in the SBA campaign, reporting 704 out of the 732 districts as "open-defecation free" (Swachh Bharat Mission, 2019), coverage of toilets in rural India improved between 2014 and 2019 from 39% to over 95% of households (Curtis, 2019). Going forward, long-term functionality and sustained maintenance of latrines and other WASH interventions may pose a significant obstacle. Research outcomes from a 2004 total-sanitation campaign in Odisha, a rural state in India, found follow-ups are needed to maintain and rehabilitate latrines in villages that received a WASH intervention, and sustain long-term behavior change. Many unmaintained latrines eventually deteriorate and become abandoned in homes which received the latrine intervention. (Orgill-Meyer, 2019).

The World Economic Forum recognizes water as one of the most important global risks and the UN Sustainable Development Goals list WASH as one of its top priorities. Water-related problems cause thousands of children to die each day and women are the ones who bear the brunt of the burden to address these issues. Fetching water, ensuring clean sanitation facilities, and preventing the spread of water-related diseases are usually viewed as a woman's responsibility and it takes a considerable amount of time each day for women in developing countries to address these needs (Coussens, 2009). This, of course, takes women away from child-rearing, work that would generate income for the family, and education opportunities.

Several studies have made an association between open defecation and diarrheal disease. For example, 24 villages in Odisha, India were studied for fecal contamination of drinking water by both humans and animals. Ten percent of all sources of drinking water were contaminated by human fecal matter and 15 percent were contaminated by animal fecal matter (Schriewer, 2015). Not surprisingly, the widespread practice of open defecation is a major transmission pathway for human fecal contamination in the environment (Schriewer, 2015). In another case study, investigators conducted an epidemiological and field investigation of diarrheal diseases in rural southern India. The researchers identified a significant increase of *Shigella* spp, enteropathogenic *Escherichia coli* and Shiga-toxin producing *E. coli* ($P < 0.001$, $P < 0.02$, $P < 0.05$) in the examined stools of an age-stratified random sample of a village's population during a diarrheal epidemic (Kang, 2001). Drinking water wells in this part of India are commonly located in fields near sites of open defecation where potable water was used during the epidemic. The researchers in this study used epidemiological and laboratory investigations to infer that the high levels of enteric pathogens may be caused by runoff fecal contamination of well water

following a rain event. Proper WASH management, access to latrines and other toilet facilities may improve sanitation by reducing the spread of disease from open defecation.

In the school environment, successful WASH programs are particularly important because of the increased demand by the student body, faculty and staff for latrines, urinals and clean water. NGOs such as Sarbodaya Sangha, Water for People, Global Water Alliance, Drink for Tomorrow, Raha Family Foundation and the Deb Family Foundation implemented WASH projects in 141 schools in the East Medinipur district of West Bengal, India (Fig 1). These WASH projects implemented between 1998 and 2014, established hygiene education programs, student-led water committees, clean water access, hand washing stations, female sanitary napkin dispensers and latrines for rural schools (Fig 2). The objectives of these WASH projects was to increase school attendance, reduce disease, and improve hygienic behaviors.

Figure 1. Location of study area in West Bengal, India



2 STUDY OBJECTIVE

The purpose of our research study is to assess the sustainability of school WASH projects in rural West Bengal. We assessed 18 of these schools for their sustainability and provided evidence-based recommendations to assist in sustaining these WASH programs. Our team evaluation was guided by the following three criteria for WASH sustainability:

- Does the school maintain a student-teacher committee for WASH education and promotion?
- Does the school have sufficient financial support for continued maintenance of WASH?
- Does the school have sufficient WASH facilities to support all students?

3 METHODS

Cross-sectional observational data was collected through photography, videography and surveying headmasters in rural government schools in the Contai subdivision of the Purba Medinipur district, West Bengal, India between December 29, 2016 and January 2, 2017. Through convenience sampling, we were able to interview 18 of the 50 plus schools in the area that received WASH interventions from Sarboday Sangha and their international partners such as Water for People. Sarboday Sangha is a voluntary agency working in the areas of rural development, child education and women empowerment through advocacy, direct program interventions and capacity building of the community to access the benefits of State Programs. There were two research teams each evaluating nine schools. Each team had a driver, a representative from the NGO Sarboday Sangha, a Bengali-English translator and two researchers. Each research team visited

2-3 schools a day and spent approximately 45 minutes at each school. The visits included a tour of the school grounds and detailed observations of drinking water facilities, latrines and handwashing facilities (Fig. 3). Interviews were conducted with the headmaster and associated staff. The interview process was guided by a survey and help from the translator. Most headmasters spoke English conversationally, however, nuances and specific details were clarified by the translator.

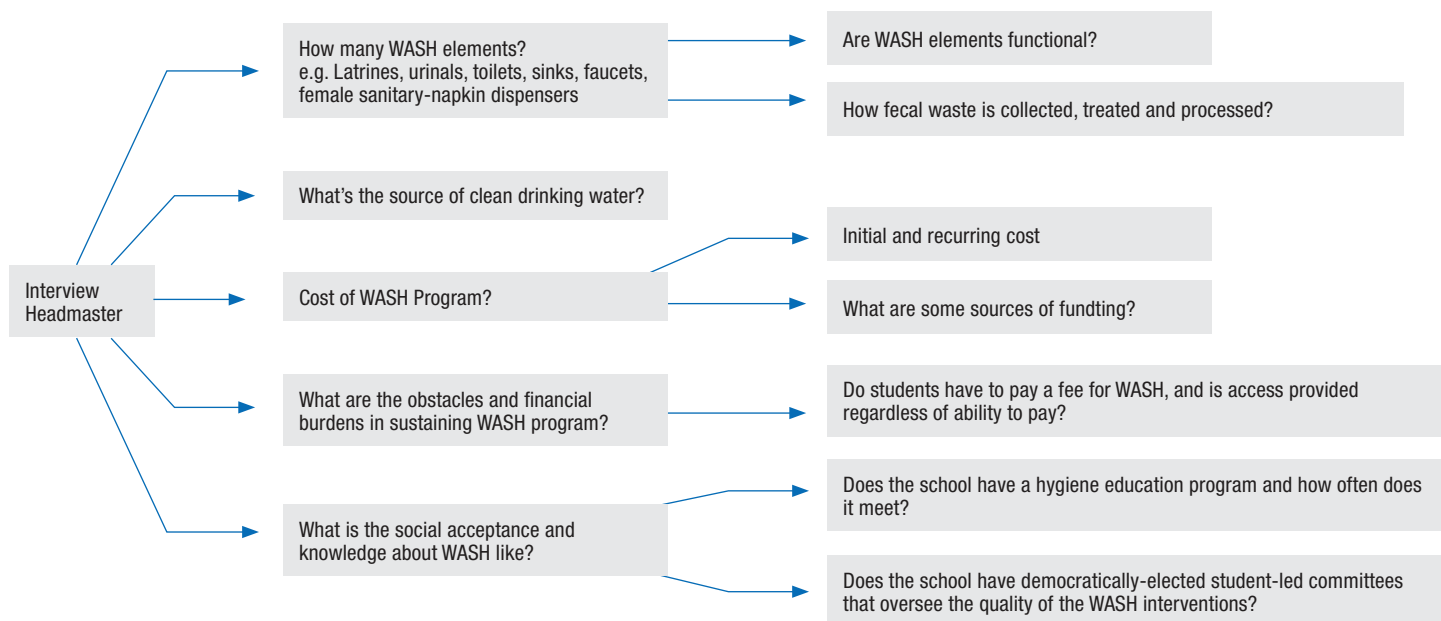
The quantitative survey consisted of five sections:

- Health -Behavior and Knowledge
- Social - School Hygiene and Education
- Technical - Resources/Hardware
- Financial - Program Costs and Fees
- Governance/Institutional Tracking - Water Committees and Nongovernmental Organizations

Interviews with headmasters took approximately 15-20 minutes and the survey was filled out by hand. After each interview, the headmaster stamped the survey with their school emblematic shield and signed the document. Data collected from the surveys were electronically databased for subsequent analysis.

During our evaluation, we gathered information on the functioning and nonfunctioning WASH elements (Fig. 4).

Figure 2. Flowchart of data collection during headmaster interviews.



We then evaluated the WASH interventions for behavioral and financial sustainability to make recommendations for replicating similar WASH interventions at other schools in similar socio-economic environments. We developed a WASH sustainability assessment system based on the Global Reporting Initiative (GRI) sustainability reporting standards (GRI, n.d.), which are a set of international standards that help organizations understand and communicate the impact of different components of a project. The GRI standards were chosen among other sustainability assessment tools for their detailed and understandable category-by-category guidelines. Using this system, we ranked the five survey categories from 1 to 10 with ten being the most sustainable and one being the least sustainable based on observations and survey results.

4 STUDY LIMITATIONS

Translations may have altered or removed key nuances in the interview process. A member of Sarboday Sangha accompanied the research teams, which may have influenced how the headmasters answered questions. These headmasters might have feared to appear non-compliant with NGO oversight. The survey was written in English and orally translated to Bengali during the interview and back to English to transcribe into the survey forms. Translation errors may have occurred.

All the interviews and data collection were done in one week. This time constraint prevented follow-up questions and more in-depth research at each school. Additionally, all information came from the mouths of teachers and headmasters. We did not interview students, who are the main users of the facilities. The study would be more powerful if a set of control schools, which did not receive a WASH intervention, were also investigated in a Randomized Controlled Trial (RTC) design.

5 RESULTS

5.1 Characteristics of Surveyed Government Schools

School enrollment ranged from 40 to 2,000 students with an average of 766 students per school. Two of the schools were all-girls and one was all-boys. The number of students per latrine or urinal ranged from eight students per facility to 100 students per facility with an average of 49 students per latrine/urinal (Table 1).

Table 1: Ratio of each school's students to latrine or urinal.

Average = 49 students per latrine/urinal

School	Number of Students	Number of Latrines/Urinals	Students per Latrine/Urinal
1	1800	36	50.0
2	40	5	8.0
3	520	7	74.3
4	71	4	17.8
5	200	7	28.6
6	420	21	20.0
7	772	12	64.3
8	400	11	36.4
9	158	11	14.4
10	300	6	50.0
11	410	12	34.2
12	1150	14	82.1
13	1889	26	72.7
14	1100	18	61.1
15	350	8	43.8
16	1200	20	60.0
17	1000	14	71.4
18	2000	20	100.0

On average and across genders, the schools had 14 latrines/urinals. All schools surveyed reported receiving the WASH intervention within the past 11 years, some as recent as 2014.

5.2 Health Behavior and Knowledge

All 18 schools reported access to running water for hand-washing, however, only 15 of the 18 schools had soap available. Toilet paper (which is not usually used in this region) and hand towels were not present at any school. All 18 schools reported zero open defecation during school hours. In general, school headmasters promoted and maintained a culture of belief that WASH improves hygiene and reduces diarrheal disease, school absence, and water pollution. Only one school reported a negligible change in school attendance after the WASH program. The other 17 reported an improvement in school attendance with 15 reportedly due to improved access to female sanitary napkin dispensers (Fig. 4). The introduction of safe and clean menstrual napkins improved school attendance across all schools with teenage females.

Headmasters reported that before the WASH program girls would stay home during their menstruation since the school lacked the necessary privacy and supplies. Headmasters also reported that nearly all students have access to latrines at home because of recent government-funded programs aimed at reducing community open defecation. However, some of the more rural school communities reported poor quality latrines at home. As a result, students maintained a sense of stewardship over school facilities and kept their latrines cleaner.

5.3 Social Impacts

Seventeen out of the 18 schools reported having some type of hygiene education program. The extent and depth of the education program varied from an annual meeting to daily lessons. The person or group instructing the lessons also varied from school staff to outside NGOs. Our survey did not go into detail about lesson plans; however, headmasters did report that lessons incorporated topics on proper hygiene, female menstrual care, benefits of containing human waste and importance of clean water access.

We also discovered that 17 out of the 18 schools had a student-led WASH committee, which was advised by at least one school faculty member. The gender ratios of these student committees were close to 50-50, with the exception of the single-gender schools. Three schools did not report information on the WASH committee gender ratio. Three out of the 17 schools reported that student WASH committee members were selected by teachers. Five out of the 17 schools reported a democratic process of electing members to the WASH committee. Nine out of the 17 schools failed to report the WASH committee student allocation process. One school reported not having either a hygiene education program or a WASH committee. The headmaster of this school reported that the students were not motivated because they had latrines at home and did not usually use the latrine facilities at school.

5.4 Facilities

All 18 schools reported using groundwater as their water source, although not all used this water for drinking. A well with a submersible pump was the most reported method of drawing in water. A few schools accessed water from ponds. One school reported access to only saline water, which was too expensive to filter for drinking, and the students were advised to bring water from home. Several schools reported paying for a drinking water delivery service. Transportation costs ranged from \$0.30 to \$0.60 (INR 20 to 40) per delivery,

which is sufficient for the school population. We discovered that most headmasters expressed a need for either drilling deeper or implementing another well to sustain drinking water.

5.5 Financial Assessment

All the schools obtained some funding from NGOs, the majority of which was from Sarboday Sangha and Water for People. The rest of the funding was either supplied by the school, the government or was unspecified. The capital costs to install the WASH infrastructure (i.e. latrine and handwashing sinks) in the 18 schools ranged from INR 100,000 to INR 700,000. In total, the combined capital costs of these WASH programs at the 18 schools was \$107,970 USD (INR 7,234,000). in capital cost. This does not include the cost of maintaining the WASH infrastructure. \$41,358 USD (INR 2,771,000) was from NGOs and donors, \$38,074 USD (INR 2,551,000) from school funds, \$7,000 USD (INR 469,000) from the Indian government and \$21,537 USD (INR 1,443,000) was unspecified (Fig 3). The average cost per student for the capital costs was \$16.97 USD/INR 1,137 (Table 2). A guideline cost for implementing a similar WASH program within similar parameters was calculated by dividing the total cost of executing the program by the number of students for each school. Costs ranged from \$1.66 to \$75.63 (INR 111 to INR 5,000) per student with an average cost of \$16.97 (INR 1,137) per student. Capital cost includes the initial setup cost of WASH infrastructure, recurring operational and maintenance costs, which are typically covered by the students.

Figure 3. Capital Cost Breakdown of the WASH Program

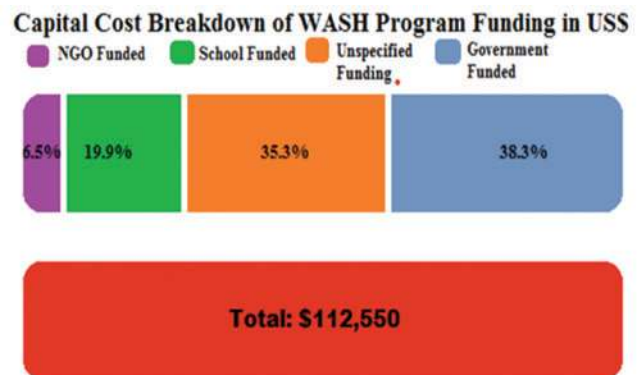


Table 2: Average funding per student per school

Total School WASH Fund/Number of students = dollars per student
 Mean Cost Per Student: \$16.97USD/INR 1,137

School Number	US Dollars	INR
1	\$1.66	111
2	\$74.63	5,000
3	\$14.06	942
4	\$21.02	1408
5	\$29.85	2000
6	\$10.66	714
7	\$4.82	323
8	\$19.35	1297
9	\$42.51	2848
10	\$11.19	750
11	\$10.91	731
12	\$5.18	347
13	\$3.94	264
14	\$4.75	318
15	\$29.85	2000
16	\$5.60	375
17	\$10.45	700
18	\$5.22	350

All the schools included in this report collected general school fees from the students. The standard government school fee was \$3.58 USD (INR 240) per student per school year. Nine of the 18 schools have a specific fee for maintaining WASH and this amount ranged from \$0.02 to \$0.15 USD (INR 1 to INR 10) per month. Some schools reported collecting fees from teachers to support maintenance costs.

There are many components to WASH that require specific funding. The most commonly reported major expense is installing and drilling a submersible pump to access groundwater. The drilling depth ranged from 650 feet to 800 feet. On average, the capital cost of a submersible pump at each school was \$1,493 USD (INR 100,089), which includes drilling, construction and associated labor fees. A few of the schools reported subsequently deepening the tube well to access more water during periods of drought or high demand. Several of the schools reported drought conditions in the summer, which reduced water access dramatically. Many farmers in the region use groundwater for irrigation by accessing the submersible pumps. As a result, during the summer drought months, demand for groundwater stresses the aquifer and the water table drops below the level of submersible pumps, causing the wells to dry up. Two of the 18 schools reported having no access to clean drinking

water during summer months and required students to bring their own drinking water from home. Several schools hire water delivery services to bring fresh drinking water during the summer months. These delivery services usually cost is between \$0.30 to \$0.60 (INR 20-40) per delivery.

Monthly WASH maintenance costs ranged from \$11.94 to \$74.63 USD (INR 800 to INR 5000). These costs include fixing damaged faucets, paying an attendant to clean, resupply female sanitary napkin dispensers and resupply soap. Septic tank cleaning occurred on a need-to-empty basis. Four schools have not cleaned their septic tank yet, whereas two reported cleaning out the septic tank twice a year. The cost ranged from \$7.46 to \$104.48 USD (INR 500 to INR 7000) per cleaning. Some headmasters reported that fecal sludge was buried in a pit, but others were unaware of the disposal process. No documented evidence of groundwater contamination was presented by any of the schools.

6 ISSUES & RECOMMENDATIONS

6.1 Issue 1: Unstable water supply

One of the most significant issues that schools face is an unstable water supply. Although every school has a submersible pump, most of them still experience water scarcity, especially during the drought-prone summer months. This is a relatively new concern, due to the recent increase of agricultural activity in the area. The solution must involve an integrated groundwater management program that considers water conservation in both agricultural and residential usages. However, a short-term solution would be to increase the well depth as some schools have already done. We recommend the schools install either a deeper pump or multiple pumps to guarantee a more stable supply of water. Schools should also consider improving the efficiency of their water use by incorporating a strong emphasis around water conservation in the school water committees.

6.2 Issue 2: Improving access to sanitary supplies

All of the schools visited said they require their students to wash hands with soap before lunch and after using toilets, but we noticed fifteen of the eighteen schools did not have soap at the hand wash stations (Fig. 6). Most of these schools were closed during holiday or just starting up the academic year. The administrators expressed that soap is not provided during holiday periods, although the holiday period was ending. Many schools had children present on school grounds without access to soap. We recommend that as long as the toilet facilities are open, soap should be made available. It is important for faculty to be cognizant of promoting hygienic behaviors anytime the toilets are used regardless of holiday status. We recognize soap bars may not be returned after use. We recommend future improvements and financial support consider installing liquid soap dispensers to minimize the risk of soap disappearing.

6.3 Issue 3: Lack of Funding

Insufficient funding is a problem for many schools and this requires a financial sustainability plan that incorporates saving money for maintenance and unexpected repairs. Based on these observations, some schools' teachers contribute to the monthly maintenance cost to supplement gaps in funding, especially since not every child can afford to contribute to the water fee. Since school staffers are also using the school toilets and earn an income, we recommend having a required water fee for school staffers to meet gaps in funding for general maintenance.

Insufficient funding often stems from both NGOs and the government not collaborating effectively enough after a school's WASH implementation. A missing plan for continuous maintenance is a problem in schools already strapped for cash. We recommend NGOs request support from the government by leveraging state's goals to improve community sanitation. This can be done by allocating state funds to commit funding for 1-3 years post implementation. This would allow the schools to save the required water fees from staff and students during the years of initial support from the government, with the intent to set up a financial savings account for future expenses.

6.4 Issue 4: Unpredictable access to supplies and skilled labor results in slow repairs

There were some broken faucets observed at schools (See Supplementary Information), which might discourage or prevent hygienic handwashing behavior. Although repairing faucets is a relatively simple process, waiting for available mechanics or supplies could take weeks depending on availability. Certain minor tasks like faucet replacement can reasonably be done by school staffers to avoid lengthy waiting periods. Our recommendation is to create an inventory list of supply parts for replacement and retail in the community, train teachers in basic maintenance and repair skills, and/or hire a local maintenance worker to service multiple schools.

6.5 Issue 5: Menstrual hygiene

The availability and cleanliness of female sanitary napkins varied. The cleanest sanitary napkin dispenser was at a school with the most well-established management system. At this school, female students contributed napkin pads while an appointed student "manager" recorded the number of contributions. This information was kept on record in a notebook. It appears as if this management system developed out of a student-faculty water committee and could be a strategic model worth promoting for other schools without napkins or a reliable management system for menstrual hygiene.

6.6 Issue 6: Contaminated groundwater

Among all the schools visited, water testing was rarely carried out. The extent or quality of the water testing was not specified, but there was always a willingness of the headmasters to receive additional funding for any WASH support.

Schools without a water monitoring and filtration system lack necessary knowledge of their water quality. During interviews with headmasters, some schools reported contaminated groundwater. This may be a result of algae and bacteria that are prevalent in the groundwater sources. However, the risk is less detectable due to limitations of water testing. The prevalence of waterborne diseases remains a problem in a region where open defecation, unofficial burial location for fecal matter, and improper waste disposal are common. We propose making regular water testing mandatory with aid from both NGOs and the government jointly subsidizing the cost.

6.7 Issue 7: Awareness and consciousness

Unsanitary WASH facilities tell teachers and students they are not important enough to have clean, well-maintained restrooms and hand wash areas. At a majority of the schools, there appeared to be a positive association between the cleanliness level of the WASH facilities and student-staff collaboration. Passionate, dedicated and knowledgeable staff gravitate towards fostering cleanliness efforts and guiding successful water committees. Knowledgeable school staff tend to enhance the student-staff collaboration by incorporating better hygiene education and promoting the significance of waterborne diseases and put more effort into implementing the program. Students are more motivated to maintain their WASH facilities when they see full commitment from the school administrators and staff. Therefore, we recommend educating school headmasters and teachers in the importance of student-staff collaboration and the benefits of the WASH program. Staff that are more knowledgeable will build support for the program and ultimately better facilitate implementation.

7 DISCUSSION

Studies have shown that lack of sanitation has a negative impact on the education, participation and livelihoods of girls and women (Jewitt & Ryley, 2014). There are strong linkages between access to WASH and gender equality; women and children are disproportionately affected by a lack of access to water, sanitation and hygiene, and culturally shoulder the largest burden in water collection. Gendered barriers prevent accessing water and sanitation. The complex intersection that gender has with age, disability, and economic status heightens the barriers to WASH access.

In September 2015, 193 world leaders committed to 17 Sustainable Development Goals (SDG) to end extreme poverty, fight inequality and injustice, and address climate change by 2030. SDG 5 focuses on gender equality and women's empowerment, while the sixth focuses on achieving access to adequate and equitable sanitation and hygiene for all (United Nations, n.d). Both goals are related and mutually reinforcing. "SDG 6 will only be achieved through a gendered and rights-based approach to WASH, while SDG 5 will

only be achieved following the recognition and inclusion of the specific WASH needs and barriers that women and girls face” (WaterAid, 2013). Many of the schools have menstrual hygiene products, gender diverse WASH committees and multiple private single stall toilets that allow privacy and improves school attendance. Female students are less likely to be harassed as they travel to the toilet inside of their school instead of going outside. Gender inclusivity of the WASH initiative was owned by both men and women.

In an area of the world where open defecation and fecal-related illnesses are common, WASH facilities are critical for human health. Latrines eliminated open defecation at all the schools, and submersible pumps provided access to running water. The sense of ownership created by the WASH program sustained a culture of pride and acceptance for most of the schools. Sanitation and hygiene empowerment is new to the regional communities representing the population of these schools. Since WASH behaviors are new, it is essential for these students to inherently understand the value of WASH. Looking forward, part of the success of these WASH programs is for social habits to be transferred back to the family and community through behavioral norms. More funding is needed to build new submersible pumps. Running water for drinking and handwashing is still an issue during the hot summer months. In the future, more time needs to be devoted for evaluating the WASH educational programs.

8 FUTURE RECOMMENDATIONS

These data could be used for future research studies conducted as a Randomized Controlled Trial (RCT) evaluating schools receiving non-WASH versus WASH interventions. A RCT is considered the gold standard when it comes to measuring the effectiveness of a new intervention or treatment (Hariton et al. 2018). Further investigation into the possibility of involving the private sector could also support the financial mechanism of WASH programs. Research that involves the data collected from the perspectives on the primary end users (the students) will provide more depth of understanding in the field of environmental health. Access to adequate sanitary and menstruation products affects girls’ school attendance (Jewitt & Ryley, 2014). Other future research should study the attendance of female students pre- and post-WASH intervention to see if their participation in school has improved. Researchers should collect quantitative data by reviewing daily attendance logs to see if the girls absenteeism and recidivism improve by having better latrine facilities and free menstrual hygiene kits in schools.

9 CONCLUSION

Water and sanitation play a crucial role in curbing the transmission of diarrheal disease. Due to the poor quality of the drinking water supply and sanitation options, water-borne diseases erupt every year during the summer and rainy seasons.

Women and children are disproportionately affected by a lack of access to water, sanitation and hygiene, and shoulder the heaviest burden in water collection. Addressing the WASH needs of women and children can provide direct and indirect health, education, and economic benefits to the entire community. Investing in global safe drinking water, sanitation and hygiene is an efficient way to improve a variety of development outcomes including rural public health. A successful WASH program in schools would include hygiene education programs, student-led water committees, clean water access, hand washing stations, disposable female sanitary napkins, and functional latrines and urinals. Providing students with safe drinking water options and better latrines are essential to increase school attendance, reduce disease, and improve hygienic behaviors. This research will inform future observational research as well as interventions to improve financial sustainability of WASH programs in rural schools.

SUPPLEMENTARY INFORMATION

Supplementary information related to this article can be found on page 56.

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Evaluating Water, Sanitation and Hygiene Interventions in Rural Schools of West Bengal, India

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Figure S1. Drinking water and handwashing station.

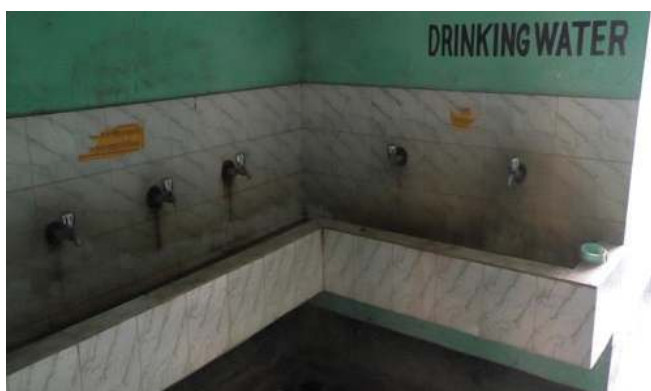


Photo credit: Akudo Ejelonu

Figure S2. Girl's restrooms installed in a government high school.



Photo credit: Akudo Ejelonu

Figure S3. Sanitary napkin dispenser in a girl's restroom.



Photo credit: Akudo Ejelonu

Figure S4. A typical latrine with a water bucket found in surveyed schools.



Photo credit: Akudo Ejelonu.

Table S1: Characteristics of Sampled Government Schools

Government Schools	Year of WASH Intervention	# of Students	# of Boys	# of Girls	Total WASH Program Cost (Lakh)	Fee Paid, Per Student (INR)	How many of the students pay?	Where is latrine waste stored?	Costs and Processing of Latrine Waste	Was soap accessible at hand washing station?
School 1	Not reported	1,800	1,080	720	2	240 annually	Most	Septic Tank	Not cleaned yet.	No
School 2	2006	40	20	20	2	240 annually	Most	Septic Tank	NGO will clean. Has not occurred yet.	No
School 3	2010	520	520	0	4.9	5 monthly*	95%	Septic Tank	Cleaned every 3-4 years.	Yes
School 4	Not reported	71	38	33	1	240 annually	Most	Not reported	Not reported.	Yes
School 5	2012	200	0	200	4	100-150 annually	Not reported	Not reported	Not reported.	No
School 6	2012	420	197	223	3	3 monthly	95%	2 500L septic tanks	Cleaned every 5 years.	No
School 7	2007	772	309	463	2.5	2 monthly	Most	Septic Tank	Once every two years by private company, costs about 7,000 Rs	No
School 8	2010	400	180	220	5.19	2 monthly	70%	Septic Tank	Never changed, may last 10-20 years.	No
School 9	2014	158	68	88	4.5	240 annually	Most	Septic Tank	Cleaning hasn't occurred yet.	No
School 10	2009	300	0	300	2.25	240 annually	Most	Septic Tank	Cleaned twice a year. Costs about 3,000-6,000 rupees to empty. Take waste to a hole and bury it.	Yes
School 11	2012	410	205	205	3	2 monthly	Most	Two Septic Tanks	Once a year. Hire a professional for 2,000-3,000 rupees.	No
School 12	2011	1,150	575	575	4	240 annually	Most	Septic Tank	Hired a professional.	No
School 13	Not reported	1,889	1,000	889	5	240 annually	Most	Septic Tank	Cleaned twice a year by a hired professional. Costs about 2,500 Rs.	No
School 14	2011	1,100	900	200	3.5	10-15 annually	100%	Septic Tank	Cleaned once every 4-5 years.	No
School 15	2010	350	175	175	7	1 monthly	100%	Septic Tank	Cleaning hasn't occurred yet.	No
School 16	2010	1,200	660	440	4.5	10 annually	100%	Septic Tank	Yearly, 500 rupees.	No
School 17	2014	1,000	500	500	7	10 annually	Most	Septic Tank	2 times a year, 500 rupees. Bury waste in the ground.	No
School 18	2010	2,000	1,000	1000	7	1 monthly	90%	Septic Tank	Every 4-5 years / 4000 rupees per septic tank.	No

* Teachers pay 100 INR per month; headmaster pays 200 INR per month

Table S1 shares the total WASH intervention program costs for each school reported by the headmaster. The costs (1 Lakh = 100,000 and INR 67 = US \$1) for construction and installation of WASH facilities ranged from \$1,493 to \$10,447 (INR 1 to 7 lakhs). Student fee went up to \$3.58 (INR 240) per year and all schools reported that nearly all students could afford to pay the fee. Even the students who couldn't pay were still allowed to use the WASH facilities. Of the schools that reported how waste was stored, all reported using septic tanks. Fecal sludge removal from the septic tanks varied in frequency and cost. Hired professionals are the preferred method and reported labor costs ranged from \$7.46 to \$104.48 (INR 500 to INR 7,000) per removal job.

Figure S5. A typical hand washing station in surveyed schools (water faucets).



Photo credit: Huiran Feng.

Figure S6. A typical hand washing station in surveyed schools (bar soap).



Photo credit: Huiran Feng