A Case Study of Improving WaSH Environments at Schools

Evaluation Report 2019

cántaro azul

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This report was prepared for the United Nations Children's Fund (UNICEF), by Fundación Cántaro Azul.
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Contents

Introduction

WaSH (water, sanitation, and hygiene) in schools is globally recognized as a key intervention to promote children's right to health, clean environment, and a key pre-requisite to the right to a basic education[1,2]. However, guaranteeing access to WaSH in every school for every child can be a huge challenge, especially during emergencies. Ensuring schools can reopen with adequate WaSH facilities, namely safe drinking water, hygiene, and improved sanitation facilities, is an essential part of recovery. In September 2017 two earthquakes struck Mexico. One struck southern Mexico causing severe damage to the states of Chiapas and Oaxaca. The Cántaro Azul Foundation, in partnership with UNICEF Mexico, in their third phase of post-disaster recovery, focused on providing permanent WaSH improvements in 21 schools in Chiapas, Mexico.

Photo credit: Carlos Alberto Cordero Contreras

Research suggests if students have access to clean and appropriate toilets, functioning handwashing facilities with soap, sufficient and safe drinking water, and have developed adequate hygiene skills, they will[1,2,3,4,5]:

- Be healthier
- Perform better in school
- Positively influence the hygiene practices among their family members and the wider community
- Change their current hygiene behavior but also use better hygiene practices in the future when they are likely to become parents, teachers, health staff or other workers
- Be able to apply learnt hygiene skills in other aspects of their lives.

The Cántaro Azul Foundation (FCA) set out to improve school WaSH environments in 21 schools affected by the September 2017 earthquake. All schools received a comprehensive WaSH program that included improvements to drinking water quality, water supply, sanitation facilities, hygiene facilities, and education, as well as communication and capacity-strengthening activities. The impact of the intervention is described in this case study.

1 Clasen, Thomas, et al. "Interventions to Improve Water Quality for Preventing Diarrhoea: Systematic Review and Meta-Analysis." Bmj, vol. 334, no. 7597, 2007

2 Chard, Anna N., et al. "The Impact of Water Consumption on Hydration and Cognition among Schoolchildren: Methods and Results from a Crossover Trial in Rural Mali." Plos One, vol. 14, no. 1, 2019

3 Freeman, Matthew C., et al. "Assessing the Impact of a School-Based Water Treatment, Hygiene and Sanitation Programme on Pupil Absence in Nyanza Province, Kenya: a Cluster-Randomized Trial." Tropical Medicine & International Health, 2011

4 Trinies, Victoria, et al. "Effects of Water Provision and Hydration on Cognitive Function among Primary-School Pupils in Zambia: A Randomized Trial." Plos One, vol. 11, no. 3, 2016

5 Freeman, M. C., et al. "The Impact of a School-Based Water Supply and Treatment, Hygiene, and Sanitation Programme on Pupil Diarrhoea: a Cluster-Randomized Trial." Epidemiology and Infection, vol. 142, no. 02, 2013

Approach

Setting and selection: Two lists of schools damaged by the 2017 earthquake were compiled independently by UNICEF and Cántaro Azul. The lists were compared and schools located in Chiapas were visited to conduct a needs survey and corroborate damages. Of the schools visited, 21 were chosen to intervene directly. Schools included ranged in size, level (e.g. pre-school, etc.), geographical region, and pre-existing condition of water, sanitation, and hygiene infrastructure. Twenty-one schools with 4,809 students participated in the intervention described in this case study.

Intervention: All schools received a comprehensive WaSH program that included improvements to drinking water quality, water supply, sanitation facilities, hygiene facilities, and information, education, and communication activities. The improvements were based on a needs assessment conducted at baseline, and as a result they were not uniform. The goal was to ensure each school achieved a basic standard of WaSH services adapted from the WHO's Water, Sanitation, and Hygiene Standards for Schools in Low-cost Settings[6]. Standards and core activities of the project are listed in Table 1.

Data collection: Baseline data was collected (September 2018) and following implementation (November 2018 – January 2019). Data collected included access to an improved water supply; consistency of water access; water treatment practices; number, type, and condition of

6 WHO/UNICEF, et al. Water Sanitation and Hygiene Standards for Schools in Low-Cost Settings. 2009.
17 INIFED "Normas y especificacions para estudios, proyectos, construccion e instalaciones", Mexico City, MX. Volume 3 Volume Architecture Design, 2014

Table 1. Description of Intervention Activities

Domain	Standard/Activity
Drinking water quality	Provision of an on-site drinking water treatment system to ensure access to safe water in sufficient quantities.
Water supply	Rehabilitation of water points, provision of large storage containers, and/or rehabilitation of water pumps to ensure there is access to sufficient quantities of water to cover each schools' needs (e.g. drinking water, sanitation, and hygiene).
Sanitation	Installation or rehabilitation of sanitation facilities so that there were a sufficient number of basic sanitation facilities that met the minimum requirements of the Mexican government [see Table 2][16]. A basic sanitation facility is classified as improved facilities (flush/pour flush toilets, pit latrine with slab, composting toilet), which are single-sex, functional, and user privacy protection.
Hygiene	Installation or rehabilitation of hygiene facilities so that there was at least one functional hygiene facility that provides running water located within 5m of each bathroom facility.
Information, education, and capacity-strengthening activities	Promotion of good WaSH practices and behavior change at school; training on hygiene promotion to teachers and school management committees, establishment of healthy school environment committees, and training on maintenance of water and sanitation systems.

Table 2. Required minimum number of toilets INIFED standards[16]

School Type	School Size (# Groups)	Required # of Toilets	
		Female	Male
Pre-school	3 to 6	2	2
	9	6	4
Primary	6	2	1
	12	5	3
	18	11	7
Secondary	6	3	1
	12	5	3
	18	11	7

Data collection (cont.): …school sanitation facilities; number, type and condition of school hygiene facilities; and access to water and soap for handwashing. Contextual information concerning preferences and the historical WaSH situation at the school were collected. Additionally, full water quality panel tests were carried out for primary drinking water sources and for primary non-drinking water sources. Tests included: E. coli, pH, salinity, total dissolved solids, conductivity, total chlorine, free chlorine, color, turbidity, nitrates, nitrites, arsenic, manganese, iron, sulfates, and fluoride.

Tools used to collect data include structured interviews with school directors, janitors, teachers, and parent's committee; focus groups with students; structured observation of school WaSH conditions and use of WaSH facilities; and installation of water meters to obtain data on water consumption.

Analysis: Data from structured observations, water meter readings, and results of water quality tests were recorded into a standardized Excel spreadsheet. Data from structured interviews and focus groups were recorded using a digital recorder and transcribed verbatim for analysis. Following transcription, the interviews and focus group discussions were coded for relevant themes and sub-themes to provide contextual information for behaviors observed at the school. Data was stratified by urban/rural, size of school, school level, and geographical region to determine if any of these uncontrollable external factors were associated with WaSH environments. All data was cleaned and analyzed using STATA.

17 INIFED "Normas y especificacions para estudios, proyectos, construccion e instalaciones", Mexico City, MX. Volume 3 Volume Architecture Design, 2014

Impact: Water

Water consumption
Data collected from twenty-one schools found that, as a result of the intervention, 4,818 students consumed 60,580 liters of safe water during our short follow-up period (November 2018 to January 2019).

On-site water treatment systems were installed in all 21 schools during our WaSH improvements intervention. Water meters were connected to each system to measure consumption. Prior to the intervention 20 out of 21 schools purchased bottled water in 20L containers (aka garrafones), a common practice in Mexico. From structured interviews with school staff we calculated an average number of 20L garrafones purchased per week for each school. Using these statistics, we found average water consumption per student per day at baseline, was 0.16 liters (Note: the one school that did not purchase bottled water, the children brought water from home and this school was not considered in this figure). Post-intervention students consumed on average per day 0.39 liters – ***a 2.4-fold increase in safe water consumption***.

Preliminary figures from JMP found that 89% of schools in Mexico only had a limited drinking water service and 11% of schools had no drinking water service[7], highlighting a gap in access to year-round, reliable, and safe water supply in sufficient quantities to support students' needs. While, a sufficient supply of safe water is not discussed as often as water quality in low and middle income settings, a few studies

7 "Drinking water, sanitation and hygiene in schools: global baseline report 2018. New York: United Nations Children's Fund (UNICEF) and World Health Organization, 2018

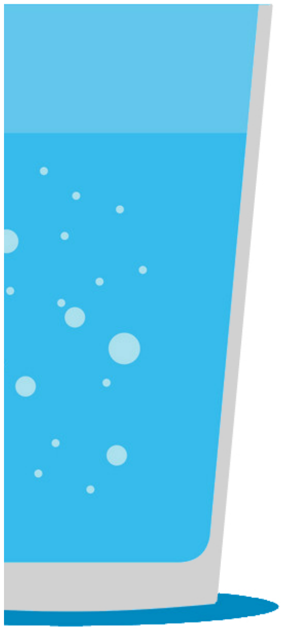
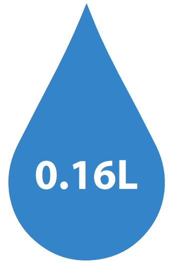


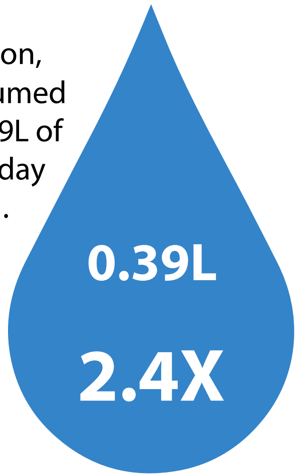
Figure 1



At baseline, students were consuming on average 0.16L of safe water per day while at school.

Post-intervention, students consumed on average 0.39L of safe water per day while at school.

Safe water consumption increased by 2.4X



The intervention increased water consumption per student per day in all categories
(rural/urban, school size, region, and school level)

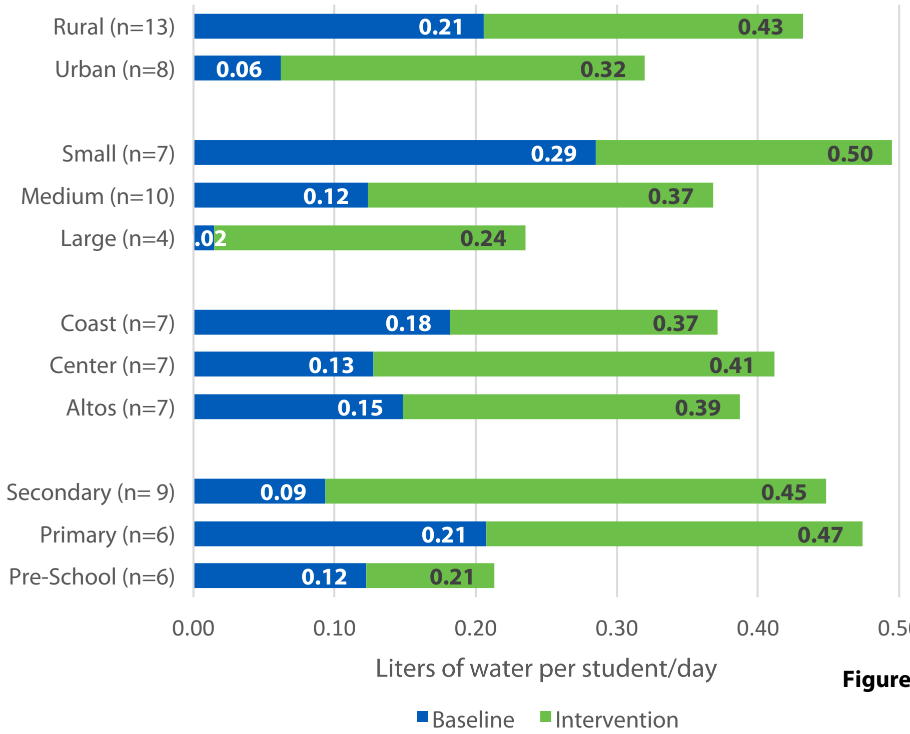


Figure 2

assessing dehydration prevalence among school-age children living in hot and/or arid regions found that approximately two-thirds of children were in a state of moderate to severe dehydration – 84% of Italian school children, 68% of Israeli school children, and 43% of Zambian school children. As a result of dehydration, the children experienced decreased physical activity, mental capacity, and urinary tract infections[8,9,10]. These studies and the WaSH statistics on Mexican schools provided by JMP demonstrate why increased water intake with increased provision of on-site water treatment systems is so important for the health and well-being of Mexican students.

This intervention ensured each school had free safe water, on-site, and a water point was available in each classroom. While 20 out of 21 schools had access to safe water prior to the intervention, there was still a daily water intake increase in all schools. From structured interviews and observations, it became apparent the intervention significantly reduced financial and physical barriers to water access. Namely, staff reported cost restricted the number of *garrafones* that could be purchased each week, water was usually only purchased/transported once per week even if all the water had been consumed, and it was often located in one central location instead of in each classroom. Removing these barriers made accessing safe water easier and more convenient, ultimately increasing student daily water intake.

Rates of water consumption at baseline and post-intervention were stratified by urban/rural, school size, geographical region, and school level [see Figure 2]. In all categories, there was an increase in water consumption from baseline to post-intervention. There was no marked

8 "Jasper, Christian, et al. "Water and Sanitation in Schools: A Systematic Review of the Health and Educational Outcomes." International Journal of Environmental Research and Public Health, vol. 9, no. 8, 2012
9 Hunter, M. L., et al. "Fluid for Thought: Availability of Drinks in Primary and Secondary Schools in Cardiff, UK." International Journal of Paediatric Dentistry, vol. 14, no. 4, 2004
10 Kaushik, A., et al. "A Study of the Association between Children?s Access to Drinking Water in Primary Schools and Their Fluid Intake: Can Water Be Cool in School?" Child: Care, Health and Development, vol. 33, no. 4, 2007

Box 1: Bottled water in Mexico

Mexico is the world's leader in bottled water per capita consumption. From a survey conducted by the Inter-American Development Bank (IDB) in 2010 in Mexico, nearly 70% of respondents reported buying bottled water as their main source of drinking water. ***In Chiapas, 98% of respondents reported using bottled water for their daily drinking water***. (IDB, 2010)

difference in consumption between regions, but there were interesting differences between urban and rural schools, schools of different sizes, and different school levels.

For the purposes of this case study, "urban" was defined as localities containing >15,000 residents and "rural" was defined as localities with <15,000 residents (INEGI)[18]. In both areas water consumption per student per day markedly increased [see Figure 2]. We were surprised to find that students in urban schools consumed less water compared to students in rural schools. At baseline, rural students were consuming 3.5 times more water per day compared to urban students. While, rural students still consumed more water than urban students at post-intervention, ***urban students experienced a 5.3-fold increase in safe water consumption,*** a greater increase in safe water compared to their rural counterparts thereby reducing the urban/rural gap**.**

There was a strong correlation between water consumption rates and school sizes both at baseline and at post-intervention. Small schools were defined as having <100 students, medium schools had between 100 – 500 students, and large schools were defined as having > 500 students. Small schools had the greatest total water consumption at post-intervention with 0.5L/student/day. ***While large schools consumed less at post-intervention, they saw the greatest overall increase in water consumption – a 12-fold increase***. Large schools cited purchasing water and financial constraints were a greater concern and limited their water consumption. With the on-site treatment system, safe water could be provided for free and finances no longer restricted the quantity of drinking water schools provided to the children.

Finally, water consumption rates were stratified by school level [see Figure 2]. In Mexico, pre-school includes children from ages 4 to 6, primary school comprises grades 1 – 6 and ages 6 – 12 years old, and secondary school comprises grades 7 – 9 and ages 12 to 15[12]. For all

Photo credit: Carlos Alberto Cordero Contreras

12 Secretaria de Educacion Publica "Sitio De Secretaría De Educación Pública." <Gob.mx/SEP, www.gob.mx/sep>
18 Instituto Nacional de Estadistica y Geografpia (INEGI) <https://www.inegi.org.mx/eventos/2015/Poblacion/doc/p-WalterRangel.pdf>

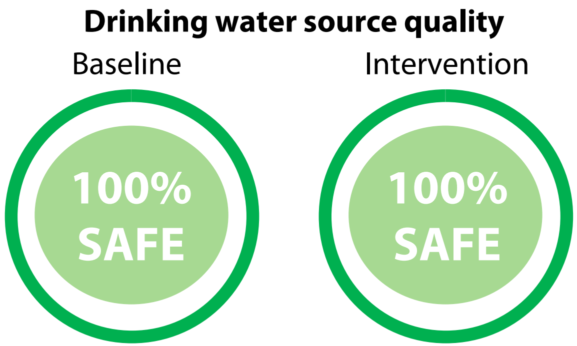


Figure 3

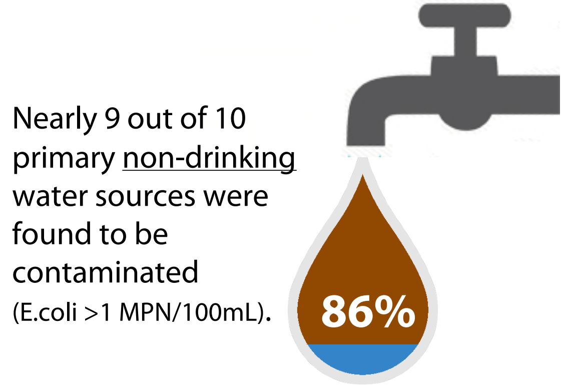


Figure 4

school levels, we saw a marked increase in water consumption. At baseline, we were surprised to find secondary schools had the lowest water consumption, 0.09L/student/day. Older children require greater quantities of water due to increased physical activity and general body mass[8]. FCA was pleased to find at post-intervention, students in secondary schools experienced a large in increased in daily water intake and were consuming similar rates to primary school students (0.45L/student/day). Pre-school students consumed the least amount of water per student/day at post-intervention. It is believed this is a result of the small physical size of the students and the reduced pre-school hours (half the length of primary and secondary schools).

Water quality

Drinking water from all schools at post-intervention and at baseline were safe (Note: at baseline 20 schools were tested, one school did not have a drinking water source). Extensive water quality tests were conducted. Samples were tested from drinking water sources at baseline, primary non-drinking water sources, and drinking water samples from the treatment system provided during interventions. Water quality tests included: E. coli, pH, salinity, total dissolved solids, conductivity, total chlorine, free chlorine, color, turbidity, nitrates, nitrites, arsenic, manganese, iron, sulfates, and fluoride.

From the results of the primary non-drinking water sources, it was determined that nearly 9 out of 10 of these water sources were contaminated with fecal coliforms (E. coli > 1 MPN/100mL). Additionally, we found that 19% of these water sources were contaminated with nitrates, 10% had high levels of turbidity, 10% high levels of nitrites, and 5% had detectable levels of arsenic [see Figure 5]. The water quality limits we used were taken from the U.S EPA[13]. If the WHO's water quality guidelines were applied, no water sources were above the guideline values for nitrates (>50mg/l)[14] and no water sources were above guideline values for nitrites (3 mg/l). However, one school had concerning levels of arsenic. School administration was informed and told to stop use of this water source immediately. All schools had safe levels of salinity, total dissolved solids (TDS), manganese, iron, sulfates, and fluoride.

8 "Jasper, Christian, et al. "Water and Sanitation in Schools: A Systematic Review of the Health and Educational Outcomes." International Journal of Environmental Research and Public Health, vol. 9, no. 8, 2012

13 U.S. Environmental Protection Agency (EPA). 2017. *Water Quality Standards Handbook: Chapter 3: Water Quality Criteria.* EPA-823-B-17-001. EPA Office of Water, Office of Science and Technology, Washington, DC
14 Guidelines for Drinking-Water Quality. World Health Organization, 2011

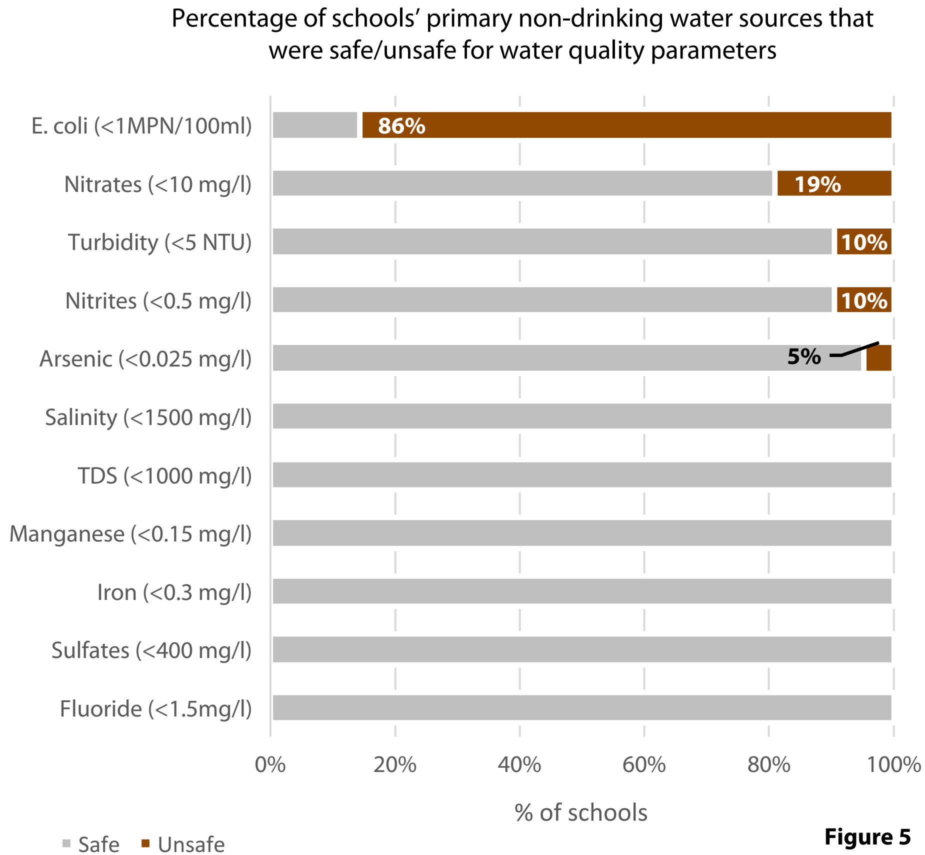


Figure 5

Water affordability

With the provision of an on-site water treatment system, schools no longer had to pay for drinking water. Lifting this financial barrier significantly increased safe water consumption. Additionally, it saved schools and/or the parents on average $5,422 Mexican Pesos per year ($283 USD). While this may not seem like a large sum to an outsider, the diagnostic team discovered this is often larger or comparable to the annual budget provided by the parent's community of most schools. Parents and schools report receiving no financial support from the government except in the form of salaries. As a result, all supplies (e.g. learning, cleaning, water) and any repairs needed are financed by the parents who are often from low-income backgrounds. Free safe water is a significant gain for a school and the surrounding community.

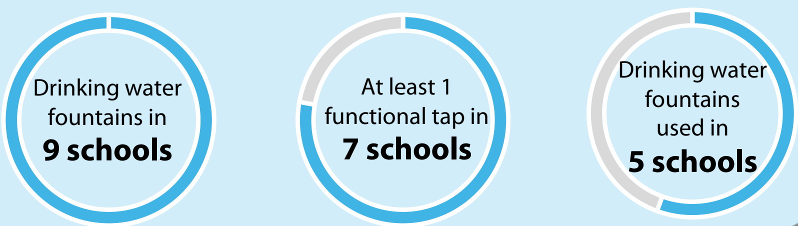
Figure 6

On average schools save $5,422 pesos per year with the provided on-site water treatment system vs. buying bottled water. This is equivalent to the annual budget provided by parent's communities of many schools.

Box 2: Drinking water fountains in schools

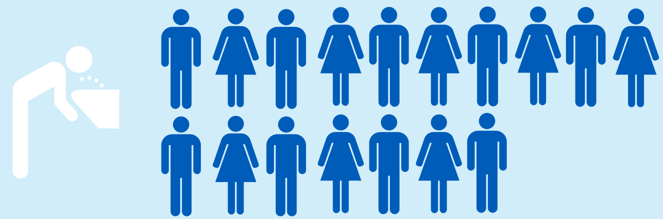
In 2015, drinking water fountain programs in Mexican schools began as a component of a larger education reform plan. In Chiapas, the majority of these programs were sponsored by the Institute of Educational Infrastructure at the national level (INIFED) and at the state level (INIFECH). The programs are meant to include free access to a sufficient quantity of safe water, manage the installation, and maintain the drinking water fountain systems. In 9 out of the 21 schools drinking water fountains had previously been installed. Technically this means on-site water treatment systems were already available, but from the evaluation it was determined the improvements FCA made to the water supply and water quality at the school were still necessary and had significant positive impacts.

Prior to the intervention, FCA determined drinking water fountains had been installed in 9 schools. However, in only 7 schools did they find at least one functional drinking water fountain tap, and of these 7 schools only 5 reported using them. The two schools with functional taps reported the children did not like the taste and/or perceived the water was not safe for consumption.



1: 90
Tap-to-student ratio

1: 158
Functional tap-to-student ratio



The number of provided taps was not sufficient. Considering the current functionality, there was only one usable tap for every 158 students on average per school. If all taps were functional it would be on average only one tap for every 90 students per school. From structured interviews with school staff, they confirmed that the quantity of water provided by the drinking water fountains was not sufficient.

Box 2: Drinking water fountains in schools (cont.)

In all 9 schools, they reported purchasing *garrafones* prior to the intervention to supplement water from the drinking water fountains. With the purchased *garrafones*, on average students consumed 0.13L/day. Post-intervention data revealed the water from the water treatment system FCA installed, had been utilized at a significant rate and average water consumption per student per day increased to 0.45L. Two studies in Europe actually found water fountains led to inadequate hydration in schools and ultimately resulted in dehydration[9,10].

While the system may not be able to cover all drinking water needs, all functional taps provided safe water. Additionally, in the 5 schools that reported using the fountains they report the children used them frequently and enjoy the taste. However, during interviews, staff often complained about maintenance. In 1/3 of the schools they did not know who to contact in the event of a breakdown, 60% of schools they received no training on how to maintain the system, and the average age of drinking water fountains is 3 years. While they are a helpful addition to safe water supplies at schools, there is evidence drinking water fountains would not be sufficient as the only safe water facility available.

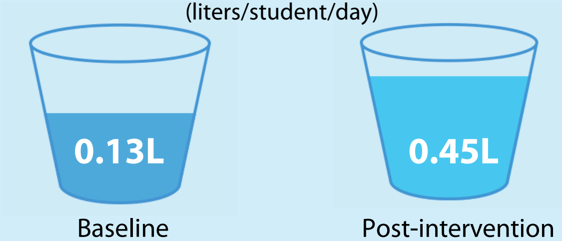
NO training 60%

NO maintenance 33%

Avg. age 3 YRS

100% taps SAFE

Supplemental water consumption
(liters/student/day)



WHO INSTALLED?

45%	INIFED
33%	INFECH
22%	Don't know

9 Hunter, M. L., et al. "Fluid for Thought: Availability of Drinks in Primary and Secondary Schools in Cardiff, UK." International Journal of Paediatric Dentistry, vol. 14, no. 4, 2004
10 Kaushik, A., et al. "A Study of the Association between Children?s Access to Drinking Water in Primary Schools and Their Fluid Intake: Can Water Be Cool in School?" Child: Care, Health and Development, vol. 33, no. 4, 2007

Impact: Sanitation & hygiene

Usable toilet-to-student ratios
Data collected from twenty-one schools found that as a result of the intervention, 22 sanitation facilities were constructed and 151 of 172 sanitation facilities were rehabilitated with the goal of ensuring a sufficient number of improved, usable sanitation facilities met the minimum requirements of the Mexican government [see Table 2][17]. An "improved" and "usable" sanitation facility, for the purposes of this intervention, is defined as a flush/pour flush toilet, pit latrine with slab, or composting toilet, which is single-sex, functional, and protects the privacy of the user[7]. The sanitation improvements undertaken during the intervention benefitted 4,818 students.

At baseline, we found only 11% of sanitation facilities were usable [see Figure 9]. Leaving on average only one usable facility for every 114 male students and every 111 female students [see Figure 7]. It was common to find only one or two usable sanitation facilities for an entire school at baseline. After the improvements FCA made to the school WaSH environments, access to a usable sanitation facility increased 5-fold for both male and female students. On average, there was one usable sanitation facility for every 24 male students and every 22 female students.

17 INIFED "Normas y especificacions para estudios, proyectos, construccion e instalaciones", Mexico City, MX. Volume 3 Volume Architecture Design, 2014
7 "Drinking water, sanitation and hygiene in schools: global baseline report 2018. New York: United Nations Children's Fund (UNICEF) and World Health Organization, 2018

Avg. Student-to-toilet ratios (usable)

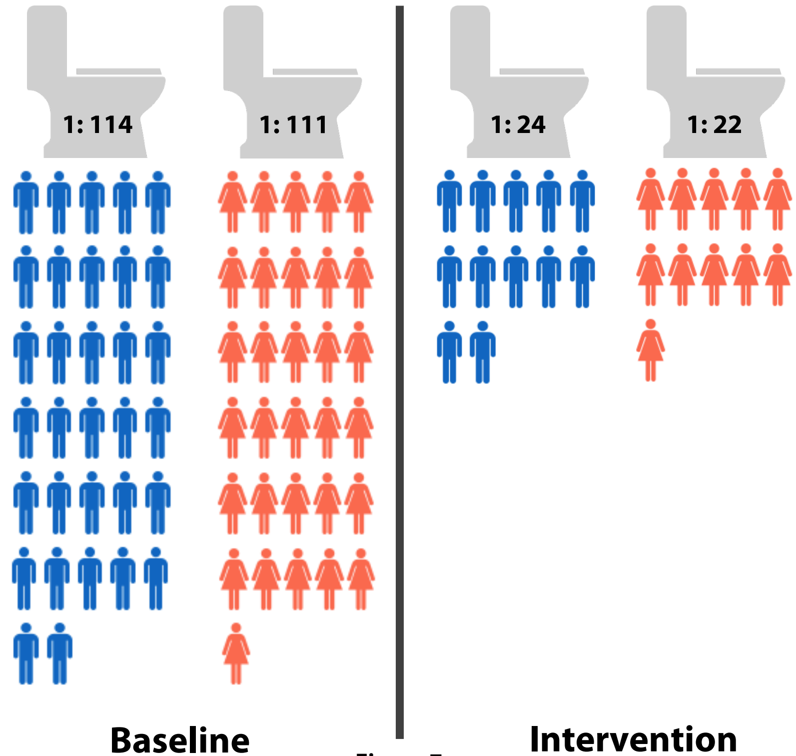


Figure 7

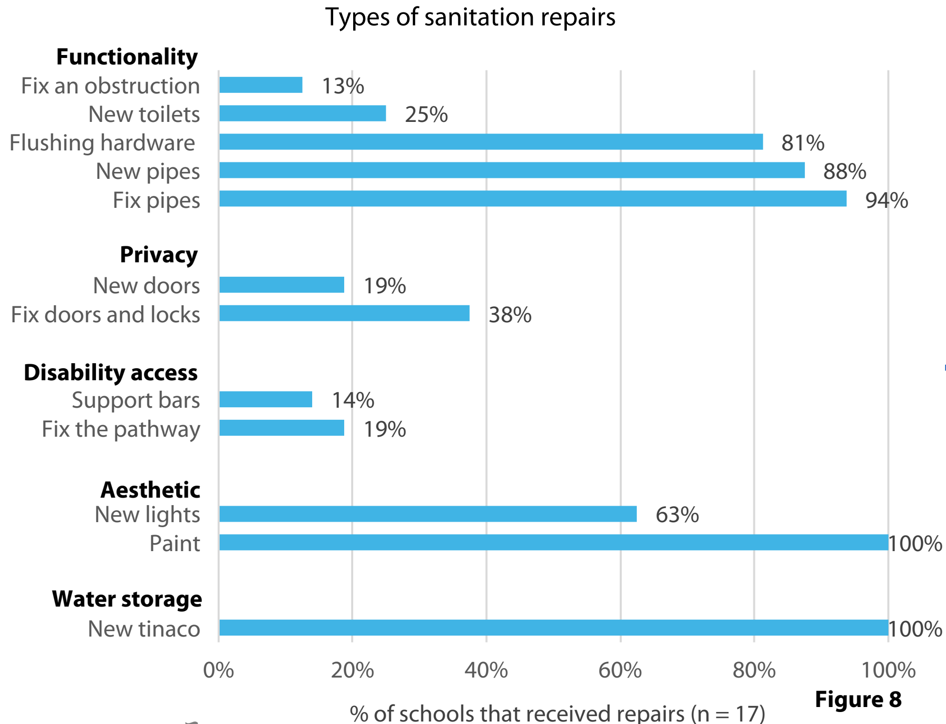
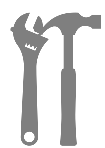


Figure 8

New sanitation facilities in 4 schools



Sanitation facility repairs

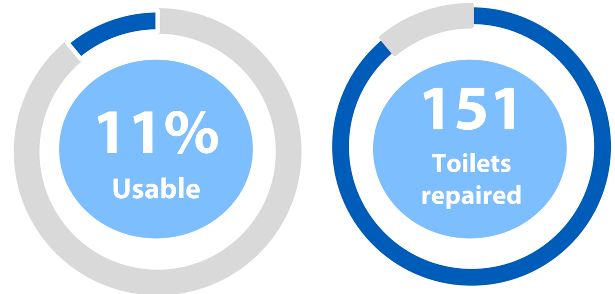


Figure 9

However, not all schools met INIFED's standards for toilets [see Table 2 at post-intervention. In particular, 16 out 21 schools met the standards for girls and 19 out of 21 schools met the standards for boys. For male students the ratio was unmet in large schools (>500 students). However for female students the ratio was unmet in two large schools and in two small schools (<100 students). In the small schools only one sanitation facility was available per sex while the standards state that there should be at least two sanitation facilities available for female students. In the 5 schools where the standards were unmet, only one or two additional sanitation facilities per sex are required to meet INIFED's standard requirements.

Sanitation facility maintenance & repairs

The low rate of usable sanitation facilities at baseline (11%) highlights a critical gap across these schools and the WASH sector at large – developing an innovative and effective way to ensure behavior change and habit formation among teachers and pupils to ensure adherence to toilet maintenance. From structured interviews with school staff and focus groups with students it was determined toilet maintenance was a common issue that plagued schools. It was not unusual for toilets to remain in disrepair for several years. Staff often cited finances were a major reason for the pervasive state of disrepair. In addition to finances, many reported that a common reason for not fixing sanitation facilities is because they were just accustomed to this level of disrepair in bathrooms and didn't think it was absolutely necessary to repair the facilities.

FCA performed a range of repairs to the sanitation facilities to ensure they were usable [see Figure 8]. From the rehabilitations, beyond aesthetic issues, it was found that increasing water storage capacity to ensure the flush toilets were functional was the most common repair. All 17 schools, where sanitation facilities were rehabilitated, required an extra *tinaco* (storage container of 2,000 to 1,500 liters that typically reside on the roof). After water storage, the most common type of repair concerned functionality – fixed an obstruction, new toilets, flushing hardware, replace pipes, and/or fix broken pipes. Functionality repairs were required in at least 94% of schools (16 out of 17). Privacy repairs - repairing doors, locks, and providing new doors - were required in 38% of schools (6 out of 17). Finally, disability-accessible-related repairs of sanitation facilities were performed in 19% of schools (3 out of 21 schools). It should be noted that more disability access repairs were not made because in many schools the repairs required would have been extensive and the required investments were not feasible. These repairs highlight that water supply and functionality may be among the most pressing issues for sanitation facility usability and there should be a focus on toilet maintenance in future programs .

Installation and use of new latrines

In four schools, new dry ecological latrines were installed. In three schools, the sanitation facilities had been damaged by the earthquake and the buildings were deemed not structurally sound by INIFED, however FCA did find the children were still using the facilities at baseline. In one school, the children only had access to unimproved pit latrines that were of very poor quality. Originally the implementing organization intended to provide statistics on usage and perceptions of the new sanitation facilities, however at their second follow-up visit the new facilities had not yet been used by any of the schools. From conversations with school staff, in three schools FCA enumerators discovered school staff believed that the facilities were still not finished. This is a result of poor communication. In these three schools, it is true at least one toilet required additional maintenance but the majority were finished and ready to be used. In the fourth school, construction was taking much longer than expected and at the time of the second follow-up visit by the monitoring and evaluation team, none of the facilities were finished.

Photo credit: Carlos Alberto Cordero Contreras

Avg. Student-to-handwashing facility ratio
(functional)

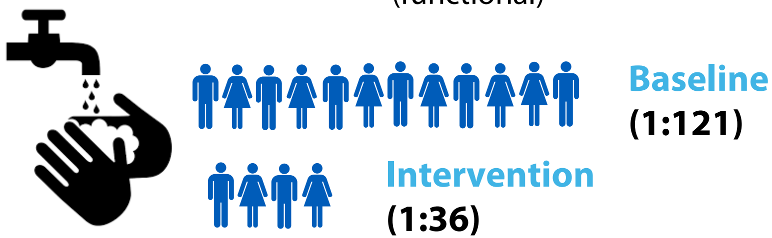


Figure 10

Handwashing facility repairs

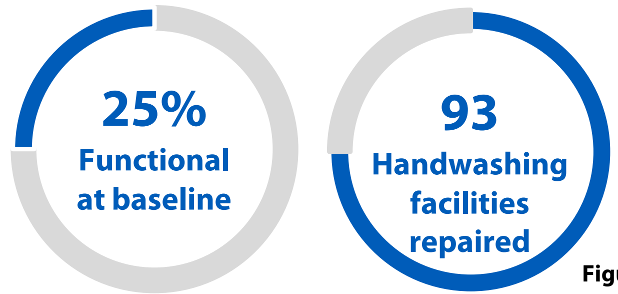


Figure 11

Handwashing facility functionality
Data collected from 21 schools found that as a result of the intervention, 6 new handwashing facilities were installed and 93 handwashing facilites were rehabilitated [see Figure 11] with the goal of ensuring there was at least one functional handwashing station (i.e. provides running water) within 5 meters of each bathroom.

At baseline, it was found that only 25% of handwashing facilities were functional [see Figure 11], leaving on average only one functional handwashing facility for every 121 students. Similar to sanitation facilities, it was common to find only one or two functional handwashing facilities at each school. Research from a study in Colombia, suggests that children with access to handwashing facilities and materials were 3x more likely to consistently wash their hands with soap before eating and after toilet use[8]. After the improvements FCA made to the school WaSH environments, access to a functional handwashing station increased nearly 3.5-fold (1:36).

Many children learn some of their most important hygiene skills at school, and for many this is where they are introduced to hygiene practices that may not be promoted or possible in the home. However, good hygiene behavior and the effectiveness of hygiene promotion in schools are severely limited where water supply, sanitation facilities, and hygiene facilities are inadequate or nonexistent. Teachers cannot credibly convey the importance of handwashing if there is no water or soap in the school, or promote proper hand hygiene after toilet use if they themselves avoid their use because the toilets are non-functional, dirty, or unsafe.

Overall, it is important to ensure that environmental health conditions are enabling and acceptable. Adequate water supply, sanitation and hygiene are crucial foundations of a healthy school environment. The intervention successfully assisted in improving WaSH environments in 21 schools in Chiapas, Mexico.

8 "Jasper, Christian, et al. "Water and Sanitation in Schools: A Systematic Review of the Health and Educational Outcomes." International Journal of Environmental Research and Public Health, vol. 9, no. 8, 2012

Challenges & lessons learned

While the ‘Improving School WaSH Environments’ intervention discussed in this case study saw a successful increase in safe water consumption, access to usable sanitation facilities, and access to functional hygiene facilities, the intervention encountered some hurdles. Some key challenges and lessons learned include:

- **Meeting original construction timelines proved challenging**. This was due to a combination of unforeseen delays, poor planning, and tight timelines. Schools shut down unexpectedly and without warning for up to a week multiple times, due to teacher strikes, causing delays. Construction took place in schools dispersed across multiple state regions and our team faced difficulties managing timelines and construction (i.e. motivating crews) across the 21 schools. School vacations and unexpected strikes constricted our timelines significantly and we did not leave room in our plan for delays. Improvements in strategic planning for future projects are currently under review.
- **Access to free, on-site, safe water can significantly increase daily water intake.** While 20 out of 21 schools had access to safe water prior to the intervention, we still saw daily water intake increase in all schools with the provided on-site water treatment system. Purchasing water and bringing water from off-site created a barrier. In many schools, it presented a financial barrier restricting the number of *garrfones* that could be purchased. In some schools, finances were not cited as a major barrier, instead we observed that convenience and access played a larger role in restricting water. Staff would purchase water at beginning of each week and even if the water was consumed before the week was over they would not purchase more till the following week. When asked why the staff reported simply, ‘this was the schedule’. Having access to free, safe water, on-site markedly increased daily water consumption.
- **On-site water treatment systems can be properly maintained by staff**. With on-site water treatment systems, the primary issue reported is ensuring the users consistently treat the water correctly. We found during our second follow-up (~10 weeks after the intervention) that all 21 schools were producing safe water with the system. This confirms both our system is relatively easy to use and the training we provided was effective in teaching correct usage of the system, ensuring students consume safe water.
- **Drinking water fountains and on-site water treatment systems in schools can complement each other**. We found in the 5 schools where the drinking water fountains were functioning and reportedly used, the schools reported using both systems frequently. School staff reported the children enjoyed the taste of water from the drinking fountains because it was cold, which encouraged children to drink water. Additionally, from interviews with school staff and installed water meters we found the on-site water treatment systems were also being used at a substantial rate because they could easily provide a larger quantity of water that the children enjoyed. The systems do not compete. Both provide safe water and encourage children to drink more, overall improving the health of the students.

- **Committee members change every year, potentially compromising institutional knowledge and continued proper maintenance of water treatment system.** During our capacity strengthening programs we created water committees to manage the water treatment system. While we found they operated very successfully, members change every year and we found incoming members may not be trained effectively by former members. This could have impacts on the future maintenance of water treatment. Finding methods to pass on training will ensure future students will always receive safe water.
- **Ensuring there is a disability accessible sanitation facility in every school will require a significant investment**. We found 1/3 of the schools included in the intervention had at least one student or staff member had limited mobility, however we found no bathroom was disability accessible (grab bars in the stall, at least 150cm diameter floor space to allow a wheelchair to make a 180-degree rotation, and a flat pathway and accompanying ramps from classroom to the bathroom[16]). We rehabilitated facilities in 3 schools to ensure they were disability accessible, including one school specifically designed for students with special needs. However, in most schools we found a substantial amount of construction would be required to adapt a bathroom stall that had the required floor space. Creating more inclusive WaSH spaces in Mexican schools is crucial but will require planning and a large financial investment.
- **Innovative and effective ways to ensure staff and students maintain toilets and hygiene facilities may be a critical gap in the sustainability of WaSH interventions**. Our educational activities focused on healthy environments, disease transmission, and hygiene promotion, like many published WaSH interventions, but from interviews and observations we discovered they may not address one of the root causes of poor WaSH practices in these schools.

Traditionally habit change has focused on consistent and hygienic use of WaSH facilities. However, we discovered that in all schools when access to improved WaSH facilities was increased correct behaviors also increased (i.e. handwashing with soap and increased consumption of safe water). At baseline, we found that adequate access was severely compromised because the facilities had not been well maintained and left in disrepair. In many cases the repairs were relatively inexpensive, for example replacing toilet flushing components costs $150 MX ($8 USD), still 81% of schools had not taken steps to fix this issue [see Figure 8]. While we improved access, in the future if something breaks the schools may not take the necessary actions to repair the facility and school WaSH environments may be compromised. Creating behavior change strategies that focus on proper maintenance of facilities could significantly increase the sustainability of school WaSH interventions

16 Mactaggart, Islay, et al. "Access to Water and Sanitation among People with Disabilities: Results from Cross-Sectional Surveys in Bangladesh, Cameroon, India and Malawi." BMJ Open, vol. 8, no. 6, 2018,

Recommendations for future work

It is important to ensure that environmental health conditions are enabling and acceptable. Adequate water supply, sanitation and hygiene are crucial foundations of a healthy school environment. The following are recommendations to strengthen future WaSH interventions in schools in Mexico:

- Develop and implement behavior change strategies that focus on effective ways to ensure staff and students maintain sanitation and hygiene facilities. Poor maintenance reduces access to improved WaSH facilities and reduced access can impede healthy hygienic practices.

- Work with schools to develop system to provide free/cheap safe water to families. The systems we delivered could provide water to the community, ensuring students consume safe water inside and outside of the school.

- Help develop methods to pass water committee training on to future committees to maintain institutional knowledge. Committees change members every year and training may not be effectively passed on to future committee members.

- Promote on-site water treatment systems even where schools already buy bottled water and drinking water fountains exist. Access to free, on-site, safe water can significantly increase daily intake of safe water.

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