

WASHPALS FINAL REPORT

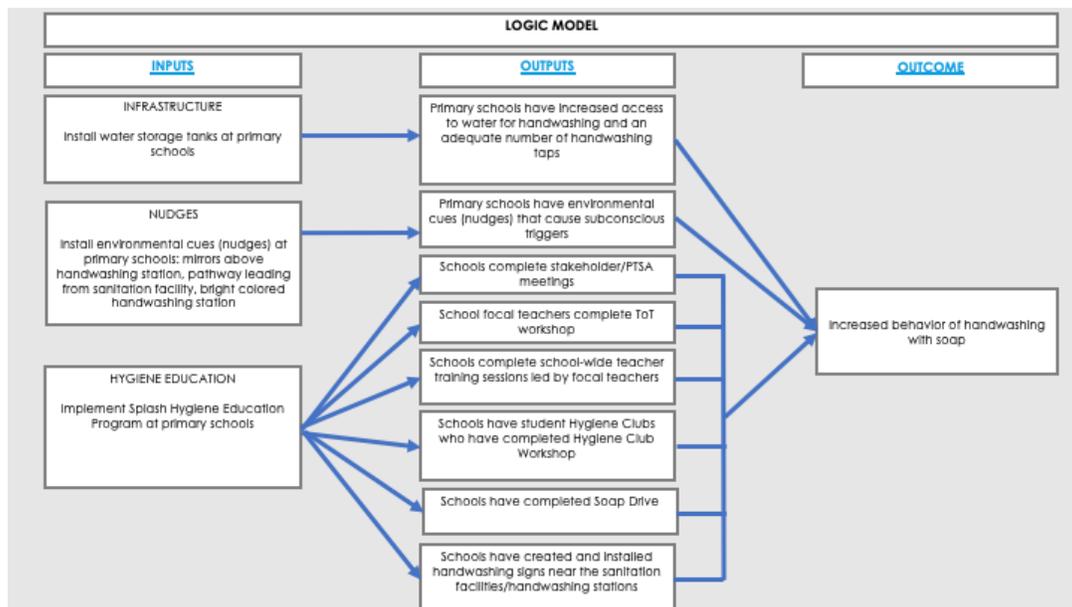
OVERVIEW

To promote the emergence of innovative approaches to changing hygiene behaviors, USAID funded Splash International to test the introduction of subtle environmental nudges in school and household settings to influence the adoption of handwashing with soap by children and their families. The grant expands upon previous research demonstrating that nudges placed at school facilities alone are effective in increasing handwashing practices by students. On November 8, 2018, Splash notified WASHPaLS that results from the baseline assessment showed higher than anticipated handwashing rates in both schools and homes, leaving the study underpowered to document impact from proposed interventions, and, thus, unable to answer the proposed study questions. Follows are detailed findings and lessons learned from the study.

TWO-STUDY APPROACH

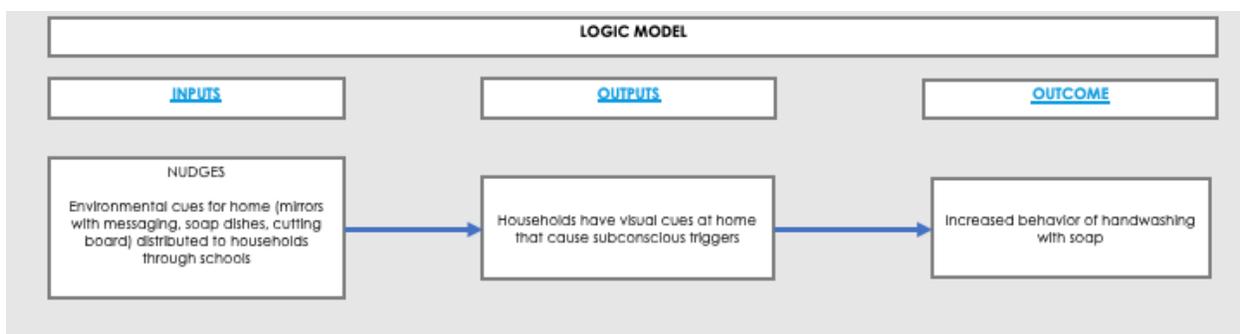
The experiment was divided into two studies focused on behaviors at schools and households. The school-focused study (Study A) asked: What is the impact of nudges in combination with hygiene education, compared to nudges alone? As outlined in the below logic model, Splash planned to introduce environmental nudges in six Ethiopian government schools—the installation of colorful handwashing stations, mirrors above them, and pathways leading from the bathroom to the handwashing stations. An additional six schools would receive the same nudges paired with hygiene education through focal teacher training, student hygiene clubs, child-to-child training, and school-wide events like soap drives. Results from these twelve schools were to be compared against each other and another six schools not receiving any intervention.

FIGURE 1: STUDY A LOGIC MODEL



The household study (Study B) was carried out in households of children attending a school that does not receive any Splash interventions to explore the impacts that household nudges, when distributed through schools, have on handwashing behavior in the home. The study sought to leverage key moments and “quick wins” where parents and families already interact with schools, such as school registration, parent meetings, and parent-teacher associations, to send nudges home with families for households to put in place and use. As outlined in the below logic model, nudges that were to be tested included the provision of a mirror with visual messaging, soap dish, and cutting board for food preparation. Splash planned to assess handwashing behavior via proxy measures in 120 households receiving a nudge compared with the same number that would act as a control group.

FIGURE 2: STUDY B LOGIC MODEL



The primary initial objectives we hoped to meet with this research were to: 1) Assess the effect of Splash’s WASH model on the hygiene practices of students; 2) Determine if and how much child-focused nudges affect hygiene behavior at schools; and 3) Determine the effectiveness of household nudges when using schools as a platform for reaching families. At schools, we proposed to rely on structured observation of handwashing (with soap) behaviors in order to assess the adoption of new behaviors by children. This work would include a baseline assessment, a mid-line assessment and an end-line assessment at selected schools and households. Unbiased, external enumerators would be used to conduct school and household surveys. Household questions and observations would assess existing WASH infrastructure at the home, and secondary indicators, like soap availability (proximity to taps). In each group, we planned to compare the baseline, mid, and end assessment results against each other with the assumption that results will spike and then level out over time. Splash planned to also compare the control groups to treatment groups, with the assumption that treatment groups would have better results.

BACKGROUND ON GRANT ACTIVITY

This grant aimed to expand upon the positive results from a previous pilot study Splash conducted in Nepal, testing the use of mirrors and other physical nudges in Ethiopian government schools alongside educational programs and comparing these results with 1) nudge programs without a hygiene education component, and 2) a control group. Additionally, we aimed to explore whether school-based programs would have a positive impact on home behaviors, testing the efficacy of using schools as a platform for distributing household nudges. Based on our belief that interventions focused directly at the school have great potential to influence the community, we proposed to reach children under five through targeting two influential populations: older siblings and parents. Splash would use nudges to affect the behaviors of children at school. Potential nudge approaches we initially proposed included the installation of mirrors

above handwashing stations, footprints leading from the bathroom to handwashing stations, and/or colorful posters that contain hygiene messaging. We also anticipated that the installation of new Splash fiberglass stations themselves, which are fun, colorful, and kid-friendly, would serve as a nudge. Splash would provide nudges to parents and households during existing school events, such as student registration or parent meetings. These household nudges would be provided for families to bring home and place in their house in order to influence all household members. Some potential household nudge approaches we initially proposed included providing families with calendars that contain hygiene messaging; mirrors to take home and hang or use near handwashing stations; a water barrel and scoop for handwashing; and/or soap holders or dispensers to encourage handwashing.

MILESTONES ACHIEVED AND MODIFICATIONS REQUESTED

A summary of each milestone, including accomplishments, delays, challenges encountered, and scope modifications are outlined in Table 1 on Page 4. The grant started on January 5, 2018. During the first quarter of 2018, Splash submitted the Work Plan (Deliverable 1) and Gender Analysis (Deliverable 2a), in accordance with the work plan and deliverables schedule. In March 2018, we submitted our final Study A protocol to WASHPaLS (in partial fulfillment of Deliverable 2) and finalized multiple rounds of revisions with both WASHPaLS and Matt Freeman from Emory University (contracted by Splash to assist with the statistical analysis for this study) in preparation for Study A submission to IRB. We also completed a vetting process to select the final eligible schools amongst 45 potentials (that met population size and infrastructure requirements) to select from for the study.

In April, we updated the grant workplan and study timeline and submitted to WASHPaLS for review for consideration of a no-cost extension, and to extend the period of performance of the award to accommodate unexpected delays in initial implementation. WASHPaLS agreed to the no-cost extension, to extend the period of performance of the award by 4 months, to update estimated due dates for deliverables 4 - 8, and to revise the Implementation Schedule accordingly. We requested the extension to account for Study B revisions based on WASHPaLS feedback and information gathered during household surveys in Addis Ababa. IRB submission in Addis Ababa, Ethiopia and USA were delayed due to these changing study protocols and also the site selection process, which took longer than expected due to school infrastructure constraints in Addis. This extension also allowed us to conduct the study during a single academic year without an extended summer break and potential changes to school staff and students between data collections.

In July, we received the Ethical Clearance Letter (with study number and stamp) from the Addis Ababa Health Bureau for Study A. On July 10, 2018 we also received approval from the US IRB via Emory University. That month we also submitted a draft of the Study B protocol to WASHPaLS for review and incorporated Study B feedback from Matt Freeman. As a result of this feedback, we agreed to remove the water barrel/handwashing station from the design entirely. Instead, Group 1 (Treatment) would receive a nudge package: mirror with message, soap dish, and cutting board. Group 2 (Control) would receive nothing. In August, we submitted our Study B protocol to WASHPaLS for final approval and to IRB for review and approval. On August 29, 2018 we received approval from the US IRB via Emory University. In August, we also held enrollment meetings with Study A schools. On September 5, 2018 we secured ethical approvals from both US and Ethiopia bodies for the WASHPaLS Study B (Household) research, in the form of an amendment to the Study A approval from Emory University and via the Addis Ababa Health Bureau.

In early September, we completed a pilot of the survey tools for both studies and finalized the survey revisions. Subsequently, we led an in-person enumerator training in preparation for baseline data collection for Study A. These enumerators conducted Study A baseline data collection between October 1-19. At this time, Splash also began procurement of nudges and nudge materials. For Study B, we announced the study opportunity to households at a scheduled school meeting at the beginning of the academic year on October 7. We then conducted parent meetings in order to enroll household participants in the study, enrolling 198 on October 14 and an additional 80 on October 21. We also led a three-day enumerator training in preparation for baseline data collection for Study B. These enumerators conducted baseline data collection between October 17-26. At this time, Splash began procurement of all household nudges.

We did not begin infrastructure and nudge installations or distributions, nor hygiene education activities, as originally scheduled in November, due to concerns that we had about the viability of this study, and, particularly, the budgetary implications of altering either the research question or sample sizes at this late date, given the baseline data analysis findings. More detail on these findings may be found in the results in the sections that follow. In total, we met five grant milestones. In addition, Splash developed a [poster](#) for presentation at the 2018 International Social and Behavior Change Communication Summit in April, which was viewed by 1,200 people and for the Global Handwashing Think Tank in October, that was viewed by 74 people.

TABLE I: MILESTONE SCOPE AND DELIVERABLES

MILESTONE PLAN					
NO	DESCRIPTION AND REQUIRED DELIVERABLES	INITIAL ESTIMATED DUE DATE	REVISED DUE DATE (IF CHANGE REQUESTED)	MILESTONE COMPLETED (YES/NO)	AMOUNT
1	Work Plan: Work Plan using the template provided by WASHPaLS. Call or comment sessions by WASHPaLS prior to the finalization and acceptance of the plan (WASHPaLS will commit to a call within 1 week of submission)	30 Days	N/A	Yes	\$19,993
2	Research Protocol: Research Protocol using the template provided by WASHPaLS including draft surveys and assessments for WASHPaLS review and approval	45 Days	5 months	Yes	\$19,993
	Gender Analysis: Complete gender analysis using format provided by WASHPaLS for WASHPaLS review and approval. Call session with WASHPaLS gender team to initiate gender analysis, followed by comment session by WASHPaLS prior to the finalization and acceptance of the plan		5 months	Yes	
3	Ethiopia IRB Approval: IRB approval or exemption letter	90 Days	5 months	Yes	\$0
4	Assessment: Assessment utilizing templates previously approved by WASHPaLS including indicator information and supporting documentation	6 Months	April 30, 2019	Yes	\$19,993

MILESTONE PLAN					
NO	DESCRIPTION AND REQUIRED DELIVERABLES	INITIAL ESTIMATED DUE DATE	REVISED DUE DATE (IF CHANGE REQUESTED)	MILESTONE COMPLETED (YES/NO)	AMOUNT
5	(i.e., photos, participant lists, etc.). The Baseline Assessment / Topline Report (4) will describe the methodology and include basic descriptive statistics. Midline and Endline Field Updates (5/6) will not include data analysis, only reports from the field, anecdotal observations and learning, deviations from protocol, challenges and remediation. Analysis of treatment groups compared to control groups will take place post-Endline Assessment and be included in Final Report.	9 Months	Removed	N/A	
6		14 Months	Removed	N/A	
7	Final Report Draft: Draft Final Report submitted to WASHPaLS. Call or comment sessions by WASHPaLS prior to the finalization and acceptance of the plan (within 1 week of submission)	15 months	Removed	N/A	
8	Final Report Dissemination: Final report, PowerPoint presentation of dissemination, photos of event and participant lists.	16 months	Removed	N/A	
Total					\$59,979

STUDY A RESULTS

POWER CALCULATION & ASSUMPTIONS

We assumed a baseline handwashing prevalence of 10%, derived from Splash’s prior formative research on school handwashing, and standard deviation of 11.2, derived from Caruso and colleagues¹ in Kenya, one of the few studies that collected structured observations of handwashing. Assuming a minimal detectable difference of 10% to 30% between the *control* and *nudges only* groups and a difference of 30% to 50% between *nudges only* and *hygiene education + nudges*, we calculated a sample size of 6 schools per group when making these two comparisons.

SAMPLING APPROACH

Splash conducted a city-wide survey of all public schools in Addis Ababa in 2016 and used this list to identify all co-educational, public primary schools serving grades 1-8 in Addis Ababa who had not received a prior intervention from Splash, all of which would be eligible for inclusion subject to the below criteria. The Addis Ababa Education Bureau also provided Splash with total student enrollment numbers for all public primary schools as of January 2018. This was used to identify schools that met our inclusion criteria with total student populations between 150-600. Total student population was selected based on budgetary constraints around the amount of infrastructure to be provided to each school in order to meet target ratios. Splash staff contacted these schools by phone in January 2018 to ask questions

¹ Caruso, B. A., Freeman, M. C., Garn, J. V., Dreibelbis, R., Saboori, S., Muga, R., & Rheingans, R. (2014). Assessing the impact of a school-based latrine cleaning and handwashing program on pupil absence in Nyanza Province, Kenya: a cluster-randomized trial. *Tropical medicine & international health*, 19(10), 1185-1197.

regarding water availability and existing infrastructure, identifying those that met inclusion criteria below. In-person visits were conducted by Splash staff in February 2018 to verify that schools met the inclusion criteria, as outlined below. None of the schools identified shared a compound.

Inclusion criteria:

- Total student population between 150-600
- Water availability: standard municipal supply connection with regular flow at least 3 times per week
- Sanitation facilities: existing gender-segregated toilets
- Sanitation facilities: existing stall to student ratio of at least 1:100
- Handwashing facilities: existing tap to student ratio of at least 1:100
- Existing handwashing facilities located at or near existing sanitation facilities

Exclusion criteria:

- Prior intervention from Splash
- Selected schools must not share a compound with each other, though they may share a compound with a school that is not participating in the study

Of the 22 schools identified, 8 were of size 150-375 (Type A) and 14 were of size 376-600 (Type B). Splash used stratified random selection to ensure an equal distribution of schools with similar population sizes. The list of Type A schools was numbered from 1-8 and the list of Type B schools was numbered from 9-22. We also blinded school names. Ultimately, 6 Type A schools and 12 Type B schools were selected for participation by Matthew Freeman, using a random number generator in Excel. To ensure that we considered a gender balance when we conducted site selection at schools, Splash only selected co-ed schools for the study. Splash was not intending to analyze only male or only female hygiene related behavior; however, the study was designed with the particular needs of males and females in mind. Splash was eager to compare the behaviors of males and females in a shared environment.

DATA COLLECTION AND INCLUSION CRITERIA

Data collection was conducted by external enumerators employed by Zeleman, a research firm in Addis Ababa contracted through a competitive, open proposal selection process. These enumerators were trained by Splash to conduct observations of student handwashing behavior, which took place over at least three, but not more than six, consecutive days. On arrival at the site, the enumerator announced their presence to school officials, but no school officials were present during observation. Each observation took place over 1.5 hours; approximately 30 minutes prior to morning break time, and 30 minutes after morning break time. Enumerators positioned themselves in a location close to the exit of at least one sanitation facility and where handwashing stations could be observed. To reduce observation bias, this location was as far from the students as possible, while still allowing accurate observation of behavior at handwashing stations. Enumerators were instructed not to speak to students unless directly addressed, in which case they were directed to simply indicate that they were present at the school to, “learn about school operations.” In order to reduce observation bias and normalize results, at least three consecutive days of observation were conducted at each school.

Splash required that water be flowing from at least half of taps present at handwashing stations in order for a school to be observed during the visit. If water was not flowing from at least half of taps present on

arrival, we required that the enumerator leave without conducting observation and return on a consecutive day. If water flow was interrupted during the observation period, we required the enumerator to end the observation, record why the observation was ended, and return on a consecutive day. To complete an observation, we also required at least two toilet stalls (one male and one female) be accessible (not locked from the outside or otherwise blocked), functional (pan not broken or clogged) and in use during the observation period. On arrival at each school, enumerators were required to instruct teachers to unlock/unblock as many toilet stalls as possible at least 15 minutes prior to beginning their observation. If no toilet stalls were found functional, the enumerator would be required to leave without conducting an observation and return on a consecutive day. If some stalls became dysfunctional during the observation period, the enumerator would continue the observation without interruption. If all stalls became dysfunctional during the observation period, the enumerator would end the observation, record why the observation was ended, and return on a consecutive day.



Photos from Study A Enumerator trainings

Splash required that at least one piece of soap must be present for every functional tap being observed prior to the observation (1:1). If soap was not already present, or was not present in the desired quantity, enumerators were required to instruct teachers to place soap at least 15 minutes prior to beginning the observation. Enumerators were required to always carry soap with them and provide this soap to teachers if they did not have access to a sufficient supply. If some soap was removed or used up during the observation period, the enumerator would continue the observation without interruption. If all soap was removed or entirely used up during the observation period, the enumerator would end the observation, record why the observation was ended, and return on a consecutive day. Enumerators observed as many students as possible on each day at each school, up to a maximum of 75, during the observation period (1.5 hours).

Data collection tools and analysis plans enabled us to measure results and disaggregate by biological sex. Enumerators were asked to observe both males and females as they exited the toilet facilities. We did not control to ensure we observed an equal number of males and females. Observation was random based on actual circumstances during the observation period. During study observations, enumerators were also asked to mark down the approximate age of the person being observed, to enable data disaggregation based on approximate age and to consider whether there are any behaviors that correlate to menstruation age for girls.

BASELINE FINDINGS

In total, enumerators attempted to observe 18 schools. Three successful consecutive days of observation were completed at 14 schools. At 2 schools, data collection inclusion conditions were not met for the duration of the observation period, but ‘incomplete’ observations were collected, while inclusion conditions persisted. At 2 additional schools, data collection was not possible on any of the enumerators 6 attempted visits due to lack of water availability. We assessed the overall prevalence of handwashing with soap (HWWS) from student observation data (binary), adjusting for clustering at the school level, using a survey means command in STATA and not a “modeling” approach. There were no significant differences between observation dates, so all data were included in baseline estimates. The school-level mean of handwashing with soap at Baseline was found to be 37.0%. Detailed findings from Study A are attached in Annex A and detailed in Table 2 below.

TABLE 2: HANDWASHING WITH SOAP (HWWS) 37.0%

	Mean	Linearized Std. Err.	[95% Conf. Interval]	
HWWS	.3698459	.0330762	.2993457	.440346

BASELINE BUDGETARY AND OPERATIONAL IMPLICATIONS

Our power calculation was done using a baseline prevalence (10%) estimated using our formative research and a standard deviation (11%) estimated from Caruso, et. al., one of the few, if only studies, to report variance on student level handwashing with soap following toilet use. The standard deviation derived from the baseline was, at 17%, only slightly higher than the estimated standard deviation. However, the baseline was 37%. Given these two factors, we did not believe that we would be able to see the required minimum detectable effect with the given sample size, which was highly constrained by budget. The two charts below show the two comparisons. Table 3 below shows the comparison between Group 3 (Control) and Group 1 (Nudges only) which was 37% to 67%. Table 4 below shows the comparison between Group 1 (Nudges only) and Group 2 (Nudges plus education) which was 67% to 97%, assuming the previous change.

TABLE 3: COMPARISON BETWEEN GROUP 3 (CONTROL) AND GROUP 1 (NUDGES ONLY)

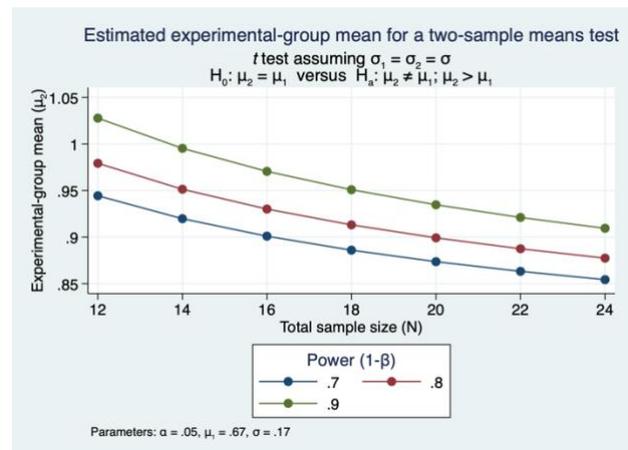
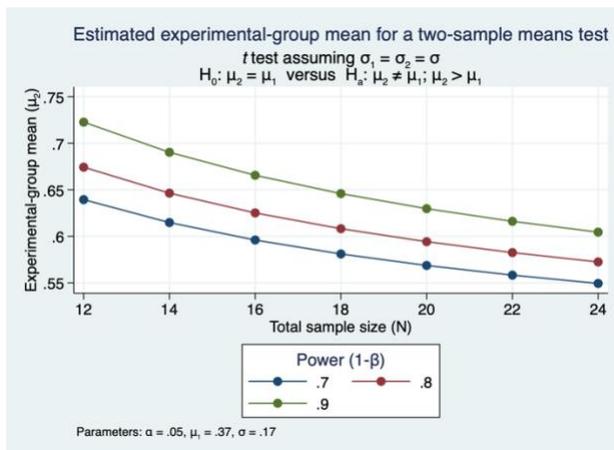
alpha	power	N	N1	N2	delta	m1	m2	sd
.05	.8	12	6	6	.3052	.369	.6742	.17
.05	.8	14	7	7	.2774	.369	.6464	.17
.05	.8	16	8	8	.2561	.369	.6251	.17
.05	.8	18	9	9	.2392	.369	.6082	.17
.05	.8	20	10	10	.2252	.369	.5942	.17
.05	.8	22	11	11	.2135	.369	.5825	.17
.05	.8	24	12	12	.2035	.369	.5725	.17

TABLE 4: COMPARISON BETWEEN GROUP 1 (NUDGES ONLY) AND GROUP 2 (NUDGES PLUS EDUCATION)

alpha	power	N	N1	N2	delta	m1	m2	sd
.05	.8	12	6	6	.3052	.674	.9792	.17
.05	.8	14	7	7	.2774	.674	.9514	.17
.05	.8	16	8	8	.2561	.674	.9301	.17
.05	.8	18	9	9	.2392	.674	.9132	.17
.05	.8	20	10	10	.2252	.674	.8992	.17
.05	.8	22	11	11	.2135	.674	.8875	.17
.05	.8	24	12	12	.2035	.674	.8775	.17

Our primary interest was in the second comparison (between Nudges only and Nudges plus education), and unfortunately, we did not believe that the minimum detectable change (37->67->97) was feasible and thus, in order to detect results, we would have needed to adjust the sample size. In order to detect a more reasonable change (first comparison from 37->50 and second comparison 50->60) we would have needed more than 48 schools per arm or a minimum total of 144 schools instead of 18. The power curves used may be found in Figure 3 below. The implication of increasing the sample size by 126 additional schools would be an increase in costs of approximately \$200,000 not including personnel time, and an estimated additional 10,000 person hours.

FIGURE 3: POWER CURVES



LESSONS LEARNED

While it is encouraging to see that handwashing with soap is so much higher than anticipated (37% instead of 10%) this did vary widely between schools (11-79%). Because handwashing with soap is not possible without both soap present and water availability, we wanted to remove these environmental considerations and instead conduct an assessment of the impact of nudges and hygiene education alone. However, because our observation criteria required both water and soap to be present, this prevented

measurement at schools where these conditions were not met and/or at times at each school when these conditions were not met.

We also learned several things through the selection of appropriate nudges for schools. We conducted rapid prototype testing for the school nudges: installing them and conducting before and after handwashing observations to assess their impact. Things such as durability were a big consideration and learning during this process. For example, we found it incredibly difficult to find high-quality, long-lasting paint for the pathway, compared to a mirror which could handle the outdoor environment. Further research should be invested in materials for each nudge that would last in an urban school environment.

STUDY B RESULTS

POWER CALCULATION & ASSUMPTIONS

Our budget could accommodate a sample size of 120 households per group. We did not have sufficient pilot data to estimate the population prevalence, so we intended to conduct a post-baseline power calculation using $\alpha = 0.05$ and power of 80%. However, we believed that the proportion of households with a handwashing station, as defined by the study team, would be less than 20%. Our detectible difference therefore ranged from an absolute delta of 11% at a 5% baseline, to an absolute delta of 16% at a 20% baseline (see Figure 4 below). We are confident that these changes are smaller than the public health relevant change needed to scale this intervention.

FIGURE 4: STUDY B SAMPLE SIZE CALCULATION

alpha	power	N	N1	N2	delta	p1	p2
.05	.8	240	120	120	.1104	.05	.1604
.05	.8	240	120	120	.1343	.1	.2343
.05	.8	240	120	120	.1503	.15	.3003
.05	.8	240	120	120	.1618	.2	.3618

**P1 is the proportion for controls/baseline. P2 is proportion in the intervention group at follow-up.*

SAMPLING APPROACH

In 2017, Splash signed a three-year project agreement with the Addis Ababa Education Bureau. This project agreement includes a mutually-agreed upon list of schools where Splash interventions will take place between 2017-2019. All co-educational, public, primary schools in Addis Ababa that were listed in the project agreement were eligible for inclusion, subject to additional inclusion criteria below. From the 43 schools meeting the inclusion criteria, one school was randomly selected for participation by Matthew Freeman for this study, using a random number generator in Excel.

Inclusion criteria:

- Total student population of at least 1,000

Exclusion criteria:

- Prior intervention from Splash

We then selected 240 households for participation in this study. All households with at least one child in any grade enrolled in the 2018-2019 academic year at the selected school were deemed eligible for inclusion, after taking into account the inclusion criteria below.

Inclusion criteria:

- Household access to a water source within a 15-minute walk from home

There were no other selection criteria related to households, as such Splash neither prioritized nor eliminated any type of household from participation in the study. We planned to document and thus be able to disaggregate the information by different types of households (female-headed household, multi-generational, etc.).

Splash utilized a previously-scheduled parent meeting at the beginning of the school year to announce the opportunity for households to participate in the research study. Splash conducted two household enrollment meetings. We used only one previously scheduled parent meeting to conduct Parent Meeting 1 (announcing the research study and extending the invitation to participate). All other parent meetings were scheduled exclusively for research study purposes. Splash provided printed invitation letters for the school to distribute to students inviting households to participate in these meetings.

During the first meeting, 198 households met our inclusion criteria and were enrolled. During the second meeting, 80 households met our inclusion criteria and were enrolled. Out of the 278 households wishing to participate, Splash used a random number generator in Excel to randomly select 240 households for participation.



Photos from Study B Parent Meetings 1 and 2

Splash did not control for who attended the parent meetings; however, we scheduled and sequenced them



to ensure wider participation and also to ensure that participants interested in enrolling in the study had the opportunity to discuss that decision with other members of their household prior to signing up. During Splash’s formative research prior to the study, adult females were interviewed and asked about the days that work best for them (and for any males in the household) to attend a school meeting. Based on their responses, Splash selected a day (Sunday) that appeared to be most conducive to parent attendance (male and female). Splash also made it clear that parents were allowed to bring their young children to these meetings, if needed, so that needing childcare was not a barrier to participation.

All enumerators selected to conduct the household survey at 236 households were female. Additionally, Splash ensured that all enumerators are trained on ethical and gender sensitive survey practices. The enumerators interviewed whomever happened to be home and asked about overall household hygiene conditions and asked about the presence of soap and water. Splash developed a gender-neutral survey that could be asked of any (adult) household member. We also recorded the age group, gender, and household role of each respondent to allow for comparisons across socioeconomic factors.

BASELINE FINDINGS

Of the 240 households enrolled, baseline data was collected at 236 households between October 17-26, 2018. Our primary outcome was the presence of water and soap (binary) in each household and was found to be 30.5% (see Table 5 below). Detailed findings from Study B are attached in Annex B.

TABLE 5: PRESENCE OF SOAP & WATER AT PRIMARY HANDWASHING LOCATION

Soap and water present	Freq.	Percent	Cum.
No	164	69.49	69.49
Yes	72	30.51	100.00
Total	236	100.00	

BASELINE BUDGETARY AND OPERATIONAL IMPLICATIONS

With a baseline presence of water and soap at households of 30.5% we would be powered to detect a change greater than 17.7 percentage points, or up to 48%. While the baseline is higher than the maximum anticipated (30.5% instead of 20%) a difference of 17.7%, or a post-intervention presence of water and soap of at least 48%, may have been possible. We would not have needed to increase sample size, budget, or person hours for Study B, but given we were not moving forward with Study A, had doubts about the effectiveness of our intervention (details below), and were using less rigorous proxy measures instead of more intensive observations, we also determined not to move forward with Study B.

LESSONS LEARNED

While baseline findings were higher than anticipated, the minimum detectable difference was within a range we felt was possible to achieve and we did not have concerns related to sample size or statistical significance. However; the presence of handwashing stations with water and soap at more households



than anticipated caused us to question our assumptions about barriers to handwashing and to doubt whether the planned intervention would have the desired impact.

We learned several things through the selection of appropriate nudges particularly for households, as this is not part of our current intervention model. To determine the appropriate nudge interventions for households, we conducted interviews with sector experts to compile initial ideas, specifically London School of Hygiene and Tropical Medicine, WaterAid, East Meets West, USAID and the Global Handwashing Partnership. We also hosted a summit with professionals from a variety of sectors (WASH, product design, Human Centered Design, health, and behavioral science), to brainstorm ideas – in particular household nudges. Household interviews and observations, as well as focus group discussions helped us to narrow the household nudges, using perceived value and purpose as benchmarks. During the formative research phase, we found that mirrors and water barrels with messaging on them had the strongest attraction and promise from participants. Both were described as being in high traffic parts of the home and would see daily use. We ultimately selected cutting boards as the nudge because of the feedback from women surveyed (during the assessment phase to determine nudges) who are largely responsible for preparing household food.

Through this exploration process, we found that our experience of using schools as a point of distribution for nudges holds a lot of promise for reaching households. Interest in the study was high and parents voluntarily attended school-wide meetings, waited several hours to sign up to participate, and were generally enthusiastic about participating, regardless of the material benefit of receiving nudges and the participation incentives.



ANNEX A: DETAILED STUDY A RESULTS

Hand washing with soap (HHWS) 37.0%

	Mean	Linearized Std. Err.	[95% Conf. Interval]	
HHWS	.3698459	.0330762	.2993457	.440346

HHWS by Gender

Male students: 40.6% / Female students 33.4%

	Mean	Linearized Std. Err.	[95% Conf. Interval]	
HHWS				
Female	.3341965	.0357916	.2579086	.4104845
Male	.4062379	.03493	.3317864	.4806893

HHWS By grade

Over	Mean	Linearized Std. Err.	[95% Conf. Interval]	
HHWS				
Grade 1-3	.3552553	.0369406	.2765183	.4339924
Grade 4-6	.4511059	.0415806	.362479	.5397329
Grade 7-8	.2754381	.0401555	.1898486	.3610276

Behaviors at Handwashing Stations

HHWS: 37.0%

Drank Water from Handwashing Station (not clean): 9.8%

Rinsed hair/face at Handwashing Station: 12.9%

	Mean	Linearized Std. Err.	[95% Conf. Interval]	
HHWS	.3696899	.0484215	.2664819	.4728979
Drink	.0985124	.0166002	.06313	.1338949
Hair/Face	.128584	.0155681	.0954014	.1617666



Behaviors at Handwashing Stations By Gender

	Mean	Linearized Std. Err.	[95% Conf. Interval]	
HWWS				
Male	.4384046	.0545953	.3220375	.5547717
Female	.2995132	.0565083	.1790685	.4199579
Drink				
Male	.1047719	.0212291	.0595231	.1500207
Female	.0921197	.0202497	.0489585	.135281
Hair/Face				
Male	.1173458	.0218575	.0707577	.163934
Female	.1400612	.0193587	.098799	.1813234

Behaviors at Handwashing Stations By Grade

Over	Mean	Linearized Std. Err.	[95% Conf. Interval]	
HWWS				
Grade 1-3	.3258805	.0473639	.2249267	.4268343
Grade 4-6	.3796882	.0452993	.283135	.4762414
Grade 7-8	.363529	.0592834	.2371694	.4898885
Drink				
Grade 1-3	.0802053	.0143461	.0496272	.1107834
Grade 4-6	.1204102	.019019	.0798723	.1609482
Grade 7-8	.1013442	.0292513	.0389967	.1636918
Hair/Face				
Grade 1-3	.1325242	.0172103	.0958413	.169207
Grade 4-6	.1479822	.0249439	.0948155	.201149
Grade 7-8	.111699	.0210318	.0668708	.1565272



**Baseline Behavior by Intervention Group: Group 1 (Nudge Only) ,
Group 2 (Nudge + Education) , Group 3 (Control)**
Results are at BASELINE, prior to any intervention

	Over	Mean	Linearized Std. Err.	[95% Conf. Interval]	

HWWS					
Group 1		.4073985	.0742601	.2491169	.5656801
Group 2		.3447528	.0582193	.2206612	.4688444
Group 3		.3637975	.117483	.1133884	.6142066

Drink					
Group 1		.06737	.022692	.0190032	.1157368
Group 2		.1199629	.0307079	.0545106	.1854151
Group 3		.102287	.0240993	.0509206	.1536534

Hair/Face					
Group 1		.1228986	.0326203	.05337	.1924272
Group 2		.133228	.0247578	.0804581	.1859979
Group 3		.1283442	.0230374	.0792412	.1774471



ANNEX B: DETAILED STUDY B RESULTS

Presence of Soap & Water at Primary Handwashing Location

Soap and water present	Freq.	Percent	Cum.
No	164	69.49	69.49
Yes	72	30.51	100.00
Total	236	100.00	

Presence of Soap & Water at Primary Handwashing Location by Intervention: Group 1 (Intervention), Group 2 (Control) *Results are at BASELINE, prior to any Intervention*

Soap and water present	Intervention			Total
	Group 1	Group 2		
No	81	82	1	164
	68.64	70.09	100.00	69.49
Yes	37	35	0	72
	31.36	29.91	0.00	30.51
Total	118	117	1	236
	100.00	100.00	100.00	100.00

Presence of Water at Primary Handwashing Location

water present at HW station	Freq.	Percent	Cum.
No	146	61.86	61.86
Yes	6	2.54	64.41
	84	35.59	100.00
Total	236	100.00	



Presence of Water within 2m of Primary Handwashing Location

Water present within 2 meters	Freq.	Percent	Cum.
	1	0.42	0.42
No	115	48.73	49.15
No handwashing facility	15	6.36	55.51
Yes	105	44.49	100.00
Total	236	100.00	

Presence of Water within 15m of Primary Handwashing Location
If not water present within 2m

HWWat15	Freq.	Percent	Cum.
	121	51.27	51.27
No	25	10.59	61.86
Yes	90	38.14	100.00
Total	236	100.00	

Presence of Water within 2-15m of Primary Handwashing Location

Water present within 15 meters (including 2 meters)	Freq.	Percent	Cum.
0	41	17.37	17.37
1	195	82.63	100.00
Total	236	100.00	

Presence of Soap at Primary Handwashing Location

Soap present at HW station	Freq.	Percent	Cum.
	1	0.42	0.42
No	145	61.44	61.86
No handwashing facility	15	6.36	68.22
Yes	75	31.78	100.00
Total	236	100.00	



Primary Handwashing Type

Primary HW type	Freq.	Percent	Cum.
	1	0.42	0.42
Indoor tap with running water	8	3.39	3.81
No handwashing facility	15	6.36	10.17
Outdoor tap with running water	43	18.22	28.39
Water jug and bowl	159	67.37	95.76
Water storage vessel (barrel, ewer, b..	10	4.24	100.00
Total	236	100.00	

Primary Handwashing Location

Primary HW location	Freq.	Percent	Cum.
	1	0.42	0.42
At/Near Kitchen/Cooking Area	26	11.02	11.44
At/Near Sanitation Facility	5	2.12	13.56
In Salon/Living Room	64	27.12	40.68
No Handwashing Facility	15	6.36	47.03
Outdoor/Compound	125	52.97	100.00
Total	236	100.00	

Gender of Household Respondent

Gender of respondent	Freq.	Percent	Cum.
	1	0.42	0.42
Female	183	77.54	77.97
Male	52	22.03	100.00
Total	236	100.00	

Respondent Head of Household

Interviewee is head of household	Freq.	Percent	Cum.
	1	0.42	0.42
No	88	37.29	37.71
Yes	147	62.29	100.00
Total	236	100.00	



Household Role of Respondent

Interviewee role within household	Freq.	Percent	Cum.
Interviewee	1	0.42	0.42
Aunt/Uncle	18	7.63	8.05
Grandparent	17	7.20	15.25
Other	9	3.81	19.07
Parent	166	70.34	89.41
Sibling/Cousin	25	10.59	100.00
Total	236	100.00	

Household Religion

Religion	Freq.	Percent	Cum.
Interviewee	1	0.42	0.42
Muslim	21	8.90	9.32
Orthodox Christian	209	88.56	97.88
Other	1	0.42	98.31
Protestant	4	1.69	100.00
Total	236	100.00	

Household Home Ownership

Household owns their home	Freq.	Percent	Cum.
Interviewee	1	0.42	0.42
Other	10	4.24	4.66
Own	53	22.46	27.12
Rent	170	72.03	99.15
Unknown	2	0.85	100.00
Total	236	100.00	



Household Income

Household income	Freq.	Percent	Cum.
0 - 500 Birr	1	0.42	0.42
1001 - 3000 Birr	22	9.32	9.75
3001 - 5000 Birr	98	41.53	51.27
501 - 1000 Birr	12	5.08	56.36
More than 5000 Birr	72	30.51	86.86
Unknown/Prefer not to answer	4	1.69	88.56
	27	11.44	100.00
Total	236	100.00	

Average Number of Individuals per Household

Average number per HH.

	Mean	Std. Err.	[95% Conf. Interval]	
#adult	1.408511	.0483935	1.313168	1.503853
#male adult	1.187234	.0578077	1.073344	1.301124
#female adult	1.153191	.0594705	1.036026	1.270357
#male child	1.012766	.0696759	.8754937	1.150038
#fem child	.787234	.0477464	.6931663	.8813018
#school child	.6170213	.0492777	.5199366	.714106