

# Hand Hygiene Evaluation Report

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## Executive Summary

Contests are a popular and scalable way of sharing information with large numbers of households in Vietnam, but they have not been used for sanitation or hand hygiene behavior change. In 2017, iDE implemented a hand hygiene contest in two provinces, whereby 98,937 members of the Women's Union and their family members completed a hand hygiene quiz. Those who answered all questions correctly and gave the closest estimate of the number of participants to complete the quiz from their community received a small prize. A quasi-experimental impact evaluation tested whether the hand hygiene contest had an attributable effect on hand hygiene knowledge retention and practices, and whether ownership of an improved sanitation facility (ISF) had an incremental effect on knowledge and practice.

A multi-stage clustered sample of 925 households were surveyed from three experimental groups: 1) contest participants with no ISF, 2) contest participants with an ISF, and 3) counterfactual group from a matched set of districts outside of the intervention areas. Multiple knowledge and practice indicators were analyzed, including: answering all four hand hygiene knowledge questions correctly, and presence of soap and water plus the respondent claiming to wash his/her hands after defecation. Pairwise hypothesis tests show that contest participants had a 47 percentage point increase in hand hygiene knowledge retention and that owning an ISF increased hand hygiene retention by 13 percentage points. When looking at hand hygiene practices, the contest had a significant effect equal to 22 percentage points, and ISF ownership increased this effect by 37 percentage points.

This study shows that contests may be an effective and scalable way to transfer knowledge and elicit behavior change in rural Vietnam. Results suggest that ISF ownership has a much larger effect on hygiene practices than just participating in the contest, but that the contest alone can improve hygiene practices.

## Treatment Groups

There are number of potential treatment groups across three primary dimensions - each having a possible effect on hand hygiene knowledge and practices:

1. Hand Hygiene Contest: Households that participated in hand-hygiene contest and those that did not participate in the contest.
2. Latrine Sales and Hand Hygiene Promotional Meetings: Households that participated in a sales promotion event that included hand hygiene messaging and those that did not participate in a sales promotion even including hand hygiene messaging.
3. Improved Latrine Ownership: Households that own an improved latrine and those that do not own an improved latrine.

## Sampling

To identify where a household falls within each of these dimensions, we will use both the hand hygiene contest participant forms and the latrine installation records as our sample frame to draw random samples using the design described in the following sections.

### Hand Hygiene Contest Participants

In total, 98,937 people participated in the hand hygiene contest. iDE's original estimate was that that 60% of 57,000 individuals will participate in the hand hygiene contest, meaning an estimated 34,200 individuals from 57 communes across 2 districts of Nghe An and Tuyen Quang provinces. The first step in estimating the percent of households answering questions correctly for the hand hygiene contest required iDE Vietnam to score and stratify the individual forms. iDE Vietnam randomly sampled 10% of all hand hygiene participant forms and graded ("marked") them based on whether the household answered all four questions correctly, whether they answered some correctly but not all, or if they did not answer any correctly. When scoring the form, iDE wrote a unique identifier on each form that is easily visible. This was used for two purposes: 1) it allowed iDE Vietnam to obtain an initial point estimate on hand hygiene knowledge coming out of the hand hygiene contest; and, 2) These numbers allowed iDE to randomly select forms to include in the customer survey round described in the next paragraph.

Once the hand-hygiene contest forms were scored and stratified by iDE Vietnam, iDE was originally instructed to randomly select 125 forms from each of the three strata for a follow-up survey. The 125 forms were to be randomly selected from the forms using probability proportional to size sampling by commune (i.e., households from the

communes that had a higher number of contest participants will be more likely to be selected in the random sample).

Strata	Criteria	# of sampled HHs
All correct	The household has answered all four of the hand hygiene knowledge questions correctly	125
Some correct	The household has answered at least one of the hand hygiene knowledge questions correctly, but less than all four have been answered correctly.	125
No correct answers	The household has answered none of the hand hygiene knowledge questions correctly.	125

The random sample did not follow the above plan because only 7 out of 1,390 (0.5%) and 4 out of 1,103 (0.4%) randomly sampled contest participants had no correct answers in Ham Yen and Yen Thanh districts, respectively. Furthermore, 71 out of 1,390 (5.1%) and 28 out of 1,103 (2.5%) answered one question correctly. Given the high rate of answering at least one contest question correct, we have adjusted the sample to be stratified by those that answered all 4 questions correctly and those that answered less than 4 correctly following the table below:

Strata	Criteria	# of sampled HHs from Ham Yen	# of sampled HHs from Yen Thanh
All correct	The household has answered all four of the hand hygiene knowledge questions correctly	100	100
Some correct or no correct answers	The household has either answered no questions correctly or the household has answered at least one of the hand hygiene knowledge questions correctly, but less than all four have been answered correctly.	100	100

## Latrine Clients

In addition to randomly sampling participants in the hand hygiene contest, iDE included a sample of households that participated in latrine and hand hygiene promotional meetings carried out by the Women’s Union and Center for Preventative Medicine, but

that did not participate in the hand hygiene contest. iDE does not collect household records for everyone that attended promotional events to draw a sample from, so, instead iDE randomly sampled those that purchased an improved latrine and are in the iDE-maintained latrine installation database. We recognize that this may positively bias the hand hygiene knowledge estimates, because owning an installed latrine is highly correlated with an individual's likelihood to have hand hygiene knowledge due to the nature of the project activities.

As part of iDE's standard M&E plan, iDE Vietnam selected 400 households that have installed a latrine from the communes where promotional events included both latrine promotion and hand hygiene messaging. These households have installed a latrine at least 3 months prior to the data collection to allow for the household to establish regular use patterns of the latrine/bathroom.

## Counterfactual Group

In order to estimate the incremental effect of the project on hand hygiene knowledge and practice it was necessary to also use a counterfactual. In this specific case, the counterfactual was quite difficult to identify due to the larger scale of the project and the mass marketing nature of project activities - not to mention other hand-hygiene related projects and promotions going on beyond the WASH-SUP project. Nonetheless, iDE has identified a group of 2 districts (Tan Ky and Chiem Hoa) that were not yet been exposed to hand hygiene messaging through the latrine promotional events or during the iDE-led hand hygiene contest, and iDE randomly selected households from this set of districts to serve as the counterfactual.<sup>1</sup>

For the counterfactual group, iDE selected a group of 150 households that do not have an improved latrine that are within the 2 districts that have not been exposed to hand hygiene messaging. The sample includes households from at least 3 communes per district. These households were identified by contacting the village head, within the hamlets where there is at least one installed latrine in the latrine dataset, and asking for the contact information of those households that do not yet have an installed latrine.

## Survey Instrument

We used the same survey instrument for each of the groups listed above so that all of the data can be compiled and analyzed together. The survey instrument was deployed on TaroWorks and mapped to iDE's management information system on Salesforce.com.

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<sup>1</sup> These communes will, eventually, be exposed to hand hygiene messaging through both the latrine and hand hygiene promotional events and the hand hygiene contest, but at the time of data collection they were not yet exposed. This evaluation design would be considered a roll-out design.

The data was entered using mobile forms and visible to the program managers, iDE Vietnam’s M&E manager and iDE’s Global iQ support team based at iDE HQ.

Although the survey instruments were nearly identical, there were two different TaroWorks jobs used based on which sample frame the household was drawn from.<sup>2</sup>

Sample Frame	TaroWorks Job name	# of completed surveys
Latrine Clients	VN Khảo sát Hộ gia đình v1.0	400
Hand Hygiene Contest Participants	VN Khảo sát nhóm thi Kiến thức RTVXP và nhóm Đối chứng v1.0	375
Counterfactual Group	VN Khảo sát nhóm thi Kiến thức RTVXP và nhóm Đối chứng v1.0	151

## Analysis Plan

Treatment effects for Hand hygiene contest participants that also participated in the latrine and hand-washing promotional meeting were estimated by taking the difference in % from a sample of latrine clients that also stated they participated in the hand hygiene contest event and scoring them to determine if they answered all four questions correctly and the % of control group participants that have not participated in the contest or latrine promotion and their responses to the four knowledge questions.

$$Treatment\ Effect_{(contest, promotion)} = \% correct\ score_{(contest, promotion)} - \% correct\ score_{(control)}$$

Treatment effect for hand hygiene contest participants that did not participate in the latrine and hand-washing promotional meeting (or have an iDE improved latrine) were estimated by taking the difference in % from a sample of hand hygiene contest forms that stated they did not participate in the promotional event and scoring them to determine if they answered all four questions correctly and the % of control group participants that have not participated in the contest or latrine promotion and their responses to the four knowledge questions.

$$Treatment\ Effect_{(contest, no\ promotion)} = \% correct\ score_{(contest, no\ promotion)} - \% correct\ score_{(control)}$$

<sup>2</sup> This is because for latrine customers, we already have basic client information stored in Salesforce and the interviewer “drills down” to the correct client record at the beginning of the survey.

Treatment effects for participation in the latrine and hand-washing promotional meeting were estimated by taking the difference in % from a sample of hand hygiene contest forms that stated they did participate in the promotional event but did not participate in the hand hygiene contest and scoring them to determine if they answered all four questions correctly and the % of control group participants that have not participated in the contest or latrine promotion and their responses to the 4 knowledge questions.

$$Treatment\ Effect_{(no\ contest,\ promotion)} = \% \text{ correct score}_{(no\ contest,\ promotion)} - \% \text{ correct score}_{(control)}$$

In addition, iDE has tested what the incremental effect is by using hypothesis tests to determine whether or not the promotion had a larger effect on hand hygiene knowledge or if the promotional event had a larger effect.

$$H_0: Treatment\ Effect_{(contest,\ no\ promotion)} = Treatment\ Effect_{(no\ contest,\ promotion)}$$

Furthermore, iDE has tested whether or not the combined effect of both the promotional event and the contest is greater than either one by itself.

$$H_0: Treatment\ Effect_{(contest,\ promotion)} = Treatment\ Effect_{(no\ contest,\ promotion)}$$

$$H_0: Treatment\ Effect_{(contest,\ promotion)} = Treatment\ Effect_{(contest,\ no\ promotion)}$$

To estimate the number of additional people with increased has of hygiene practices we multiplied the treatment effect for each subgroup by the number of people that are included in the subgroup - based on project monitoring figures. For example:

$$\begin{aligned} \# \text{ of additional people with increased knowledge} = \\ (TE_{(promotion,\ no\ contest)} * n_{(promotion,\ no\ contest)}) + (TE_{(contest,\ no\ promotion)} * n_{(contest,\ no\ promotion)}) + \\ (TE_{(contest,\ promotion)} * n_{(contest,\ promotion)}) \end{aligned}$$

The analysis was carried out using Stata statistical analysis package and will include significance levels for all hypothesis tests. This analysis was led by iDE’s Global iQ team at iDE’s headquarters.

## Results

### Descriptive Statistics

The final sample for each experimental group by province is summarized in the table below:

Experimental Group Sizes	Province Name		Total Collected	Original Sample Design
	Ngha An	Tuyên		
Control	75	76	151	150
Latrine Clients, No Contest	250	78	328	375
Latrine Client & Contest Participant	5	87	92	
Contest Participant, No Latrine Client	203	200	403	400
<b>Total</b>	<b>533</b>	<b>440</b>	<b>974</b>	<b>925</b>

Percent of each experimental group sample that is poor is shown in the table below. When looking at the segment of the sample that has an iDE latrine, we find that only 5.5% of households are poor, compared to the non-iDE latrine owners where 14.6% are poor.

Experimental Group	Mean	N
Control	36%	150
Latrine Clients, No Contest	3%	328
Contest Participant, No Latrine Client	9%	403
Latrine Client & Contest Participant	13%	92
<b>Total</b>	<b>11%</b>	<b>973</b>

The differences between all groups are statistically significant at 5% with the exception of contest participants without an iDE latrine and latrine clients with contest participant.

In addition to seeing differences in poverty levels among the experimental groups, we also find that there are differences in toilet technologies being used by the household across experimental groups. Of course, we would expect to see differences between iDE latrine clients and those that are control or contest participant only groups.

Experimental Group	Pourflush of offset soaked pit	Septic System	Ventilated improved pit (VIP)	Double Vault	Other

Control	1%	36%	20%	31%	12%
Latrine Clients, No Contest	3%	97%	0%	0%	0%
Contest Participant, No Latrine Client	3%	53%	5%	35%	4%
Latrine Client & Contest Participant	5%	93%	0%	1%	0%

## Outcome Areas

There were seven primary outcomes of interest that were included in the quantitative analysis for estimating the effect iDE has had on hand hygiene knowledge and behavior change. These are presented in the table below:

Outcome area	Specific Measure Used	Variable type
Increase in Hand Hygiene Knowledge	1: answer all four hand hygiene knowledge questions correctly	Binary
	2: answer at least three hand hygiene knowledge questions correctly	Binary
	3: number of hand hygiene questions answered correctly	Continuous
Increase in Hand Hygiene Behavior Change	4: at least 2 use proxy variables are observed at the household (i.e., soap is present, water is present, meets hygienic standards, has handwashing sticker).	Binary
	5: respondent claims to “always” wash hands after defecation	Binary
	6: at least 2 use proxy variables are observed at the household AND respondent claims to “always” wash hands after defecation	Binary
	7: there is presence of soap and water at the household.	Binary

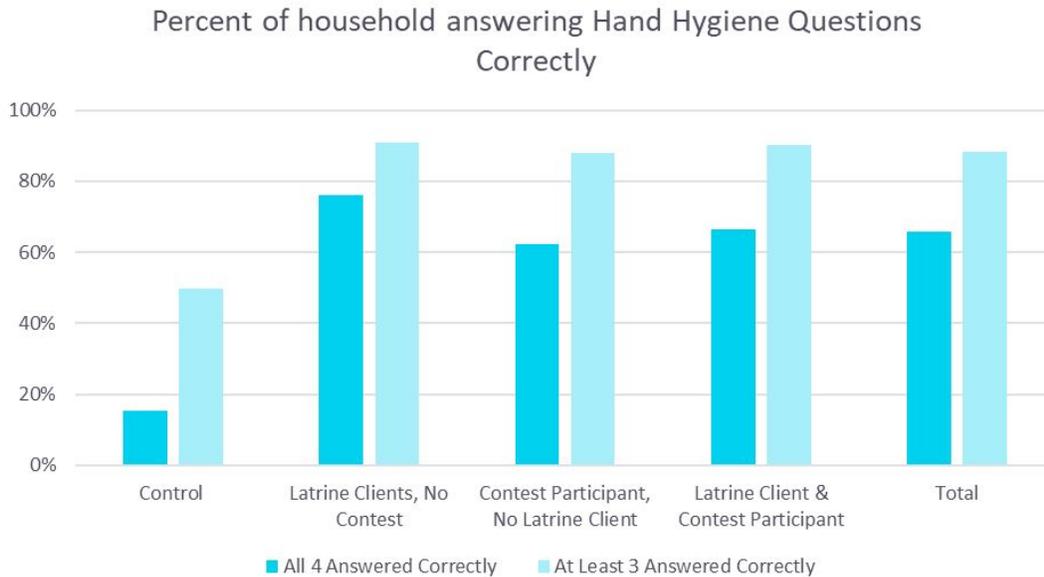
## Increase in Hand Hygiene Knowledge

Descriptive statistics for each of the outcome measures related to hand-hygiene knowledge are shown in the table below.

Percent of households answering all four hand hygiene questions correctly			
Experimental Group	Mean	Std. Error	N
Control	15%	0.36	151
Latrine Clients, No Contest	76%	0.43	328
Contest Participant, No Latrine Client	62%	0.49	403
Latrine Client & Contest Participant	66%	0.48	92
<b>Total</b>	<b>59%</b>	<b>0.49</b>	<b>974</b>

Percent of households answering at least three hand hygiene questions correctly			
Experimental Group	Mean	Std. Error	N
Control	50%	0.50	151
Latrine Clients, No Contest	91%	0.29	328
Contest Participant, No Latrine Client	88%	0.33	403
Latrine Client & Contest Participant	90%	0.30	92
<b>Total</b>	<b>88%</b>	<b>0.32</b>	<b>974</b>

Combining these statistics in the figure below, you can see that the control clients do have a lower percentage than the other treated groups. It is also apparent that the experimental group to have the highest percentage of households answer all 4 questions correctly is the latrine-only clients. This comes as a surprise as we would expect those that have been exposed to promotional activities and participated in the contest to exhibit the greatest knowledge retention.



In addition to looking at the descriptives for each of these by experimental group, we carried out pairwise hypothesis tests to determine if there are statistical differences between groups. We find that the difference between iDE Latrine clients and control group is 61 percentage points and is statistically significant at 1% level of significance when looking at answering all four hand hygiene questions correctly - meaning the sales promotion and ownership of an improved latrine significantly increases hand hygiene knowledge. Additionally, the difference between those iDE clients that have invested in a toilet and those that were only exposed to the hand hygiene contest have a 13 percentage point increase in hand-hygiene knowledge. The table below presents the treatment effect estimates for answering all hand hygiene questions correctly.

Pairwise testing for all four Hand Hygiene Questions Answered Correctly			
Compared to...	Control	Latrine Clients, No Contest	Contest Participant, No Latrine Client
Latrine Clients, No Contest	61% ***		
Contest Participant, No Latrine Client	47%***	-13%***	
Latrine Client & Contest Participant	51%***	-9%	4%

*Robust standard errors in parentheses. [ \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$  ]*

*Results based on Scheffé's pairwise comparison method, which is a single-step multiple comparison procedure which applies to the set of estimates of all possible contrasts among the factor level means.*

Similar to above, we present the estimated treatment effects and their significance levels in the table below. We see that for the outcome indicator answering at least three hand hygiene questions correctly that there are positive significant treatment effects for all three treatment groups, all significant at 1% level of significance.

Pairwise testing for at least three Hand Hygiene Questions Answered Correctly			
Compared to...	Control	Latrine Clients, No Contest	Contest Participant, No Latrine Client
Latrine Clients, No Contest	41% ***		
Contest Participant, No Latrine Client	38%***	-3%	
Latrine Client & Contest Participant	41%***	-1%	2%

*Robust standard errors in parentheses. [ \*\*\* p<0.01, \*\* p<0.05, \* p<0.1 ]*

*Results based on Scheffé's pairwise comparison method, which is a single-step multiple comparison procedure which applies to the set of estimates of all possible contrasts among the factor level means.*

For the purposes of donor reporting, we will use the outcome indicator for answering all hand hygiene questions correctly for donor reporting. Using the results in the table above, we can multiply the treatment effect by the number of households that iDE has worked with in each sub-group and obtain overall estimates for the number of households with improved hand hygiene knowledge. Using the formula presented in the previous section, we have the following:

$$\begin{aligned} \# \text{ of additional people with increased knowledge} = & \\ & ( TE_{(promotion, no contest)} * n_{(promotion, no contest)} ) + ( TE_{(contest, no promotion)} * n_{(contest, no promotion)} ) + \\ & ( TE_{(contest, promotion)} * n_{(contest, promotion)} ) \end{aligned}$$

By plugging in the treatment effects and number of households within each sub-group we have:

$$\begin{aligned} \# \text{ of additional people with increased knowledge} = & \\ & (61\% * (134,332 * 22\%)) + (47\% * ((42,000 \text{ hhs} \times 2.86 \text{ ppl/hh}) + (56,973 \times 2.7 \text{ ppl/hh}))) + \\ & (51\% * (134,332 * 78\%)) \end{aligned}$$

We end up with the following:

***# of additional people with increased knowledge = 200,174***

Of course, we could have chosen to use the other hand-hygiene knowledge outcome indicator. Given that we have specified an additional binary outcome indicator, we wanted to also provide the final estimate for the question of answering at least three correctly.

$$\begin{aligned} \text{\# of additional people with increased knowledge} = \\ (41\% * (134,332 * 22\%)) + (38\% * ((42,000 \text{ hhs} \times 2.86 \text{ ppl/hh}) + (56,973 \times 2.7 \text{ ppl/hh}))) + \\ (41\% * (134,332 * 78\%)) \end{aligned}$$

We end up with the following:

***# of additional people with increased knowledge = 159,139***

## Increase in Hand Hygiene Practice

For hand washing practice there are four main proxy indicators that we have incorporated into the survey-based data collection to gauge whether the household is practicing proper hand hygiene. These include the following:

- Is there an informative sticker near the hand-washing station informing the user of the proper way to wash their hands?
- Is there water near the toilet facility for hand-washing?
- Is there soap near the toilet facility for hand-washing?
- Does the toilet meet hygienic standards?

As described in an earlier section, there are four primary indicators that we are using to test for changes in handwashing behaviour. These include:

1. at least 2 use proxy variables are observed at the household (i.e., soap is present, water is present, meets hygienic standards, has handwashing sticker).
2. respondent claims to “always” wash hands after defecation → self-report
3. at least 2 use proxy variables are observed at the household AND respondent claims to “always” wash hands after defecation → most robust measure of behaviour
4. there is presence of soap and water at the household → DFAT indicator of choice.

Descriptive statistics for each of the outcome measures related to hand-hygiene practice are shown in the table below.

Percent of households answering with at least 2 hand washing proxy indicators			
Experimental Group	Mean	Std. Error	N
Control	37%	0.48	151
Latrine Clients, No Contest	98%	0.13	328
Contest Participant, No Latrine Client	63%	0.48	403
Latrine Client & Contest Participant	99%	0.10	92
<b>Total</b>	<b>70%</b>	<b>0.46</b>	<b>974</b>

Percent of households reporting to always wash hands after defecation			
Experimental Group	Mean	Std. Error	N
Control	51%	0.50	151
Latrine Clients, No Contest	45%	0.50	328
Contest Participant, No Latrine Client	42%	0.49	403
Latrine Client & Contest Participant	45%	0.50	92
<b>Total</b>	<b>42%</b>	<b>0.49</b>	<b>974</b>

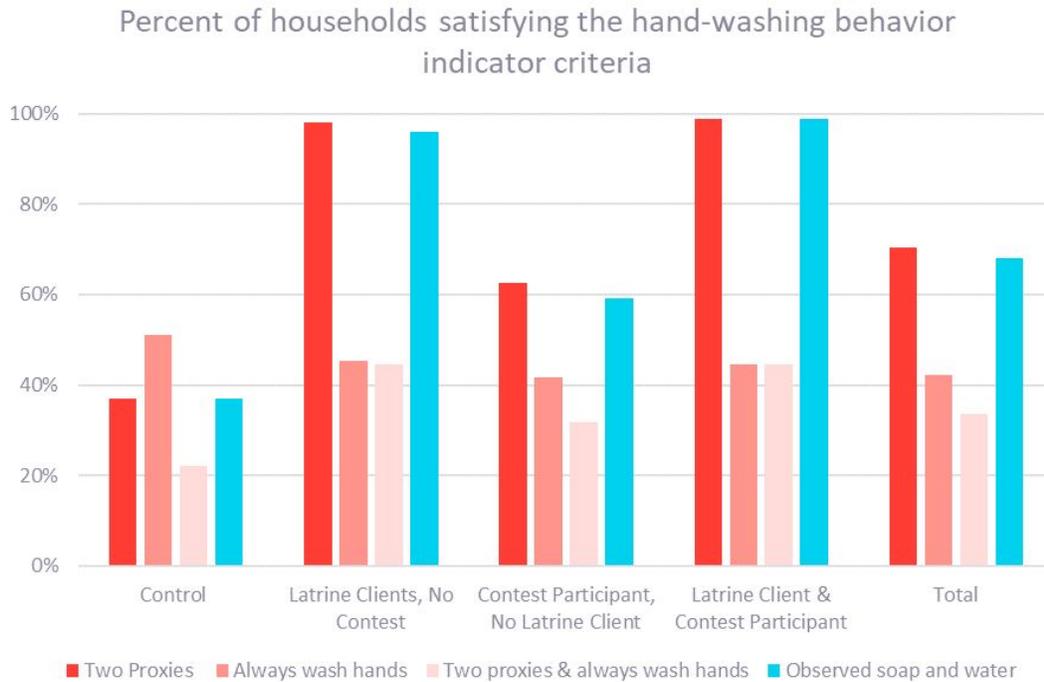
Percent of households with at least 2 proxy indicators AND report to always wash hands after defecation			
Experimental Group	Mean	Std. Error	N
Control	22%	0.41	151
Latrine Clients, No Contest	45%	0.50	328
Contest Participant, No Latrine Client	32%	0.47	403
Latrine Client & Contest Participant	45%	0.50	92

<b>Total</b>	<b>34%</b>	<b>0.47</b>	<b>974</b>
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We will focus more specifically on the observed soap and water outcome indicator because this is the one that DFAT is interested in using as the primary outcome proxy indicator for hand-hygiene practices. We see that 37% of the control group did satisfy the conditions of the indicator, and that 59% of the contest participants had soap and water present. Nearly double that percentage of households in the latrine client experimental groups had water and soap present at the home.

<b>Percent of households with water and soap at the household</b>			
<b>Experimental Group</b>	<b>Mean</b>	<b>Std. Error</b>	<b>N</b>
Control	37%	0.48	151
Latrine Clients, No Contest	96%	0.20	328
Contest Participant, No Latrine Client	59%	0.49	403
Latrine Client & Contest Participant	99%	0.10	92
<b>Total</b>	<b>68%</b>	<b>0.47</b>	<b>974</b>

Combining these statistics in the figure below, you can see that the control clients do have a lower percentage than the other treated group across all of the behavior indicators. Furthermore, you can see that the percentage of households satisfying the behavior indicator criteria is larger for those that have an iDE latrine than for those that were only exposed to the hand-hygiene contest. There is very little difference between the latrine clients that did not participate in the contest and the latrine clients that did participate in the contest.



As in the hand-washing knowledge section, we carried out pairwise hypothesis tests to determine if there are statistical differences between groups - for each of the four hand-washing practice indicators. Overall, we find positive significant treatment effects from iDE latrine promotion and ownership as well as hand-hygiene contest participation for three of the four hand-hygiene practice outcome indicators.

Pairwise testing for % of households having at least 2 hand washing proxy indicators			
Compared to...	Control	Latrine Clients, No Contest	Contest Participant, No Latrine Client
Latrine Clients, No Contest	61% ***		
Contest Participant, No Latrine Client	25%***	-36% ***	
Latrine Client & Contest Participant	62%***	0%	36%***

*Robust standard errors in parentheses. [ \*\*\* p<0.01, \*\* p<0.05, \* p<0.1 ]*  
*Results based on Scheffé's pairwise comparison method, which is a single-step multiple comparison procedure which applies to the set of estimates of all possible contrasts among the factor level means.*

We find positive significant treatment effects from both iDE latrine ownership (61 percentage points) as well as from the participation in the hand hygiene contest (25 percentage points) when looking at the indicator for the household having at least two proxy indicators related to improved hand hygiene practice. We also see that there is a positive treatment effect from latrine ownership over contest participation in isolation equal to 36 percentage points.

Pairwise testing for % of households reporting to always wash hands after defecation			
Compared to...	Control	Latrine Clients, No Contest	Contest Participant, No Latrine Client
Latrine Clients, No Contest	-5%		
Contest Participant, No Latrine Client	-9%	-4%	
Latrine Client & Contest Participant	-6%	0%	3%

*Robust standard errors in parentheses. [ \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$  ]*  
*Results based on Scheffé's pairwise comparison method, which is a single-step multiple comparison procedure which applies to the set of estimates of all possible contrasts among the factor level means.*

We find no significant differences between any experimental groups when looking at the self-reported hand-washing indicator, although the means are higher for control group, the increase is not statistically significant.

Pairwise testing for % of households with at least 2 proxy indicators AND report to always wash hands after defecation			
Compared to...	Control	Latrine Clients, No Contest	Contest Participant, No Latrine Client
Latrine Clients, No Contest	23% ***		
Contest Participant, No Latrine Client	9%	-13% ***	
Latrine Client & Contest Participant	23%***	0%	13%

*Robust standard errors in parentheses. [ \*\*\* p<0.01, \*\* p<0.05, \* p<0.1 ]*  
*Results based on Scheffé's pairwise comparison method, which is a single-step multiple comparison procedure which applies to the set of estimates of all possible contrasts among the factor level means.*

As with the first outcome indicator, we find positive significant results for iDE latrine ownership (23 percentage points) and for participation in the ownership of toilet with hand hygiene contest (23 percentage points), when looking at the outcome indicator for the household satisfying two proxies and self-reporting that they wash their hands after defecation. There is no effect from hand hygiene contest participation in isolation. By looking at the two tables above, we can deduce that this positive significant result is driven primarily by the observed use proxies, rather than the self-reported hand washing indicator.

Pairwise testing for % of households with water and soap at the household			
Compared to...	Control	Latrine Clients, No Contest	Contest Participant, No Latrine Client
Latrine Clients, No Contest	59% ***		
Contest Participant, No Latrine Client	22%***	-37% ***	
Latrine Client & Contest Participant	62%***	3%	40%***

*Robust standard errors in parentheses. [ \*\*\* p<0.01, \*\* p<0.05, \* p<0.1 ]*  
*Results based on Scheffé's method, which is a single-step multiple comparison procedure which applies to the set of estimates of all possible contrasts among the factor level means.*

When looking at the presence of both soap and water at the household (the preferred DFAT indicator for hand washing practice) we find that the treatment effect for iDE latrine promotion and ownership is equal to positive 59 percentage points and significant at 1% level of significance. Furthermore, the treatment effect for participation in the hand-hygiene contest in isolation is also positive and significant (22 percentage points) and is significant at 1% level of significance.

Using the results in the table above for the presence of soap and water, we can multiply the treatment effect by the number of households that iDE has worked with in each sub-group and obtain overall estimates for the number of households with improved hand hygiene practices. Using the formula presented in the previous section, we have the following:

$$\begin{aligned} \# \text{ of additional people with improved hand hygiene practices} = \\ (TE_{(promotion, no\ contest)} * n_{(promotion, no\ contest)}) + (TE_{(contest, no\ promotion)} * n_{(contest, no\ promotion)}) + \\ (TE_{(contest, promotion)} * n_{(contest, promotion)}) \end{aligned}$$

By plugging in the treatment effects and number of households within each sub-group we have:

$$\begin{aligned} \# \text{ of additional people with improved hand hygiene practices} = \\ (59\% * (134,332 * 22\%)) + (22\% * ((42,000 \text{ hhs} * 2.86 \text{ ppl/hh}) + (56,973 * 2.7 \text{ ppl/hh}))) + \\ (62\% * (134,332 * 78\%)) \end{aligned}$$

We end up with the following:

$$\# \text{ of additional people with improved hand hygiene practices} = \mathbf{142,646}$$

In addition to using DFAT’s preferred indicator (soap and water present), we have estimated the number of households with improved hand hygiene practices using the other outcome indicators presented above.

Outcome area	Specific Measure Used	# of People
Increase in Hand Hygiene Behavior Change	At least 2 use proxy variables are observed at the household (i.e., soap is present, water is present, meets hygienic standards, has handwashing sticker).	151,453
	The respondent claims that the household members “always wash hands after using the latrine.”	0*
	At least 2 use proxy variables are observed at the household AND respondent claims to “always” wash hands after defecation	30,896
	<b>There is presence of soap and water at the household.</b>	<b>142,646</b>

Note: \* = none of the treatment effects were statistically significant when looking at this outcome variable.

## Reporting

For the purposes of reporting to DFAT we need to consolidate all of these analyses and enter them into the PRT. Below is the proposed content for the PRT, with references to where the supporting evidence may be found.

Your Ref. No.	Fund KRA	Who is the target population that your project will influence	Impact on target population by end of project	Situation at beginning of project	Cumulative achievements to date (Annual report)
H1	4.1	Rural households in 5 targeted districts of 2 provinces	100,000 additional people have improved knowledge of good hygiene practices related to latrine use	These people have some knowledge of hygiene practices; however do not know much about the benefits of hand washing with soap related to latrine use, and do not know how to wash hands properly.	<b><u>200,174 people had improved knowledge of good hygiene practices related to latrine use</u></b> by July 2018 - based on a nonparametric treatment effects model testing the efficacy of the hand-hygiene contest as well as latrine promotion and ownership using survey-based data from 974 households across three treatment groups and one counterfactual group.
H2	4.1	Rural households in 5 targeted districts of 2 provinces	75% of the 30,000 additional households with hygienic latrines built/upgraded during the project are also practicing hand hygiene.	These people do not have the habit of washing hands with soap after latrine use.	Results from the year three hand-washing knowledge and practices evaluation show that there is a treatment effect of 59% for latrine clients when compared to control, and that hand-hygiene contest participants had a treatment effect equal to 22% over control. Based on the project latrine sales data (33,583 HHs or 134,332 people) and the hand-hygiene contest participants list (273,850), <b><u>we have estimated that 142,646 people have improved hand hygiene practices</u></b> using the DFAT-suggested indicator (i.e., soap and water present at the home).

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