Disgust, Shame and Soapy Water:
Tests of Novel Interventions to Promote Safe Water and Hygiene

Online Appendix

Raymond P. Guiteras[a,b], David I. Levine[c], Stephen P. Luby[d],
Thomas H. Polley[e], Kaniz Khatun-e-Jannat[f], Leanne Unicomb[f]

August 2015

[a] Department of Economics, University of Maryland, College Park, MD 20742 USA.
[b] Corresponding author. Tel. +1 301 405 3480; fax +1 301 405 3582. guiteras@econ.umd.edu
[c] Haas School of Business, University of California, Berkeley, CA 94720 USA
[d] Woods Institute for the Environment, MC 4205, Stanford University, Stanford, CA 94305 USA.
[e] Department of Economics, Duke University, Durham, NC 27708 USA.
[f] Water, Sanitation and Hygiene Research Group, ICDDR,B, GPO Box 128, Dhaka 1000, Bangladesh.

Contents

1 Model

In this section, we expand on the intuition provided in the main text by developing a simple formal model of health behavior. In the model, we describe how disgust and shame can motivate positive health behavior, and outline the circumstances under which they may be more or less effective than a standard positive health treatment. Our baseline case is a neoclassical agent, i.e an expected utility maximizer who discounts future utility exponentially. We then extend the model to allow for (a) present bias, which we model as classic beta-delta discounting (Laibson 1997) and (b) non-standard preferences, in particular the utility impact of disgust and feelings of shame. To focus on the key issues at hand, the model abstracts from potentially important issues such as habit formation or discordant preferences within the household.

1.1 Baseline case

Consider an agent considering whether or not to take a preventative action to mitigate an environmental health risk. For concreteness, we will refer to this action as treating water with chlorine, but other behaviors such as handwashing apply as well. The cost of treating water is c, which can include both financial and non-financial costs (e.g., inconvenience, distaste for chlorinated water). The cost is incurred in the current period t. The benefit of water treatment is a reduction in the probability of illness in the next period, $t+1$. The agent believes the probability of illness is π_0 if she does not treat her water and π_1 if she does treat her water, and believes the cost of illness to be h.[7] We assume her per-period utility is linear and separable,

$$U_t = -c_t - h_t, \tag{1}$$

where c_t is zero if not treating or c if treating, h_t is zero if not sick and h if sick, and her per-period discount factor is δ. The current-period expected utility gain from water treatment is the discounted value of the increased probability of remaining healthy, $\delta(\pi_0 - \pi_1)h$, and the current-period cost is c, so the agent will treat her water if and only if

$$\delta(\pi_0 - \pi_1)h > c. \tag{2}$$

[7] We do not model the formation of beliefs, but do allow that, in principle, an intervention could alter these beliefs.

The implications for interventions to increase water treatment are clear. First, interventions that reduce financial costs, such as providing subsidized or free chlorine, or non-financial costs, such as increasing convenience or ease of use, or reduce negative elements such as the taste or smell of chlorine, are likely to increase treatment. Second, because many Bangladeshi households either do not know about the link between untreated water and disease (often because they do not believe piped water is contaminated) or do not believe that treatment can reduce the likelihood of disease (Gupta et al. 2008), educational interventions that increase the agent's subjective belief that water treatment reduces illness ($\pi_0 - \pi_1$) are also likely to increase treatment (e.g., Jalan and Somanathan (2008)). Finally, the agent might not be aware of all the costs of water-borne disease, such as long-term effects on child development, so educational efforts might seek to increase perceived h.

1.2 Present Bias

We now augment the model to allow present bias. We use the standard formulation: utility in the current period (t) is not discounted, utility in period $t+1$ is discounted by $\beta\delta$, and utility in any subsequent period $t+s$ is discounted by $\beta\delta^s$ (for $\beta < 1$). We assume agents are not sophisticated, in the sense of O'Donoghue and Rabin (1999): they do not account for how their present bias in the future will affect their future decisions.

Now the agent's gains from water treatment are reduced by the factor β, because these gains are realized in period $t+1$, while the costs, incurred in the current period, are not affected, so she will treat her water in period t if and only if

$$\beta\delta\left(\pi_0 - \pi_1\right)h > c. \tag{3}$$

This inequality is more difficult to satisfy than Equation (2). The present bias term β is especially important if the relevant time horizon is short: daily discount factors are rarely below 0.995, while the present bias factor in poor nations has been estimated at approximately 0.70 (Bisin and Hyndman 2014, Tanaka, Camerer, and Nguyen 2010, Nguyen 2009). Note that the agent may display time-inconsistency: in period t, an agent deciding on her action in period $t+1$ would follow the decision rule given by Equation (2), not Equation (3), because β is applied to both costs and benefits.

1.3 Disgust

We now enrich our model with the emotion of disgust. We assume: (a) disgust, as a visceral, emotional reaction, carries an immediate[8] utility cost d; (b) while disgust at consuming human feces is an inherent trait, interventions can "increase" disgust, in the sense of making it more salient to individuals that failing to treat water or wash hands will lead to the consumption of human feces. In the context of the model, then, an intervention that successfully causes agents to feel disgust if they do not treat their water means that not treating water will cause an immediate utility loss of d.

A time-consistent agent will now treat her water if and only if

$$\delta\left(\pi_0 - \pi_1\right)h > c - d\,, \tag{4}$$

which is always easier to satisfy than Equation (2), because the benefit of avoided disgust offsets some of the cost of treatment. A present-biased agent will now treat her water if and only if

$$\beta\delta\left(\pi_0 - \pi_1\right)h > c - d\,. \tag{5}$$

Note that, for a present-biased agent, an intervention targeting d will be especially effective relative to an intervention that increases $\left(\pi_0 - \pi_1\right)h$ by an equal amount, because d is not discounted.

1.4 Shame

We model shame as a utility cost to being observed violating social norms by others. In this context, shame can be caused by being observed committing a disgusting act, e.g. failing to treat water or failing to wash hands after defecating.

We consider two forms of shame, internal and external. Internal shame consists of the inherent and immediate disutility of being observed failing to treat water, independent of any action the observer might take. Mobilizing the emotion of internal shame requires that at the agent's decision time, she believe observers know about the fecal contamination. This internal shame cost (S_I) enters the utility function in parallel with disgust, but multiplied by the subjective probability of being observed by a neighbor who knows there is fecal contamination without prevention, which we denote π_{Obs}. This

[8] There can be some delay if drinking occurs after the opportunity for treating and if disgust occurs only when drinking; however, most water in this setting is drunk soon after it is collected, almost always in the same day.

probability is itself the product of the probability of being observed and the probability that an observer will consider failing to treat water a disgusting act. That is, shame is more likely to be incurred in situations where (a) one is very likely to be observed and (b) there is a strong social norm that failing to treat water is disgusting. Condition (a) is plausible in our context, where many families share a water source, latrine and handwashing station, and activities in these common areas are easily observable. Condition (b) depends on the effectiveness of an intervention targeting feelings of disgust.

External shame costs (S_E) are the consequence of social sanctions. If someone breaks social norms within a cohesive group, he or she may fear loss of status, ostracism, ridicule, and other sanctions (Curtis, Danquah, and Aunger 2009). Mobilizing fear of sanctions requires that the agent believe observers recall the presence of fecal contamination and that the agent care about her standing within a social group that he or she shares with observers. Because any sanctions would occur in the future, they are discounted by $\beta\delta$.

Incorporating internal and external shame into the agent's utility function leads to the inequality

$$\beta\delta\left[\left(\pi_0-\pi_1\right)h+\pi_{Obs}S_E\right]>c-d-\pi_{Obs}S_I\,, \tag{6}$$

where $\beta=1$ for an exponential discounter. An effective intervention targeting disgust and shame will increase all of disgust (d), the perceived probability of being observed and sanctioned (π_{Obs}), the cost of the social sanction (S_E) and internalized shame costs (S_I).

2 Sample Selection

Selection of Compounds

Because these are informal settlements, it was not possible to construct a proper sampling frame. Instead, within the chosen field sites, enumerators were instructed to follow a basic, designated route through the chosen field sites. Upon identifying an eligible compound, the enumerator would contact the compound manager, the person who runs day-to-day affairs of the compound on behalf of landlords, and who typically but not always resides in the compound. The enumerator would tell the manager that the compound was eligible for an icddr,b promotion, and ask for written consent to participate in the study. If the manager declined consent, the enumerator moved on to the next eligible compound. If the manager gave consent, the enumerator collected basic stratification data. To reduce possible spillovers, compounds within 50 meters of an enrolled compound were not subsequently approached.

Selection of Households

Water testing: six households were selected randomly among those with an adult present at the time of the visit. In subsequent visits, these original six households were prioritized, with additional households selected at random until six samples were obtained.

Household survey: two households per compound were randomly selected at baseline. At the midline and endline surveys, these two households were prioritized, and replaced with a randomly selected household if not available.

3 Sequential Randomization

Here, we provide a brief summary of the sequential randomization method we employed. We provide detailed exposition on the method and field implementation in Guiteras, Levine, and Polley (2015).[9] Stata code is available from the authors upon request.

For intuition, consider a single, binary treatment that the researcher wishes to randomize, stratifying on a single, binary covariate, e.g. men and women. However, the researcher receives subjects passively, without knowing the share of men and women in the sample. Suppose that the next subject to arrive is a woman. If more women are currently allocated to treatment than control, then allocating this woman to control will reduce the variance of the estimated treatment effect by more than allocating her to treatment, so the optimal allocation for her is to control.[10] Similarly, if more women are currently allocated to control than treatment, she should be allocated to treatment. If there are equal numbers of women in treatment and control, the researcher should allocate her to the arm with fewer men to minimize the overall variance, or flip a coin if men are balanced.

Atkinson's D_A-optimal sequential allocation method (Atkinson 1982) generalizes this intuition to more complex designs with multiple treatments and multiple stratification variables. The researcher's objective function is a weighted average of the expected variances of the estimated treatments, where the researcher chooses the weights. As each unit arrives, the algorithm chooses the assignment that minimizes that minimizes this objective function, given that unit's stratification covariates and the allocation of previously enrolled units. Because this weighted average is proportional to the determinant of a quadratic form involving the sample design matrix (treatments and stratification

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[9] Stata code is provided at http://www.econ.umd.edu/research/papers/617, and we encourage any interested researchers to contact us with questions on the code or implementation.

[10] The variance of the estimated treatment effect on women, $V\left[\hat{\beta}_F\right]$, is equal to the variance of the difference in the estimated means, $V\left[\overline{y}_{F,T}-\overline{y}_{F,C}\right]$. This is equal to the sum of the variances of the components, $V\left[\overline{y}_{F,T}\right]+V\left[\overline{y}_{F,C}\right]$ (the covariance is zero), or $\sigma_F^2/N_{F,T}+\sigma_F^2/N_{F,C}$, where for simplicity we assume homoscedasticity and independence. The allocation that minimizes variance, then, is $N_{F,T}=N_{F,C}$.
In this simple example, it is unlikely that there will be any important efficiency loss from considering the subpopulation treatment effects separately, since the maximum imbalance in either subpopulation at any stage is 1. However, in a more complex design, it is not necessarily optimal to consider only the precision of the subgroup to which the current subject belongs. It may be that the allocation within that subgroup is imbalanced in one direction but the overall allocation is imbalanced in the other direction, so assigning this subject so as to minimize variance within its own subgroup does not minimize the variance of the estimate of the average treatment effect.

covariates), the algorithm requires only simple matrix algebra operations that an inexpensive computer using standard software can perform in real time.

The critical requirement is that the unit's exact place in the sequence be uncorrelated with potential outcomes.[11] This could be violated if, for example, in a clinical setting an intake nurse knew the algorithm and manipulated the order in which subjects were processed to ensure that a particular subject received a particular treatment. This was not likely in our context. Enumerators did not know which of several covariates they collected would be used as stratification variables, so they could not have anticipated which assignment any given compound would receive. In contexts where this is a concern, a "biased coin" version of the sequential allocation algorithm allocates a subject probabilistically, putting highest weight on the option that would reduce the variance the most.

Inference can be conducted using the usual regression-based methods, as we do in this paper. Alternatively, the researcher could follow the "reasoned basis for inference" logic of Fisher (1935) and construct counterfactual distributions by reshuffling the order in which subjects arrive. See also Rosenbaum (2010).

[11] Because the algorithm seeks to maintain balance at each point in the sequence, it is robust to trends or fluctuations in potential outcomes. For example, neither a geographic pattern to enrollment nor a change in recruitment methods would cause bias, even if these were correlated with potential outcomes (e.g., moving from richer to poorer neighborhoods, or making a greater effort to recruit poor subjects).

4 Cost-Effectiveness

About 1 of every 1000 children ages 1-59 months dies of diarrhea in Bangladesh each year,[12,13] and about 40% of households in our sample have a child in this age range. Clasen et al. (2007) report that consistent water treatment can avert about 40% of diarrhea. Assume an averted child death is "worth" 25 DALYs, which we believe is a conservative assumption given that global burden of disease calculations have assumed 33 DALYs per child life saved (Mathers, Ezzati, and Lopez 2007). We adopt the WHO standard that an intervention is "very cost-effective" if it the cost of saving 1 DALY is less than or equal to 1 year's GDP.[14] Bangladesh's GDP per capita was about $950 in 2013.[15]

With these assumptions, providing chlorine dispensers are a "highly effective" intervention if it costs $9.75 or less per household per year that uses chlorine regularly. With an 8 percent usage rate after 7 months (Table 1), providing a chlorine dispenser and either marketing message to a compound with 8 households is a "highly effective" intervention if it costs up to $6.24 / year. However, we estimate that a small business or NGO running at scale could promote and distribute chlorine dispensers and visit monthly to replenish chlorine and collect fees at a break-even cost of 200 to 300 taka ($2.50 to $3.50) per compound per month, or a minimum of $30 / year, well above the cost-effectiveness threshold (authors' calculations).

Almost twice as many children 1-59 months die of pneumonia as diarrhea in Bangladesh each year.[16] Handwashing with soap averts very approximately a third of both diarrhea and pneumonia (Fewtrell et al. 2005, Rabie and Curtis 2006). Thus, soapy bottles are a "highly effective" intervention if it costs $23.55 or less per household per year that washes hands with soap regularly. With about 4.8 percentage points higher handwashing with soap when we provided a soapy bottle (Table 5), providing soapy bottles, refills on soap and either marketing message to a compound with 8 households is a "highly effective" intervention if it costs up to $9 per year. The approximate cost of the soapy bottle intervention is approximately $6 per compound per year, below this threshold (authors' calculations).

These estimated benefits do not include medical costs saved (for households, governments and NGOs), the utility value of lower morbidity, or the time savings of avoiding illness. However, an offsetting downward bias may result from our assumption that no chlorine users would have boiled.

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12 http://www.unicef.org/bangladesh/media_7870.htm
13 http://www.who.int/maternal_child_adolescent/epidemiology/profiles/neonatal_child/bgd.pdf
14 http://www.who.int/choice/costs/CER_levels/en/
15 http://data.worldbank.org/indicator/NY.GDP.PCAP.CD
16 http://www.who.int/maternal_child_adolescent/epidemiology/profiles/neonatal_child/bgd.pdf

5 Disgust Box

As part of the disgust-and-shame presentation we used a custom presentation tool, the "disgust box." The key moment occurs when presenter pours clear water on the top of a box after the audience has learned that the horizontal pipe has holes in it and after the presenter has placed (fake) feces on top of the pipe. "This water sprinkling down is like rain from the sky," she explained.

She poured clean water through the pipe on the left. The water ran clear from the pipe on the right.

When she offered the water to the audience, they agreed it looked clear but was disgusting to drink. Coupled with photos of pipes running through untreated sewage, the presentation evoked feelings of disgust in most audience members.

The full disgust and shame presentation is provided in the Online Supplement. A video of the disgust box portion of the presentation is available at https://www.youtube.com/watch?v=pnEqblSbzq8.

6 References

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7 Tables

Table S1: Share of households with detectable chlorine residual, by motivational treatment

	(1) Small; 2-mo.	(2) Small; 3.5 mo.	(3) Large; 2-mo.	(4) Large; 3.5 mo.
Standard message	0.1076	0.0956	0.0664	0.0707
	(0.0238)	(0.0174)	(0.0155)	(0.0144)
Disgust message	0.1232	0.0635	0.1146	0.0988
	(0.0209)	(0.0150)	(0.0203)	(0.0173)
Est. diff. (disgust - standard)	0.0156	-0.0320	0.0482*	0.0281
Std. Err.	(0.0317)	(0.0230)	(0.0255)	(0.0225)
Num. compounds	195	195	222	218
Num. households	989	875	1270	1161

Note: this table shows the share of households, by treatment and survey wave, with detectable chlorine in their drinking water, as well as the estimated difference between the disgust and standard treatments. Columns (1) and (2) present estimates for compounds with 8 or fewer households at baseline; Columns (3) and (4) present estimates for compounds with more than 8 households.Estimation by logit regression. Estimated discrete differences presented with standard errors clustered at the compound level in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Table S2: Effect of handwashing treatment on availability of soap and water (Balanced Panel)

	(1) Baseline	(2) 3.5-month
No handwashing treatment	0.289	0.108
	(0.050)	(0.034)
Handwashing treatment	0.179	0.631
	(0.030)	(0.037)
Estimated difference	-0.111*	0.523***
Std. Err.	(0.058)	(0.051)
Difference in differences		0.633***
Std. Err.		(0.072)
Number of compounds	251	251

Note: this table shows the share of compounds, by handwashing treatment and survey wave, with soap and water available at the common latrine, as well as the estimated difference between treatments and, for survey wave 2 (3.5-month midline), a difference-in-differences estimate using the difference at baseline for comparison. Estimation by logit regression. Sample is restricted to a balanced panel, i.e. compounds surveyed in all 3 rounds. Standard errors clustered at the compound level in parentheses. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Table S3: Effect of handwashing treatment on availability of soap and water

	(1) Small; Baseline	(2) Small; 3.5-mo.	(3) Large; Baseline	(4) Large; 3.5-mo.
No handwashing treatment	0.111	0.111	0.420	0.200
	(0.053)	(0.040)	(0.070)	(0.046)
Handwashing treatment	0.143	0.568	0.204	0.601
	(0.040)	(0.043)	(0.042)	(0.041)
Estimated difference	0.032	0.457***	-0.216***	0.401***
Std. Err.	(0.066)	(0.059)	(0.082)	(0.062)
Difference in differences		0.425***		0.617***
Std. Err.		(0.086)		(0.099)
Number of compounds	113	195	143	218

Note: this table shows the share of compounds, by handwashing treatment and survey wave, with soap and water available at the common latrine, as well as the estimated difference between treatments and, for survey wave 2 (3.5-month midline), a difference-in-difference estimate using differences at baseline for comparison. Columns (1) and (2) present estimates for compounds with 8 or fewer households at baseline; Columns (3) and (4) present estimates for compounds with more than 8 households. Estimation by logit regression. Standard errors clustered at the compound level in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Table S4: Effect of losing free soap delivery on soap and water availability, by compound size

	(1) Small; Won	(2) Small; Lost	(3) Large; Won	(4) Large; Lost
Midline (3.5 mo.)	0.676	0.520	0.581	0.500
	(0.081)	(0.071)	(0.090)	(0.073)
Endline (7 mo.)	0.576	0.280	0.677	0.438
	(0.087)	(0.064)	(0.085)	(0.072)
Estimated difference	-0.101	-0.240**	0.097	-0.062
Std. Err.	(0.105)	(0.101)	(0.134)	(0.096)
Diff-in-diffs		-0.139		-0.159
Std. Err.		(0.146)		(0.165)
Number of compounds	34	50	31	48

Note: this table shows the share of compounds with soap and water available at the latrine by BDM outcome and survey wave, by compound size (8 households or fewer vs. more than 8 households). Columns (1) and (3) show levels for compounds that won the BDM auction at the 3.5-month midline survey, i.e. during the free trial and approximately two weeks before the BDM auction, and the 7-month endline survey, approximately 3 months after the BDM auction, as well as the estimated difference between the midline and endline. Columns (2) and (4) show the same for compounds that lost the BDM auction. Columns (2) and (4) also provide difference-in-differences estimates comparing changes from midline to endline between compounds that lost the in the auction vs. those that won. Compounds that won kept the chlorine dispenser and the soapy water bottle, and continued to receive 2 packets of detergent per household per month for use in the soapy water bottle. Compounds that lost retained the soapy water bottle, but did not receive resupply of detergent. The sample consists of compounds in the handwashing arm and in which an auction was conducted. Estimation by logit regression. Standard errors clustered at the compound level in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Table S5.A: Share of compounds with soap and water available at the latrine, by messaging treatment; Compounds with 8 or fewer households

	(1) Baseline	(2) 3.5-month	(3) 7-month
Standard	0.129	0.475	0.381
	(0.043)	(0.050)	(0.049)
Disgust	0.137	0.365	0.358
	(0.048)	(0.049)	(0.049)
Estimated difference	0.008	-0.110	-0.024
Std. Err.	(0.065)	(0.070)	(0.070)
Difference in differences		-0.118	-0.032
Std. Err.		(0.089)	(0.102)
Number of compounds	113	195	192

Table S5.B: Share of compounds with soap and water available at the latrine, by messaging treatment; Compounds with more than 8 households

	(1) Baseline	(2) 3.5-month	(3) 7-month
Standard	0.221	0.450	0.417
	(0.050)	(0.048)	(0.048)
Disgust	0.333	0.477	0.454
	(0.055)	(0.048)	(0.048)
Estimated difference	0.113	0.028	0.037
Std. Err.	(0.074)	(0.068)	(0.068)
Difference in differences		-0.085	-0.076
Std. Err.		(0.101)	(0.101)
Number of compounds	143	218	216

Note: this table shows the share of compounds, by messaging treatment and survey wave, with soap and water available at the common latrine, as well as the estimated difference between treatments and, for survey waves 2 (3.5-month midline) and 3 (7-month endline), difference-in-difference estimates using differences at baseline for comparison. Estimation by logit regression. Standard errors clustered at the compound level in parentheses. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Table S6: Share of compounds with soap and water available at the latrine, by messaging treatment

	Handwashing			Non-handwashing		
	(1) Baseline	(2) 3.5-month	(3) 7-month	(4) Baseline	(5) 3.5-month	(6) 7-month
Standard	0.161	0.607	0.457	0.209	0.162	0.284
	(0.040)	(0.041)	(0.042)	(0.062)	(0.045)	(0.055)
Disgust	0.193	0.563	0.433	0.372	0.157	0.362
	(0.043)	(0.043)	(0.043)	(0.074)	(0.044)	(0.058)
Estimated difference	0.032	-0.044	-0.024	0.163*	-0.005	0.079
Std. Err.	(0.059)	(0.059)	(0.060)	(0.097)	(0.063)	(0.080)
Difference in differences		-0.076	-0.056		-0.167	-0.084
Std. Err.		(0.079)	(0.086)		(0.112)	(0.131)
Number of compounds	170	275	272	86	138	136

Note: this table shows the share of compounds, by messaging treatment and survey wave, with soap and water available at the common latrine, as well as the estimated difference between treatments and, for survey waves 2 (3.5-month midline) and 3 (7-month endline), difference-in-difference estimates using differences at baseline for comparison. Columns (1) - (3) restrict the sample to compounds assigned to the Handwashing treatment; Columns (4) - (6) restrict the sample to compounds assigned to the Non-handwashing treatment. Estimation by logit regression. Standard errors clustered at the compound level in parentheses. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Table S7.A: Handwashing after visiting toilet, by handwashing treatment
Compounds with 8 or fewer households

	(1) Used water	(2) Used soap	(3) Used soap, both hands
No handwashing	0.528	0.108	0.0982
	(0.0251)	(0.0154)	(0.0146)
Handwashing	0.556	0.191	0.170
	(0.0182)	(0.0140)	(0.0131)
Estimated difference (HW - no HW)	0.029	0.083***	0.072***
Std. Err.	(0.031)	(0.021)	(0.020)
Number of compounds	195	195	195
Number of observations	2196	2200	2210

Table S7.B: Handwashing after visiting toilet, by handwashing treatment
Compounds with more than 8 households

	(1) Used water	(2) Used soap	(3) Used soap, both hands
No handwashing	0.579	0.118	0.112
	(0.0270)	(0.0167)	(0.0168)
Handwashing	0.544	0.159	0.143
	(0.0195)	(0.0129)	(0.0121)
Estimated difference (HW - no HW)	-0.035	0.042**	0.030
Std. Err.	(0.033)	(0.021)	(0.021)
Number of compounds	222	222	222
Number of observations	2945	2951	2972

Note: this table shows the share of toilet events after which compound residents (1) rinsed their hands with water (with or without soap), (2) used soap to wash at least one hand, (3) used soap to wash both hands, by handwashing treatment, as well as the estimated difference between the handwashing and non-handwashing treatments. Data collected during structured observation at approximately month 2 of the free trial. Estimation by logit regression. Standard errors clustered at the compound level in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Table S8.A: Handwashing after visiting toilet, by motivational treatment
Compounds with 8 or fewer households

	(1) Used water	(2) Used soap	(3) Used soap, both hands
Standard	0.557	0.165	0.150
	(0.0217)	(0.0165)	(0.0155)
Disgust	0.537	0.164	0.143
	(0.0199)	(0.0148)	(0.0137)
Estimated difference	-0.020	-0.001	-0.007
Std. Err.	(0.030)	(0.022)	(0.021)
Number of compounds	195	195	195
Number of observations	2196	2200	2210

Table S8.B: Handwashing after visiting toilet, by motivational treatment
Compounds with more than 8 households

	(1) Used water	(2) Used soap	(3) Used soap, both hands
Standard	0.553	0.133	0.123
	(0.0239)	(0.0134)	(0.0130)
Disgust	0.558	0.160	0.143
	(0.0205)	(0.0156)	(0.0148)
Estimated difference	0.005	0.027	0.020
Std. Err.	(0.031)	(0.021)	(0.020)
Number of compounds	222	222	222
Number of observations	2945	2951	2972

Note: this table shows the share of toilet events after which compound residents (1) rinsed their hands with water (with or without soap), (2) used soap to wash at least one hand, (3) used soap to wash both hands, by motivational treatment, as well as the estimated difference between the disgust and standard arms. Data collected during structured observation at approximately month 2 of the free trial. Estimation by logit regression. Standard errors clustered at the compound level in parentheses. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Table S9.A: Willingness to pay by messaging treatment
Compounds with 8 or fewer households

	(1) Compound WTP	(2) WTP per HH
Standard	35.500	5.309
	(6.146)	(0.937)
Disgust	42.453	6.128
	(7.428)	(1.049)
Estimated difference	6.953	0.819
Std. Err.	(9.641)	(1.406)
Number of compounds	103	103

Table S9.B: Willingness to pay by messaging treatment
Compounds with more than 8 households

	(1) Compound WTP	(2) WTP per HH
Standard	41.981	3.696
	(6.237)	(0.526)
Disgust	45.283	4.146
	(6.804)	(0.641)
Estimated difference	3.302	0.450
Std. Err.	(9.230)	(0.829)
Number of compounds	106	106

Note: this table shows mean willingness to pay (WTP) for a one-year subscription to the chlorine dispenser by messaging treatment, as well as estimated differences between treatments (disgust - standard). Column (1) reports total compound WTP, while column (2) reports WTP per household. WTP for compounds that dropped out before the sale is coded as zero. The sample is limited to compounds assigned to the group auction treatment. Units are Bangladesh Taka (BDT), approximately 75 BDT / 1 USD at the time of the sale. Estimation by OLS regression. Robust standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Table S10.A: Willingness to pay by handwashing treatment
Compounds with 8 or fewer households

	(1) Compound WTP	(2) WTP per HH
No handwashing	41.129	6.139
	(9.181)	(1.337)
Handwashing	38.194	5.555
	(5.718)	(0.830)
Estimated difference	-2.935	-0.584
Std. Err.	(10.816)	(1.574)
Number of compounds	103	103

Table S10.B: Willingness to pay by handwashing treatment
Compounds with more than 8 households

	(1) Compound WTP	(2) WTP per HH
No handwashing	44.737	4.440
	(8.410)	(0.832)
Handwashing	43.015	3.631
	(5.451)	(0.446)
Estimated difference	-1.722	-0.809
Std. Err.	(10.022)	(0.944)
Number of compounds	106	106

Note: this table shows mean willingness to pay (WTP) for a one-year subscription to the chlorine dispenser by handwashing treatment, as well as estimated differences between treatments (handwashing - no handwashing). Column (1) reports total compound WTP, while column (2) reports WTP per household. WTP for compounds that dropped out before the sale is coded as zero. The sample is limited to compounds assigned to the group auction treatment. Units are Bangladesh Taka (BDT), approximately 75 BDT / 1 USD at the time of the sale. Estimation by OLS regression. Robust standard errors in parentheses. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

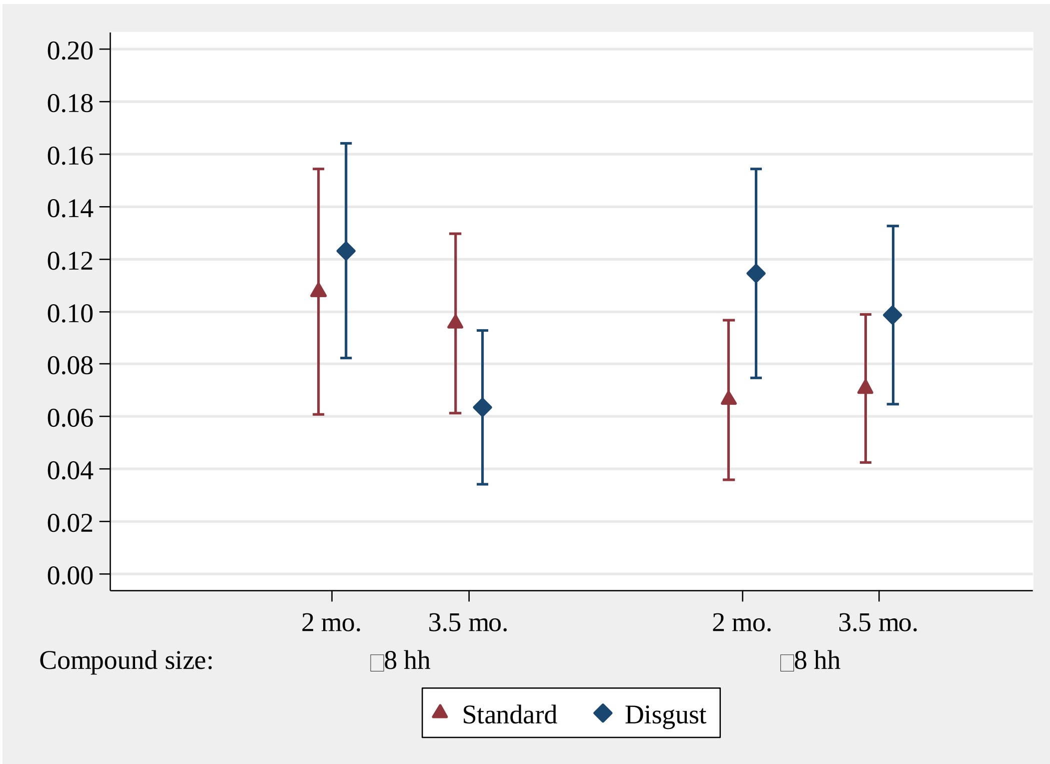
Table S11: WTP and Payment Compliance
Linear Probability Model

	(1)	(2)
Compound bid (BDT)	0.0011	0.0005
	(0.0012)	(0.0019)
Monthly payment (BDT)	-0.0034	-0.0051
	(0.0022)	(0.0054)
Interaction of bid and payment		0.0000
		(0.0000)
Avg. marg. effect of WTP	0.0011	0.0012
Std. Err.	(0.0012)	(0.0013)
Number of compounds	52	52

Note: this table presents estimates from a linear probability model where the dependent variable is an indicator for whether the compound completed its yearly subscription, i.e. makes all 12 monthly payments, and the independent variables are the compound's WTP, i.e. its bid in BDM, the monthly subscription fee, i.e. the price drawn in BDM, and, in column (2), their interaction. The first three rows present regression coefficients, while the fourth row presents the average marginal effect of a 1 BDT increase in a compound's WTP. The sample consists of all compounds that participated in the group auction and won the subscription, i.e. the lottery price was less than or equal to the compound's bid. Robust standard errors in parentheses. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

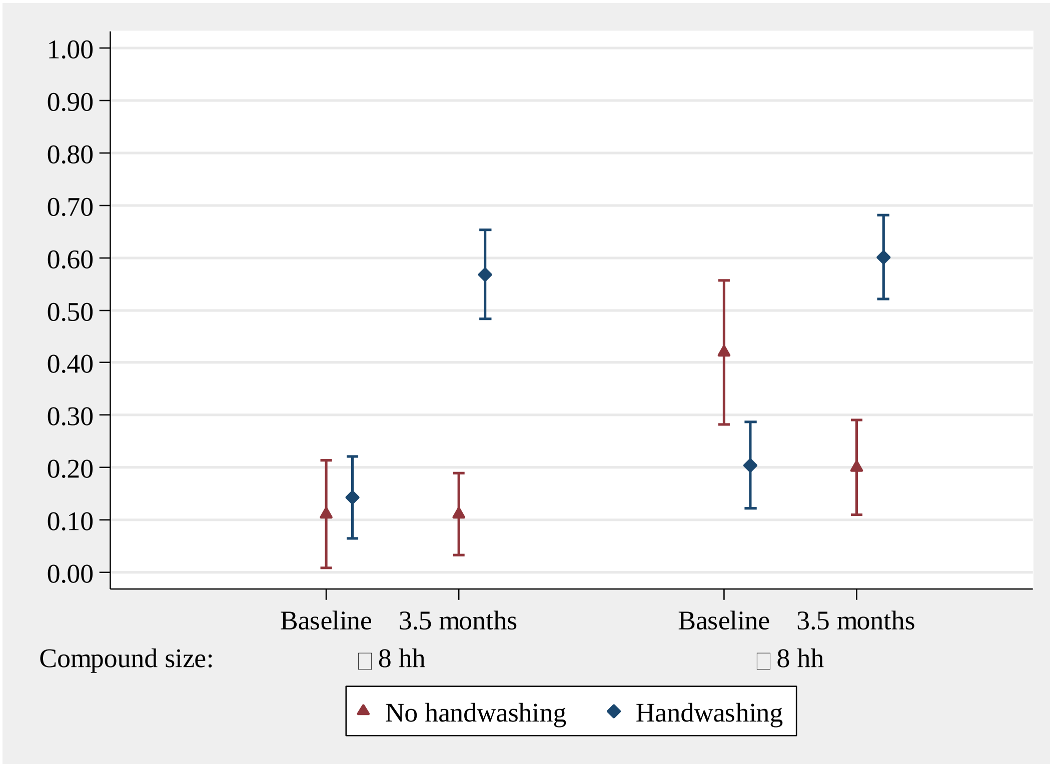
8 Figures

Figure S1: Rates of detectable chlorine in household drinking water, by treatment



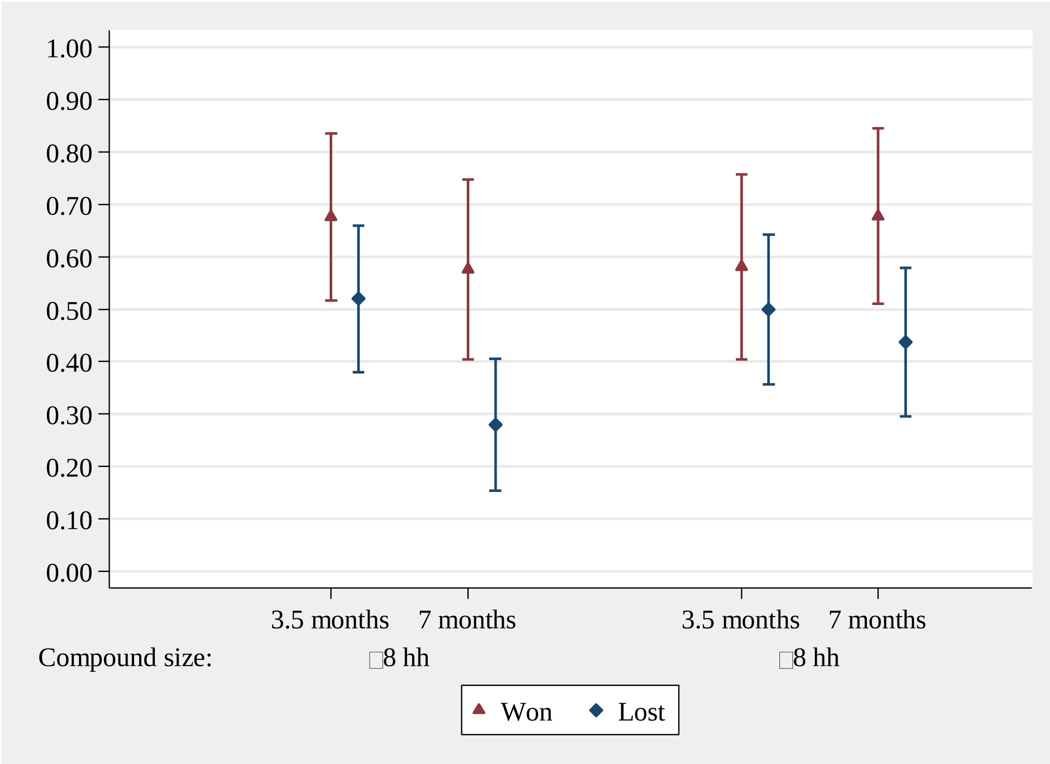
Note: this figure shows the share of households, by treatment and survey wave, with detectable chlorine in their drinking water. Estimates are presented, from left to right, for compounds with 8 or fewer households and compounds with more than 8 households. Point estimates and 95% confidence intervals estimated via logit regression. Standard errors clustered at the compound level.

Figure S2: Share of compounds with soap and water available at the common toilet, by treatment



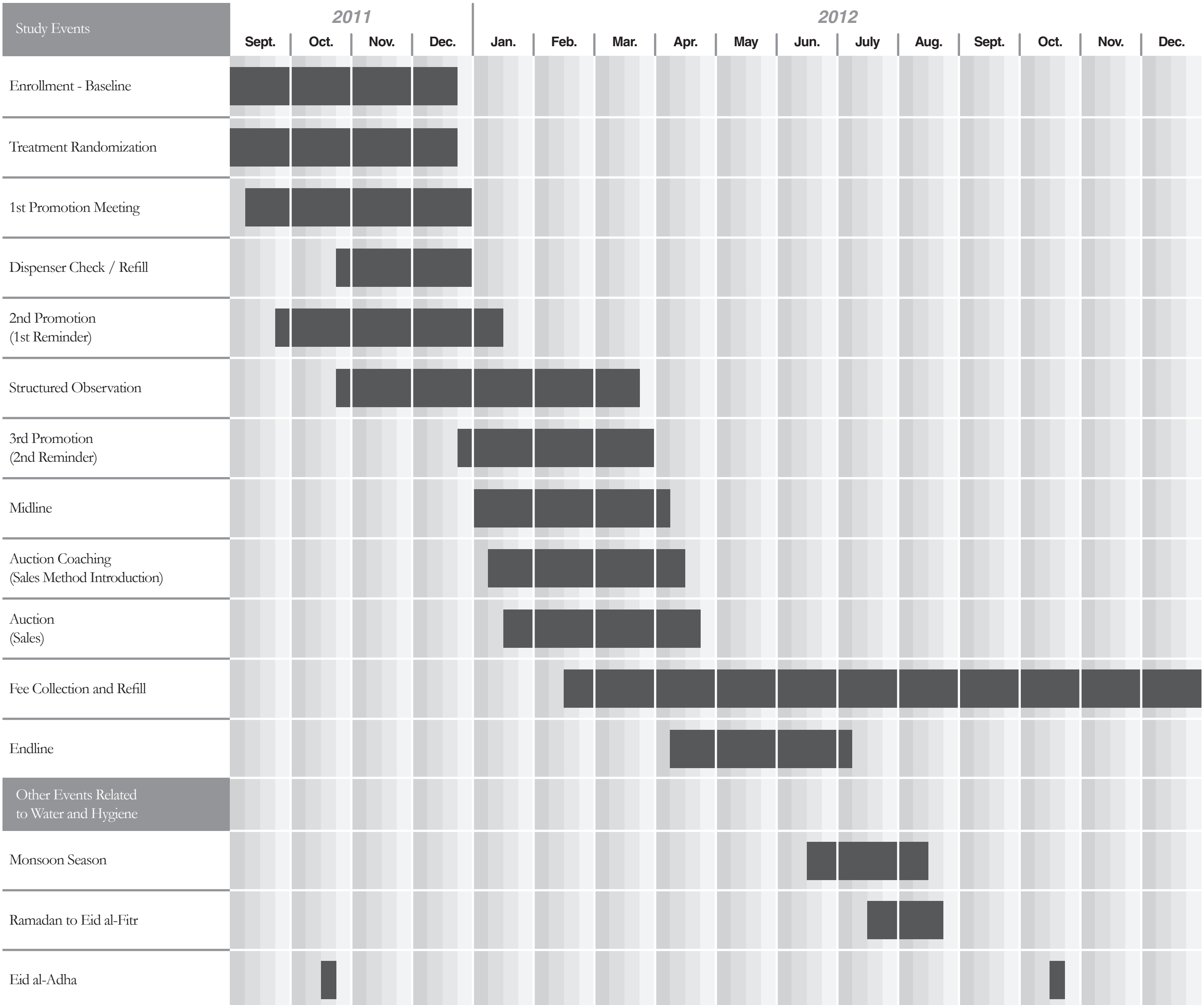
Note: this figure shows the share of compounds, by handwashing treatment and survey wave, with soap and water available at the common latrine. Point estimates and 95% confidence intervals estimated via logit regression. Standard errors clustered at the compound level. Estimates are presented, from left to right, for compounds with 8 or fewer households (baseline N=113; midline N=195) and compounds with more than 8 households (baseline N=143; midline N=218).

Figure S3: Effect of losing free soap delivery on soap and water availability at the latrine



Note: this figure shows the share of compounds, by BDM outcome and survey wave, with soap and water available at the common latrine. Compounds that won kept the chlorine dispenser and the soapy water bottle, and continued to receive 2 packets of detergent per household per month for use in the soapy water bottle. Compounds that lost retained the soapy water bottle, but did not receive resupply of detergent. The sample consists of compounds in the handwashing arm and in which an auction was conducted. Estimates are presented, from left to right, for compounds with 8 or fewer households (N=84, of which 34 won and 50 lost) and compounds with more than 8 households (N=79, of which 31 won and 48 lost).Point estimates and 95% confidence intervals estimated via logit regression. Standard errors clustered at the compound level.

Time Relative to Start of Free Trial	Visit Name	Data Collection	Behavior Change Campaign Activities
-1 week	Enrollment Baseline	Household Questionaire (2 hhs) Physical Observation (6 hhs) Rapid Observation (Spot Check)	None
-0.5 week	(Not a Visit) Treatment Randomization	None	None
Start of Free Trial	1st Promotion meeting	None	3 hour Campaign Meeting
2 weeks	2nd Promotion (1st Reminder)	Rapid Observation (Spot Check)	1.5 hour Campaign Meeting
As Needed	Dispenser Check / Refill	None	None
2 months	Structured Observation	Structured Observation (Handwashing, Water Treatment) Rapid Observation (Spot Check) Chlorine Residual Test	None
+3.5 months	3rd Promotion (2nd Reminder)	Rapid Observation (Spot Check)	1 hour Campaign Meeting
	Midline	Household Questionaire (2 hhs) Physical Observation (6 hhs) Rapid Observation (Spot Check)	None
+3.75 months	Auction Coaching (Sales Method Introduction)	Sales Practice BDM Understanding	10 minute Campaign Refresher
+4 months	Auction (Sales)	Dispenser WTP Rapid Observation (Spot Check)	10 minute Campaign Refresher
Monthly From +5 to +29 months (For Subscribers Only)	Fee Collection and Refill	Rapid Observation (Spot Check) Used Volume of Chlorine Payment	None
+7 months	Endline	Household Questionaire (2 hhs) Physical Observation (6 hhs) Rapid Observation (Spot Check)	None



Note: fee collection and refill continued for as long as 2 years, if compounds chose to renew their subscription after one year.