

Inside

Page 10

Surveillance updates

The disgust box: a novel approach to illustrate water contamination with feces

Inadequate drinking water, sanitation and hand hygiene are responsible for approximately 800,000 deaths per year in low- and middle-income countries. We evaluated the benefits of a behaviour change communication method to motivate water treatment practices in urban low income communities in Dhaka. We used a device called the 'Disgust Box' to provide a vivid demonstration of how piped water is contaminated with faeces to motivate people to chlorinate water. Most of the respondents were able to recall the demonstration at both four-month and one-year qualitative assessments. At four months, the majority of participants stated that they still felt disgusted by the demonstration and mentioned it as a motivator for water chlorination. However, after one year, despite being able to recall the demonstration, disgust was no longer mentioned as a motivator to chlorinate water. The Disgust Box has the potential to be an effective communication method to motivate water treatment but additional research is necessary to establish a more sustainable approach to reinforce behaviour change.



Inadequate drinking water, sanitation and hand hygiene are responsible for approximately 800,000 deaths per year in low- and middle-income countries (1). As a result of leaks in the distribution system, urban water sources are frequently contaminated with faecal matter (2). Treating drinking water at point-of-use (POU) remains uncommon despite promotional efforts, including provision of basic health education, so more effective behaviour change messages are needed (3,4). Disgust has been found to be a useful motivator to change hygiene-related behaviour in low-income countries (5). However, use of disgust messages to promote POU water treatment has not been evaluated. The objective of this study was to test the effectiveness of disgust-based messages compared to standard public health messages that use germs and disease to motivate water treatment behaviour.

We designed a mixed methods study which included a randomized controlled trial and qualitative assessment of interventions. The interventions included behaviour change communication messages and hardware for water chlorination (6). In this paper we will primarily focus on the qualitative assessment results of one component of our behaviour change communication. We selected five low-income communities in Dhaka, Bangladesh, and enrolled compounds (a group of households usually with a central courtyard) that had a shared water source, latrine and kitchen. In all sites the study participants were randomly assigned to two groups, one to receive standard health messages and the other to receive disgust- and shame-based (D&S) messages. We designed the qualitative assessment based on a conceptual framework, which explores assumptions of human behaviours and their determinants.

Promotional meetings and installation of water treatment devices

During the first week following enrolment we conducted the first promotional courtyard meetings in both standard health and D&S message groups. We delivered core behaviour change messages and installed hardware (a liquid chlorine dispenser and two water reservoirs) with messages for their use and maintenance in households of both groups. Two reminder promotional meetings were conducted two weeks and three and a half months after the first meeting. The Disgust Box demonstration was given only at initial promotional meetings with the D&S group.

Device and demonstration

The Disgust Box is a device that provides a vivid demonstration of how water becomes contaminated with faeces. It is a plastic container filled with dirt and mud and a pipe running through it. Pores in the pipe represent cracks. We incorporated fake faeces made out of plastic, a mug and a drinking glass to complete the demonstration process (Figure 1). The device costs about USD 15 to make.

Figure 1: The disgust box with fake plastic feces and a mug for pouring water



At the beginning of the Disgust Box demonstration, the presenter pours clear water into the pipe and clear water exits from the pipe. Next, the presenter pours coloured tea onto the dirt above the pipe and then pours clear water into the pipe and coloured water exits the pipe. After a few questions about why this happens, the audience typically responds that there must be holes in the pipe. The objective of this part of the demonstration is to ensure that participants understand that water can be contaminated if there are cracks in the pipeline. Next, the presenter puts fake plastic faeces on top of the dirt and pours clear water over to simulate rain fall and then pours clear water into the pipe and clear water exits from the pipe. The presenter then asks participants if they would like to drink this water. Usually most decline, saying that faeces must have entered the pipe, as the tea had before. Participants usually say that even though the water is clear it might have mixed with the rain water that passed over faeces and so would be disgusting to drink. Lastly, the presenter shows photos from of water pipes near sewage (Figure 2). These photos were taken in Dhaka neighbourhoods like their own. A video of the demonstration is available at <https://www.youtube.com/watch?v=pnEqblSbzq8>. In the narration, we used the word 'shit' rather than 'feces' to make the demonstration more disgusting.

Figure 2: Water distribution pipes near sewage in Dhaka



Data collection

The qualitative team performed their first round of assessments approximately four months after the first promotional meetings. This included 18 in-depth interviews (seven with standard behaviour and 11 with D&S participants) and eight focus group discussions (three among standard behaviour and five among D&S participants) at three different sites. The average size of focus groups was seven (range: 6-9) participants. We also conducted several informal discussions, four short interviews and unstructured observations in the first round of assessments in both groups. Approximately one year after the first promotional meetings, we conducted eight in-depth interviews (five among standard behaviour and three among D&S participants) to assess sustained use of water treatment devices.

Measurement of residual chlorine

Drinking water samples from households of both groups were tested using

'Hach colour gradient wheels' that detect residual chlorine at two, three and a half and seven months following the first promotional meetings. In each compound, we tested water samples from six households that were randomly selected during a baseline assessment. The presence of any amount of residual chlorine was considered to be an indicator of liquid chlorine use since source water that was tested essentially showed no chlorine (data not shown).

Data analysis

We recorded, transcribed, and coded the qualitative data. Data from observations and informal discussions were recorded in handwritten notes and cross-checked with the findings from in-depth interviews and focus group discussions and analyzed thematically.

Ethical considerations

We obtained written informed consent from the compound managers, who were usually the landlords or persons designated by landlords. The study was approved by icddr,b's Institutional Review Board.

Findings

Promotional meetings

Five promotional meetings were observed by the qualitative assessment team. During observation they found that most of the participants were young and middle aged females, and some brought their young children (aged 3-7 years) with them. The numbers of male participants were low and many often did not attend the full meetings. .

First round of qualitative assessments (follow up between 3- 4 months)

Message recall

In interviews among D&S participants, most (7/11) recalled the Disgust Box demonstration; though they used various terms to describe the device like *plastiker gu* (plastic poop) or *boro tob* (big vessel) and most (8/11) recalled the picture of the pipes passing through the drain. 'Disgusting' (*grinna laga*) was the most commonly uttered term, followed by the terms 'dirty work' (*nungra kaj*), 'doing wrong' (*bhul kaj*) or 'religiously forbidden work' (*haram kaj*) used by D&S participants to describe feelings about their previous practices. Standard message participants used less extreme terms, describing drinking untreated water with emotionally neutral terms such as 'bad' (*kharap*) and drinking 'contaminated' (*dushito*) water.

Change in knowledge

In both study areas, a majority of the respondents were able to recall core behaviour change messages delivered in the first promotional meetings. A respondent said, "*They [Field staff] showed how the water supply pipe comes through the dirty things. If we drink that water directly we may get diarrhoea, vomiting. They also showed how to mix the medicine [chlorine] into the water. We*

have to mix three drops of medicine in the 15 liters of water.”

Change in feeling

D&S respondents described their feeling regarding untreated water. One of the respondents said, *“When they [Field staff] had shown us the plastic poop [moylada] we thought that there might have poop in the untreated water [kachapani]”. Then another one added, “It must happen. We can see it that the water supply pipe comes under the drain. Recently there were large amounts of visible dirt in our water. After seeing this we feel more abhorrence [ovokti].”*

Behaviour change

In focus group discussions and in-depth interviews, participants shared how the demonstration influenced them to treat their water with chlorine:

“In the meeting a brother showed how shit [gu] could be mixed with the water that we drink. Now we drink medicine-mixed [chlorinated] water.”

“I felt disgusted when they [Field staff] had shown how shit [gu] could be mixed with water... If someone defecates on the leaky water supply pipe and if it rains then the rainy water will make the faeces mix with the supplied water. Thus water becomes dirty. That makes me think to drink this [chlorinated] water.”

“Without being informed we would drink shit-mixed water before. Who will drink that shit-mixed water after being informed?”

“Yes, pipe can leak. Once we had turbid water coming from the pipes. It was like the water we see after washing our clothes with detergent. Then we had to collect water directly from the reservoir of the water supply authority. After the promotion meeting we collect water with our own pot using medicine [chlorine] in it.”

Barriers to chlorine use

Absence of male members in the courtyard meetings was identified as a possible factor determining use of chlorine. In most cases where males (particularly husbands) were absent from the promotion meeting, females said that males did not want to drink chlorinated water. A D&S participant who did not use chlorine said, *“No, I am not drinking the chlorinated water. I get smell from it and it smells like bleaching powder.”* But later she added, *“Actually my husband did not want to drink this water. One day I asked him whether I could give him medicine-mixed water [chlorinated water] for drinking. He replied negatively... I did not want to know the reason for his refusal. It is forbidden for me. If my husband, the key person of our family, drank it I and my children would also have drank it.”*

But when the husbands had attended courtyard meetings, they sometimes motivated their wives to drink chlorinated water. A female D&S respondent said, *“My child’s father was present at the meeting. I got smell from the water earlier. But my child’s father told me to continue drinking the water so that it would be okay for me after some days.”* Another respondent said, *“All day long I am busy with my household activities and so I may forget to make the water*

chlorinated. My husband makes the water chlorinated before going to his work place in the morning."

Though the demonstration influenced feelings and attitudes about untreated water, many household members found it difficult to continue drinking chlorinated water due to its smell. A female D&S respondent said, *"My children do not want to drink it due to bad smell and so I do not drink it also. But I drank it at first."* Another D&S respondent said, *"After the meeting I was the first person who had drunk that water. But I cannot tolerate the smell of this water and so I have stopped drinking this."*

Comments on the demonstration

Most of the D&S participants mentioned that the Disgust Box demonstration was the most influential part of the demonstration for motivating their water treatment practices. One D&S respondent said, *"Can we drink our water after seeing such a thing that there are feces in our water?"*

Some D&S participants recommended the Disgust Box demonstration for promoting water chlorination. One participant said, *"If they [Field staff] show how faeces are mixed with water as they have shown us they [other compound's residents] will feel disgusted. Then they will not drink their household water. They will drink this [chlorinated] water."* Another respondent mentioned, *"Children may defecate on the leaky pipe and other dirt also can enter into the leaky pipe. If they [other compound's residents] listen to these words they will drink this chlorinated water. We listened to them [Field staff] and we understood. There is dirt in our supply water but we were not able to understand [before promotion meeting]. We thought it was iron dust from the tube-well. We understood after the promotion meeting. Wherever you will go and make them understand it would be better."*

Second round of qualitative assessments (follow up at 1 year)

A majority of respondents in both the standard behaviour and D&S message groups were able to recall core behaviour change messages delivered at the first promotional meetings. In addition, all three D&S participants interviewed in the second round of assessments recalled the messages and could clearly describe how faeces might be present in their drinking water, and two of them stated that they felt disgusted observing the plastic faeces and how faeces may contaminate their household water. One D&S participant who no longer used chlorine mentioned that the Disgust Box demonstration initially influenced her to drink chlorinated water. She said, *"When they [Field staff] showed [the demonstration using the Disgust Box] to us, initially I felt so embarrassed that I told my mother to bring chlorinated water for us. My mother was not present in the meeting all the time. We tried to drink the water for the first few days. But we could not drink it due to its smell. Now we drink boiled water."* Another D&S respondent who still used chlorine said, *"My child would get diarrhoea and he would need to drink ORS [oral rehydration*

solution]. But now he does not get diarrhoea. Though the water comes through the same pipe in the compound water source we drink the water with medicine that removes dirt from the water."

Quantitative measurement of water treatment

During follow up at two months and three and a half months after the first promotional meetings, the study team found residual chlorine in less than 15% of the water samples they collected. There were no statistically significant differences in residual chlorine detected from households of standard behaviour versus D&S participants. In a survey conducted at seven months, 45% (366/816) of participants mentioned the bad smell of chlorinated water as a barrier for using chlorine; there was no difference between standard behaviour and D&S group participants.

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Comments

The Disgust Box appears to be an effective tool for communicating a lasting message on water treatment. It provided information by simulating how faecal contaminants enter piped water and making a visceral impression on participants, with many reporting strong feelings of disgust that piped water was contaminated by faeces. The result was a high degree of self-reported intention to treat drinking water with chlorine, even when the water appears clean. And one year later, most participants exposed to the Disgust Box demonstration recalled the message. However, we did not observe differences in measured residual chlorine between groups that were and were not exposed to the Disgust Box demonstration.

The modest behaviour change found in this study may be due to several factors. Effective hygiene interventions typically involve repeated individual home visits (9) but due to budgetary constraints, we were only able to conduct one compound-wide promotional meeting that included a demonstration of the Disgust Box for D&S participants. In addition, intervention staff delivered the messages to persons present at compounds during promotional meetings, which were all conducted in the daytime, and almost all of the participants were women. Several studies have found that it is important to involve males in decisions about health-related behaviours (7,8). However, studies have shown that attaining even modest uptake of POU chlorine treatment is difficult (3,4), and respondents in this study reported the bad smell of chlorinated water was a barrier to using chlorine, which has been described previously (3).

The Disgust Box demonstration is a simple, inexpensive, and effective communication method that helps participants understand faecal

contamination in piped water and elicits feelings of disgust. However, exposure to D&S messages did not lead to higher rates of sustained behaviour change than exposure to a standard behavioural message. An important barrier to sustained POU water chlorination is the resultant unpleasant smell of the water. Though the smell of chlorinated water was a barrier for treating water with chlorine, some participants disinfected their water by boiling it following the promotional meetings. It will be important to identify more appealing POU water treatment options. In addition, the effect of repeated exposure to the Disgust Box demonstration should be determined, both alone and in combination with different POU water treatment methods.

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Surveillance updates

With each issue of HSB, updates of surveillance data described in earlier issues are provided. These updated tables and figures represent the most recent observation period available at the time of publication. We hope these updates will be helpful to health professionals who are interested in current patterns of disease and drug resistance in Bangladesh.

Proportion of diarrhoeal pathogens susceptible to antimicrobial drugs: June 2014-May 2014

Antimicrobial agents	<i>Shigella</i> N=59	<i>V. cholerae</i> O1 N=300
Mecillinam	84.2	Not tested
Ampicillin	58.3	Not tested
TMP-SMX	26.2	0.0
Ciprofloxacin	41.0	100.0
Tetracycline	Not tested	0.3
Azithromycin	70.5	100.0
Ceftriaxone	98.3	Not tested

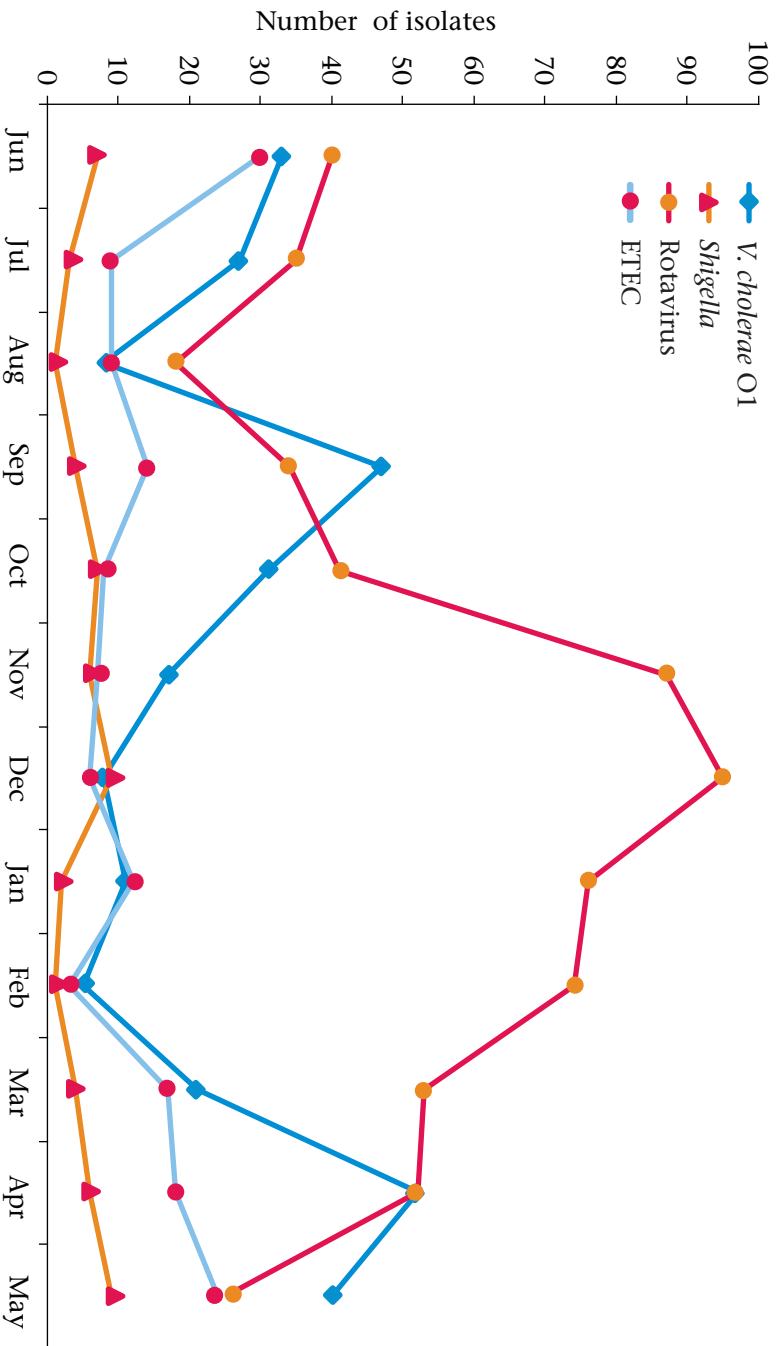
Source: Hospital Surveillance, Dhaka Hospital, icddr,b

*Antimicrobial susceptibility pattern of *S. typhi* among children <5 years during April-June 2015*

Antimicrobial agent	Total tested (N)	Susceptible n (%)	Reduced susceptibility n (%)	Resistant n (%)
Ampicillin	3	3 (100)	0 (0.0)	0 (0.0)
Cotrimoxazole	3	2 (66.7)	0 (0.0)	1 (33.3)
Chloramphenicol	3	2 (66.7)	0 (0.0)	1 (33.3)
Ceftriaxone	3	3 (100)	0 (0.0)	0 (0.0)
Ciprofloxacin	3	0 (0.0)	3 (100)	0 (0.0)
Nalidixic Acid	3	1 (33.3)	0 (0.0)	2 (66.7)

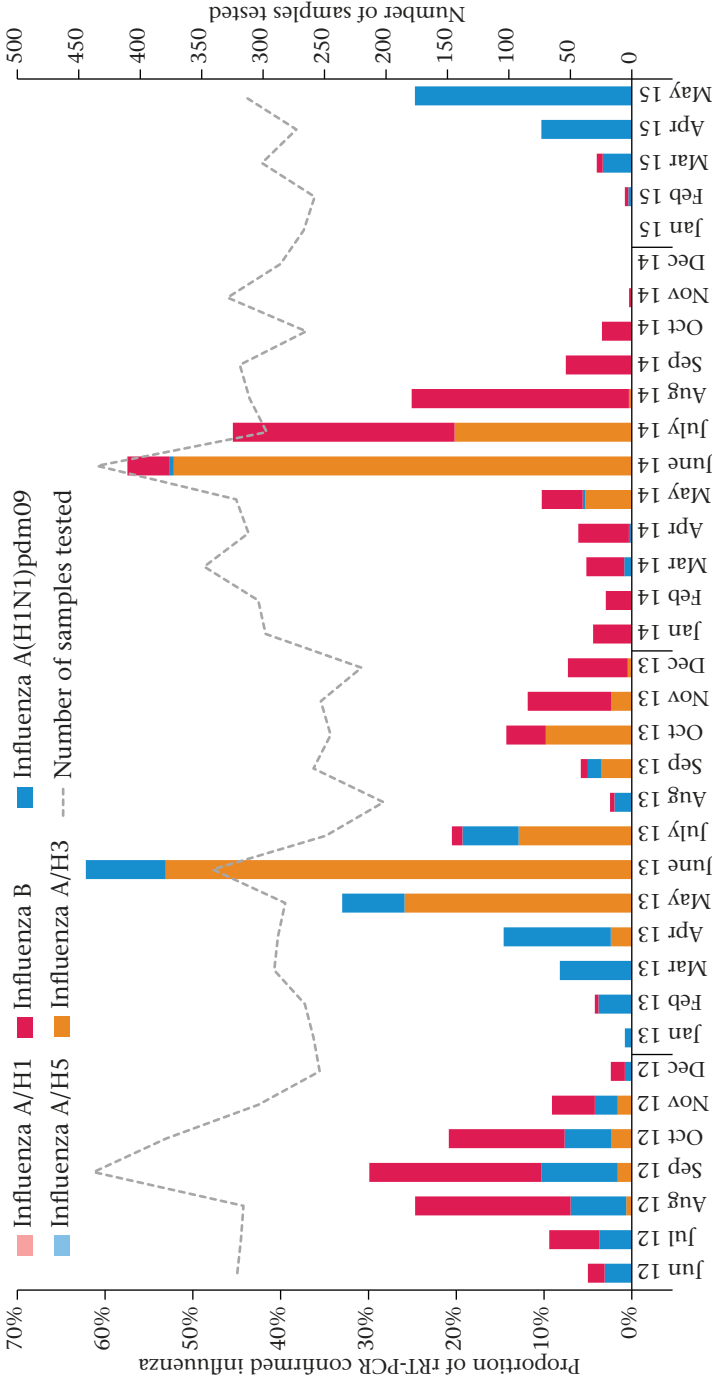
Source: Kamalapur Urban Surveillance, icddr,b

Monthly isolation of *V. cholerae* O1, Shigella, Rotavirus and ETEC: June 2014-May 2015



Source: Hospital Surveillance, Dhaka Hospital, icddr,b

Proportion of laboratory-confirmed influenza among hospitalized severe acute respiratory illness (SARI) and outpatient influenza like illness (ILI) cases between June 2012 and May 2015



Source: Patients participating in hospital-based influenza surveillance in Dhaka National Medical College Hospital, Community-based Medical College Hospital (Mymensingh), Jahurul Islam Medical College Hospital (Kishoregonj), Rajshahi Medical College Hospital, Shaheed Ziaur Rahman Medical College Hospital (Bogra), LAMB Hospital (Dinajpur), Bangabandhu Memorial Hospital (Chittagong), Comilla Medical College Hospital, Khulna Medical College Hospital, Jessore General Hospital, Jalalabad Ragib-Rabeya Medical College Hospital (Sylhet), Sher-e-Bangla Medical College Hospital (Barisal), Chittagong Medical College Hospital* and Dinajpur Medical College Hospital* (*since April 2014)



A field worker demonstrating disgust box in a courtyard meeting

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icddr,b

GPO Box 128

Dhaka 1000, Bangladesh

www.icddr.org/hsb

Editors

James D. Heffelfinger

M Sirajul Islam Molla

Emily S. Gurley

Diana DiazGranados

Contributing authors

Kaniz Khatun E Jannat

Translation

Syed Hasibul Hasan

Copy editing & overall management

M Sirajul Islam Molla

Mahbub-ul-Alam

Design & pre-press processing

Mahbub-ul-Alam

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