

---

# Digital Interventions in the Global South: A Case Study from Rural India

## **Eric Gordon**

Emerson College  
Boston, MA, 02116 USA  
Eric\_gordon@emerson.edu

## **John Harlow**

Emerson College  
Boston, MA, 02116 USA  
John\_harlow@emerson.edu

Permission to make digital or hard copies of part or all of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for third-party components of this work must be honored. For all other uses, contact the owner/author(s).  
*CHI 2020 Extended Abstracts, April 25–30, 2020, Honolulu, HI, USA.*  
© 2020 Copyright is held by the owner/author(s).  
ACM ISBN 978-1-4503-6819-3/20/04.  
DOI: <https://doi.org/10.1145/3334480>.

## **Abstract**

Water, sanitation, and hygiene (WASH) factors kill hundreds of thousands of children every year. This paper reports the results of a school-based toilet use and handwashing intervention in Tamil Nadu, India that enrolled over 2,500 students aged 7–11. Over 1,000 of those students received a robust, participatorily-designed, play-based intervention with a mobile game developed in direct partnership with the producer of Chhota Bheem, India’s most popular children’s character. Results indicate that provision of soap increased handwashing even in the control group, but that the intervention arms only improved advocacy outcomes with statistical significance. We interpret this to mean that play-based interventions can contribute to public health advocacy in the Global South.

## **Author Keywords**

Water, sanitation, and handwashing; open defecation; Chhota Bheem; mobile game; play

## **CSS Concepts**

• **Human-centered computing~Human computer interaction (HCI); HCI design and evaluation methods;** Field studies

## Introduction

In 2016, water, sanitation, and hygiene (WASH) factors caused over 300,000 preventable diarrheal deaths of children under 5 (Prüss-Ustün et al., 2019). WASH factors include adequate access to clean drinking water, household sanitation that safely disposes of excreta, and soap and water for handwashing. In 2020, the United Nations Children's Fund (UNICEF) estimated that 3 billion people lacked soap and water at home and 900 million children lacked soap and water at their school (2020). Handwashing with soap at critical times (e.g. after toilet use, before eating and cooking, etc. (Adane et al., 2017)) can prevent about one third of diarrheal diseases (Hashi et al., 2017).

World leaders addressed WASH issues in Sustainable Development Goal 6.2: "adequate and equitable sanitation and hygiene for all and end open defecation" (UN, 2019). People practice open defecation for many reasons, e.g. cultural norms, perceptions of cleanliness, and access to clean infrastructure. In rural India, over 1/3 of households practiced open defecation in 2017 (JMP, 2020), and in 2014, only 15% of people in India regularly washed their hands with soap after defecation (Peltzer & Pengpid, 2014).

In 2017, our team was awarded a grant by the UBS Optimus Foundation to develop a play-based learning program and mobile game to encourage hand washing and toilet use: *Hygiene with Chhota Bheem* (<http://elab.emerson.edu/hygiene>). This intervention focused on children because shifting the norms and perceptions of adults is more difficult. Although children cannot make decisions for their households or communities, they can be persuasive advocates, leading to the research question of this paper: how

might locally tailored, play-based mobile interventions in the global south improve knowledge, attitudes and behaviors about handwashing and toilet use?

## Methods

Early participatory design sessions with children and teachers revealed potential benefits of connecting the game to popular culture. This led to Green Gold Animation, the makers of Chhota Bheem, with "over 40 million viewers" (Dixit, 2017), agreeing to provide access to their animation assets (e.g. characters and backgrounds). The Engagement Lab @ Emerson College created the game with Green Gold's support. Project partners also included the the Indian Red Cross Society, a WASH working group of NGOs in Tamil Nadu, India, and the Mary Anne Charity Trust (MACT).

MACT's deep ties in Tamil Nadu attracted over 100 children and a dozen teachers to game design workshops in regional schools. A weeklong charette with teachers, government employees and health advocates followed. Participants were provided room and board if needed, and compensated for their time. Our Boston-based team traveled to Chennai three times in Year 1 to iterate the intervention design. During that process, we recognized the limitations of a mobile only intervention, and pivoted to include analog elements.

The result was a four-week play-based curriculum. In each week, children watched a short animated video (or read from a picture book) that introduced them to Chhota Bheem and his pals battling and defeating an evil germ wizard who hypnotized all the villagers in Dholakpur to "poop in the field" and not wash their hands. With the help of the Clean Wizard, the heroes learned "spells" to defeat the Germ Wizard, i.e. songs

The *Hygiene with Chhota Bheem* intervention addressed the psychosocial determinants of behavior described in the Integrated Behavioral Model for WASH (Dreibelbis et al., 2013):

- Why toilet use is important
- How to properly use a squatting toilet
- Why handwashing with soap is important
- When to wash hands with soap to prevent germs
- How to wash hands with soap
- Empowering children to talk to friends and family about toilets and washing hands with soap

and dances of the program's WASH learning goals. Children also completed challenges (e.g. teaching others the spells, handwashing with soap before eating) to earn stickers and help defeat the Germ Wizard.

The intervention was evaluated in a randomized control trial of 30 schools in Tamil Nadu. Twelve schools in the *Bheem* arm received the full intervention. Twelve schools in the *Analog* arm received a simplified version without the digital game or videos. Six schools in the *Control* arm with no intervention. The focus herein will be on the full intervention Bheem arm.

The Institute of Public Health in Poonamallee hosted two lead teachers from each treatment school for "train the trainer" curriculum training. The US-based team helped facilitate, but the training was administered entirely in Tamil by the project field manager. Bheem arm teachers reviewed facilitation guides, videos of the lessons, Chhota Bheem story videos, and the digital game. They were then presented with certificates and the intervention materials: a bag of liquid soap, extra copies of the storybooks, facilitation guides for other teachers, and four Lava A44 mobile phones running Android operating system 7.0. The devices were kept in the school office, and signed out by participating classrooms weekly. Control group teachers were also trained on handwashing protocols in their schools.

Surveys were administered to students prior to the intervention (baseline), following the intervention (post), and six weeks after the intervention (follow-up). The survey assessed WASH knowledge, attitudes, and behaviors using simple language (and pictures when possible) to make it as easy as possible for children to respond. Trained data collectors administered the

surveys in Tamil, reading each question and its response options aloud. Students sat in groups and circled answers on sheets for entry into a tablet on site.

## Results

The mobile game was downloaded over 23,500 times, with over 90% of those in India. During the study, the game was played 11,119 times in the intervention district, for 12,564 hours across 32 unique user IDs and 128 unique session IDs. Average user rating was 4.6/5 stars, with 88% of players rating it 5 stars.

These results are based primarily on the survey of  $n=2,614$  students who completed both the pre- and post- intervention survey: Bheem ( $n=1,051$ ), Analog ( $n=1,106$ ), and Control ( $n=457$ ). Analysis controlled for baseline characteristics that did not change between baseline and endline. Students who were absent at endline ( $n=247$ ) were dropped from the analysis.

Positive *attitudes* toward handwashing with soap (0.57 SD) and toilet use (0.48 SD) increased with statistical significance across all study arms. Students also reported that they wash their hands with soap at the same times most days across all three study arms (0.09 SD,  $p<0.01$ ). This is likely because soap was provided to all of the study schools. Students in the Bheem arm showed an average of 0.578 SD higher than the Control arm ( $p<0.01$ ) for how to wash hands, and 0.596 SD higher ( $p<0.01$ ) for how to use the toilet. If we combine the Bheem and Analog arms, there are a number of areas of statistical significance. We tested the assumption that the mobile game would reinforce learning outcomes, and that immersion in a familiar story would do the same. Those things alone did not

seem to have much impact. However, play, which is common across the A and B arms, did.

### Discussion

We began this project with the assumption that a mobile game would be an impactful intervention. Even though the game garnered a significant amount of attention among the study participants and beyond, it failed to create outcomes on its own. Rather, the play-based nature of both the Bheem and Analog arms suggest that grounding the intervention in play supplied children with confidence to advocate to their families and peers. Immersion in the play space empowered children to talk about the taboo topic of open defecation. These outcomes were especially apparent with young girls, for whom the topic can carry significant shame. While traditional measurements of knowledge, attitudes and behavior did not produce significant results, the correlation between play and advocacy is powerful.

### Acknowledgements

We gratefully acknowledge the grant from UBS Optimus Foundation, Mary Beth Dawson, Wade Kimbrough, Jahnvi Singh, Divya Dhar, David Levine, all MACT staff, and the teachers, government and health professionals, and children that helped with the design.

### References

1. Shubhra Dixit. 2017. The Hindu. Retrieved August 26, 2020 from <https://www.thehindu.com/entertainment/movies/the-curious-case-of-indian-animation/article17646834.ece>
2. Robert Dreibelbis, Peter J. Winch, Elli Leontsini, Kristyna R. S. Hulland, Pavani K. Ram, Leanne Unicomb, and Stephen P. Luby. 2013. The Integrated Behavioural Model for Water, Sanitation, and Hygiene: A systematic review of behavioural models and a framework for designing and evaluating behaviour change interventions in infrastructure-restricted settings. *BMC Public Health*. 13: 1015.
3. Abdiwahab Hashi, Abera Kumie, Janvier Gasana. 2017. Hand washing with soap and WASH educational intervention reduces under-five childhood diarrhoea incidence in Jigjiga District, Eastern Ethiopia: A community-based cluster randomized controlled trial. *Preventive Medicine Reports* 6: 361-368.
4. (JMP) WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene. 2020. WASH sanitation data. Retrieved August 26, 2020 from <https://washdata.org/data/household#!/>
5. Adane Metadel, Bezatu Mengistie, Worku Mulat, Girmay Medhin, and Helmut Kloos. 2018. The most important recommended times of hand washing with soap and water in preventing the occurrence of acute diarrhea among children under five years of age in slums of Addis Ababa, Ethiopia. *Journal of Community Health* 43: 400-405.
6. Karl Peltzer and Supa Pengpid. 2014. Oral and hand hygiene behaviour and risk factors among in-school adolescents in four Southeast Asian countries. *International Journal of Environmental Research and Public Health* 11, 3: 2780-2792.
7. Annette Prüss-Ustün, Jennyfer Wolf, Jamie Bartram, Thomas Clasen, Oliver Cumming, Matthew C. Freeman, Bruce Gordon, Paul R. Hunter, Kate Medlicott, and Richard Johnston. 2019. Burden of disease from inadequate water, sanitation and hygiene for selected adverse health outcomes: An updated analysis with a focus on low- and middle-income countries. *International Journal of Hygiene and Environmental Health* 222, 5: 765-777.

8. Swachh Bharat Mission. 2019. Retrieved August 26, 2020 from <http://sbm.gov.in/sbmdashboard/Default.aspx>
9. UNICEF. Fact sheet: Handwashing with soap, critical in the fight against coronavirus, is 'out of reach' for billions. 2020. Retrieved August 26, 2020 from <https://www.unicef.org/press-releases/fact-sheet-handwashing-soap-critical-fight-against-coronavirus-out-reach-billions>.
10. (UN) United Nations. 2019. Sustainable Development Goal 6. Retrieved August 26, 2020 from <https://sdgs.un.org/goals/goal6>