
Water, Sanitation, and Hygiene in Outbreak Response

Daniele Lantagne, Ph.D., P.E.

Associate Professor, Tufts University

Research

We seek to reduce the burden of infectious diseases by investigating and evaluating the effectiveness of water and sanitation interventions in low-income and emergency contexts.



Evidence Synthesis



- Systematic Review
 - Many previous
 - Focused on impacts
 - Strict inclusion criteria
 - 15,000 documents
 - ½ peer-reviewed
 - ½ grey
 - Included outcomes, impacts, and qualitative

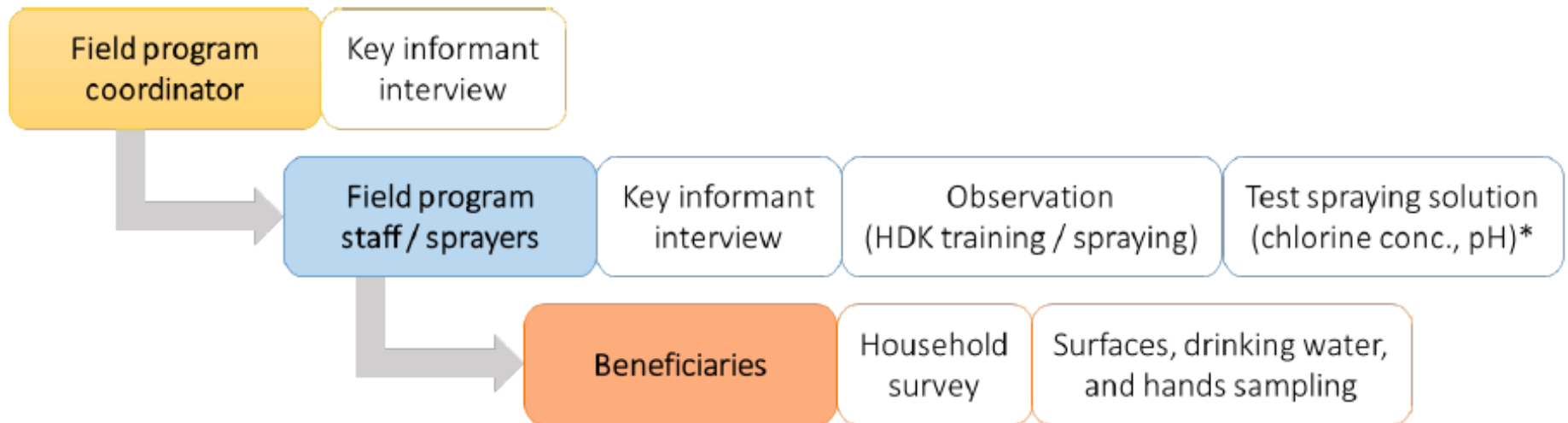
WASH Evidence in Outbreaks

- Evidence base is thin
 - High in water treatment
 - Low in hygiene/sanitation
 - Low in emergency only interventions

Figure 0.1: WASH interventions in disease outbreaks – evidence map
Source: The research team

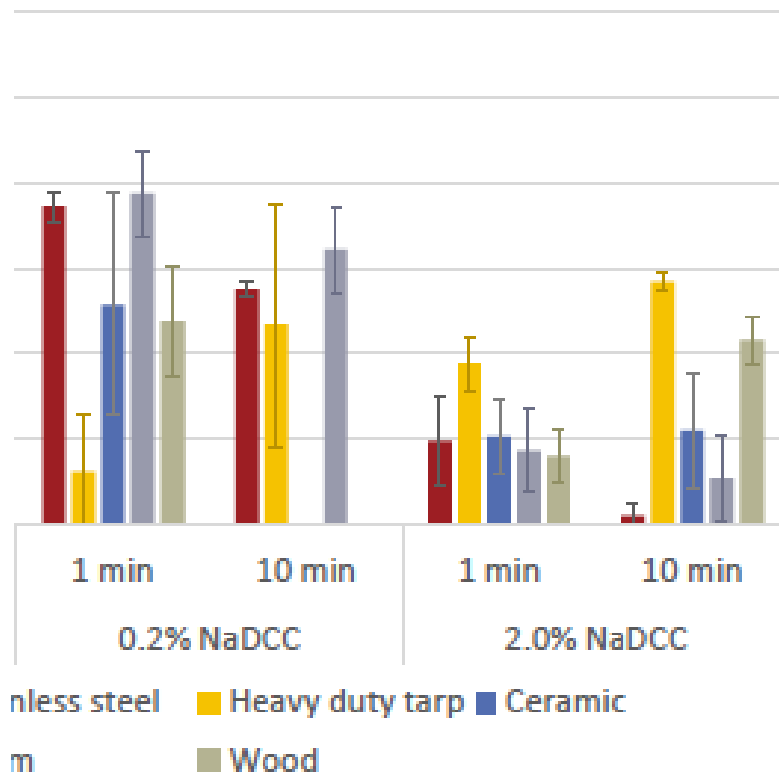


Household Spraying - Protocol

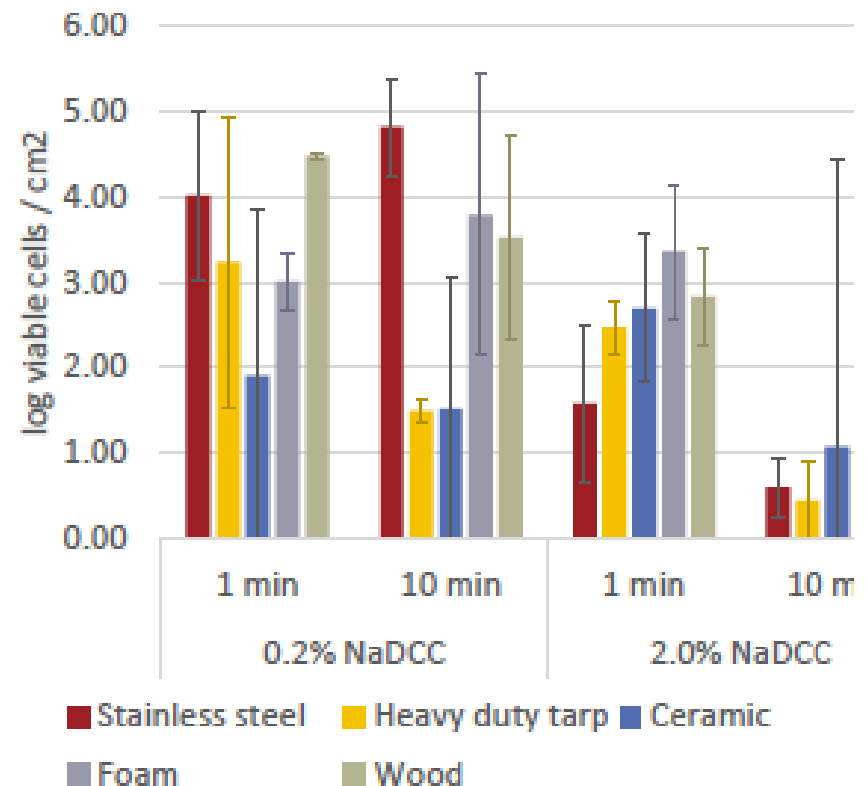


**For household spraying only.*

Pouring



Spraying



VBNC cells were detected
after disinfection.

Spraying appears more
variable, less efficacious
than pouring chlorine.

The highest efficacy was
achieved by pouring 2.0%
chlorine for 1-10 minutes

Detection of culturable *V. cholerae* on surfaces

BEFORE					SURFACE	AFTER: 30 MINUTES					AFTER: 24 HOURS				
HH01	HH02	HH03	HH04	HH05		HH01	HH02	HH03	HH04	HH05	HH01	HH02	HH03	HH04	HH05
High	High	Intermediate	High	High	Kitchen / inside floor	Not detected	Not detected	Low	Low	High	Low	Not detected	Intermediate	High	High
High	Low	Intermediate	Not detected	Not detected	Latrine floor	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected
Low	Not detected	Low	Not detected	Low	Patient's bed	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Intermediate	Low
Low	Not detected	Low	Not detected	Intermediate	Jerrycan	Not detected	Not detected	Not detected	Not detected	Low	Not detected	Not detected	Not detected	Not detected	Not detected
Intermediate	Not detected	Not detected	Low	Not detected	Wall	Not detected	Not detected	Not detected	Not detected	Not detected	Low	Not detected	Not detected	Not detected	Not detected
Not detected	Not detected	Not detected	Not detected	High	Furniture (table)	Not detected	Not detected	Not detected	Not detected	Low	Not detected	Not detected	Not detected	Not detected	Not detected
Not detected	Not detected	Not detected	Not detected	Intermediate	Curtains	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Low
Low	Not detected	Not detected	Not detected	Not detected	Door	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected

BEFORE					SURFACE	AFTER: 30 MIN					AFTER: 24 HRS				
HH06	HH07	HH08	HH09	HH10		HH06	HH07	HH08	HH09	HH10	HH06	HH07	HH08	HH09	HH10
High	High	High	Low	High	Patient's bed	High	High	Low	Not detected	Intermediate	Intermediate	High	Intermediate	Not detected	High
Not detected	High	High	High	High	Kitchen floor	Not detected	High	High	High	High	High	High	High	Intermediate	High
Not detected	High	High	High	High	Latrine floor	Not detected	High	Not detected	Not detected	High	Not detected	High	Low	High	High
High	Not detected	Not detected	Intermediate	Not detected	Floor close to bed	High	Not detected	Not detected	Not detected	Not detected	High	Not detected	Not detected	Intermediate	Not detected
Not detected	High	Intermediate	Low	Low	Wall	High	Intermediate	Intermediate	Low	Not detected	Low	Intermediate	Low	Low	Not detected
Not detected	Intermediate	Intermediate	Not detected	Low	Curtain	Not detected	Low	Not detected	Not detected	Not detected	Not detected	Low	Not detected	Not detected	Low
Not detected	Low	Low	Not detected	Not detected	Jerrycan, container	Not detected	Not detected	Not detected	Not detected	Not detected	Low	Intermediate	Not detected	Not detected	Low
Not detected	Low	Low	Not detected	Not detected	Latrine door / wall	Not detected	Low	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Low	Low
Not detected	Low	Not detected	Not detected	Not detected	Entrance door	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Low	Intermediate

High (>5000 CFU/100 cm ²)
Intermediate (200-5000 CFU/100 cm ²)
Low (<200 UCF/100 cm ²)
Not detected

Results suggest that household spraying can be effective (Program #1) .

It is recommended sprayers follow a systematic protocol and spray surfaces until wet. Cases that do not reach care structures and asymptomatic cases are not covered.

Chlorine dosage can be problematic and should be adjusted regularly.

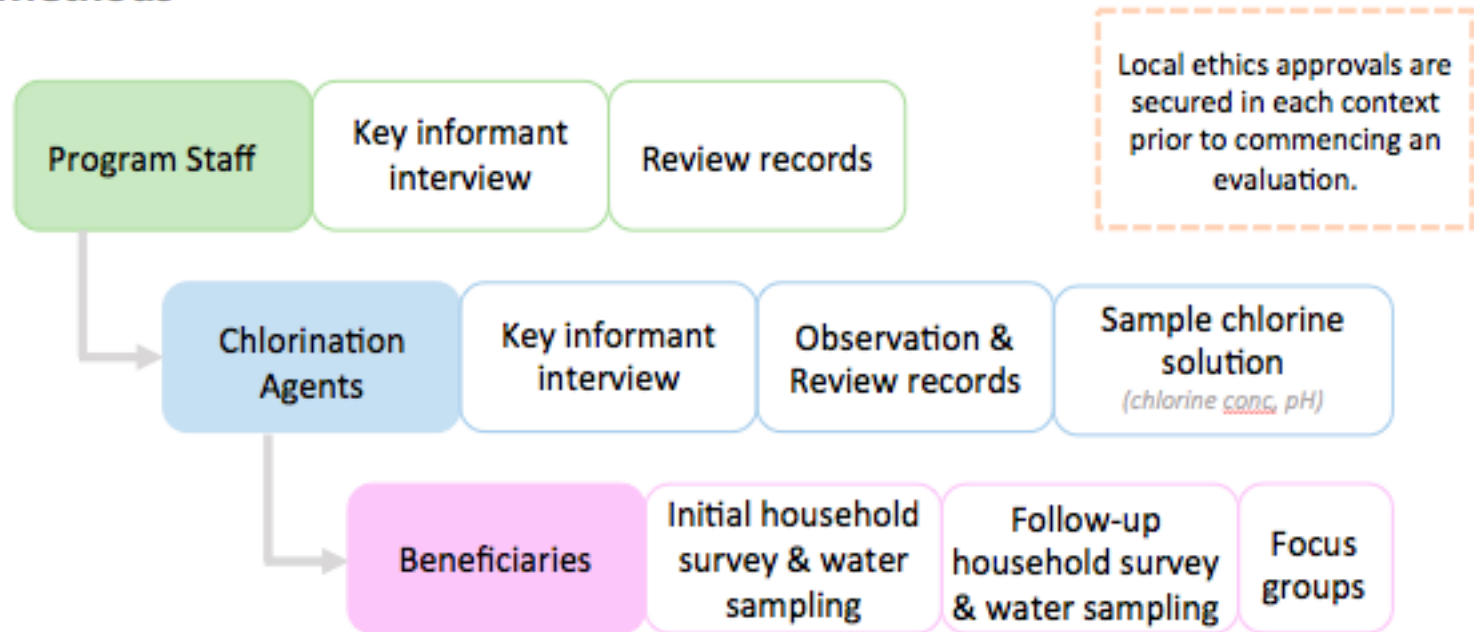


Tufts
UNIVERSITY

School of
Engineering

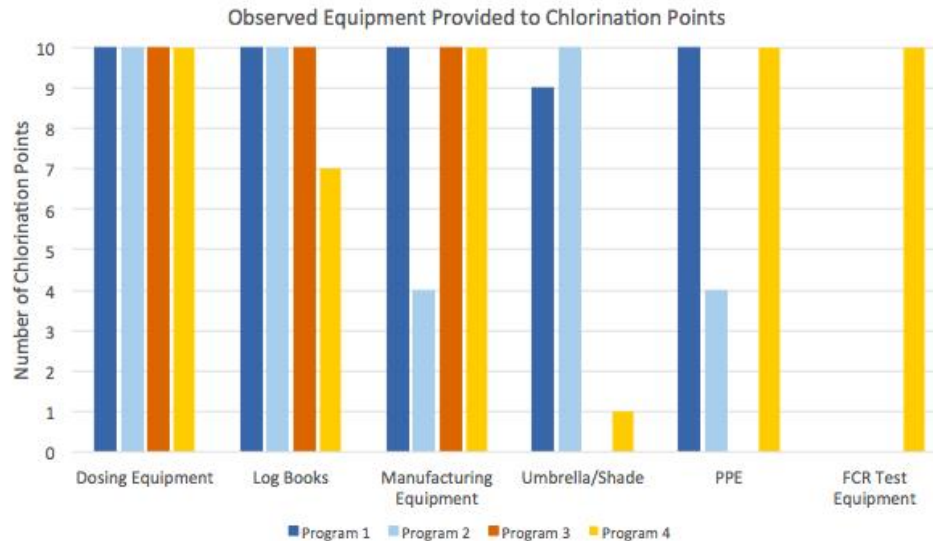
Bucket Chlorination

Methods



Bucket Chlorination

Observations of Chlorination Points



- Two programs did not distribute umbrellas (or equivalent to shade agents and chlorine
- PPE (gloves, mask, goggles) was frequently shared between agents resulting in missing pieces
- Only one program expected agents to test their own free chlorine residual (FCR)



	Average Concentration [%]	Min. [%]	Max. [%]
Program 1	3	1.3	7.2
Program 2	0.78	0.13	1.19
Program 3	0.18	0.07	0.34
Program 4	0.51	0.28	0.78

Bucket Chlorination - Solutions

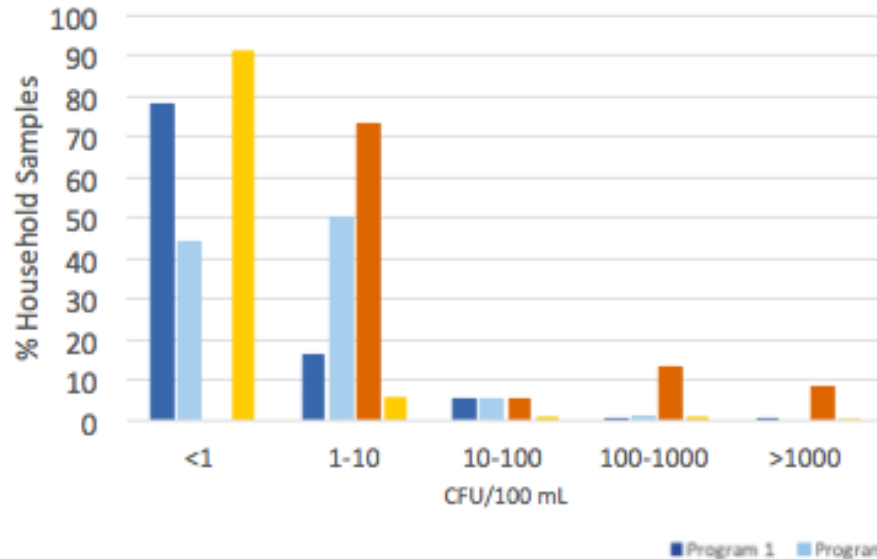


Examples of chlorine stock solution preparation, storage, and dosing.

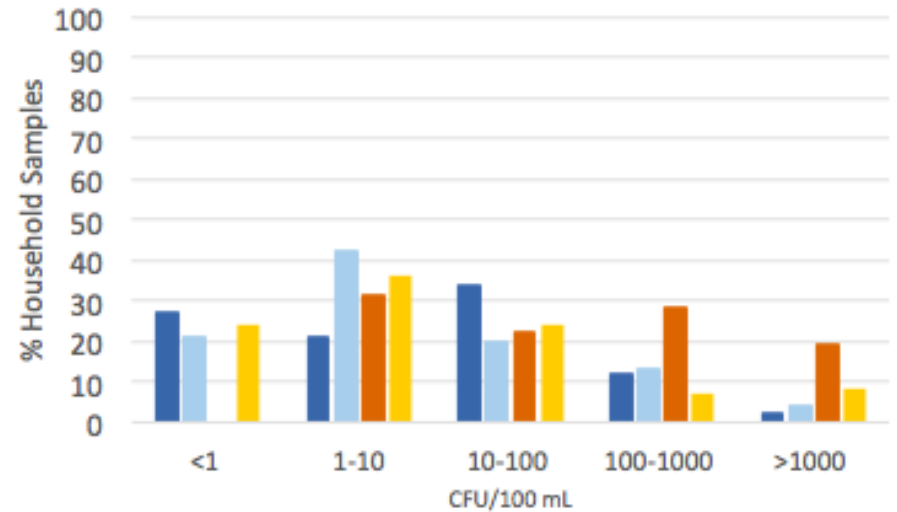
Bucket Chlorination - Microbiological

Microbiological results 30 minutes after treatment

E. coli



Total Coliforms



Next Steps

- Data collection, analysis and writing
- Recommendations
- Role of WASH
 - For prevention
 - In IPC in HCF
 - Who responsible?

Acknowledgements



- Travis Yates
 - Systematic Review
- Karin Gallandat
 - Household Spraying
- Gabrielle String
 - Bucket Chlorination



Research for health
in humanitarian crises

| elrha



*Action Research on Common Under Researched WASH Interventions
Tufts University, in collaboration with response organizations*



Tufts
UNIVERSITY

School of
Engineering