# Management systems for ensuring sustainable WASH facilities in humanitarian contexts

St John Day

13th April 2018

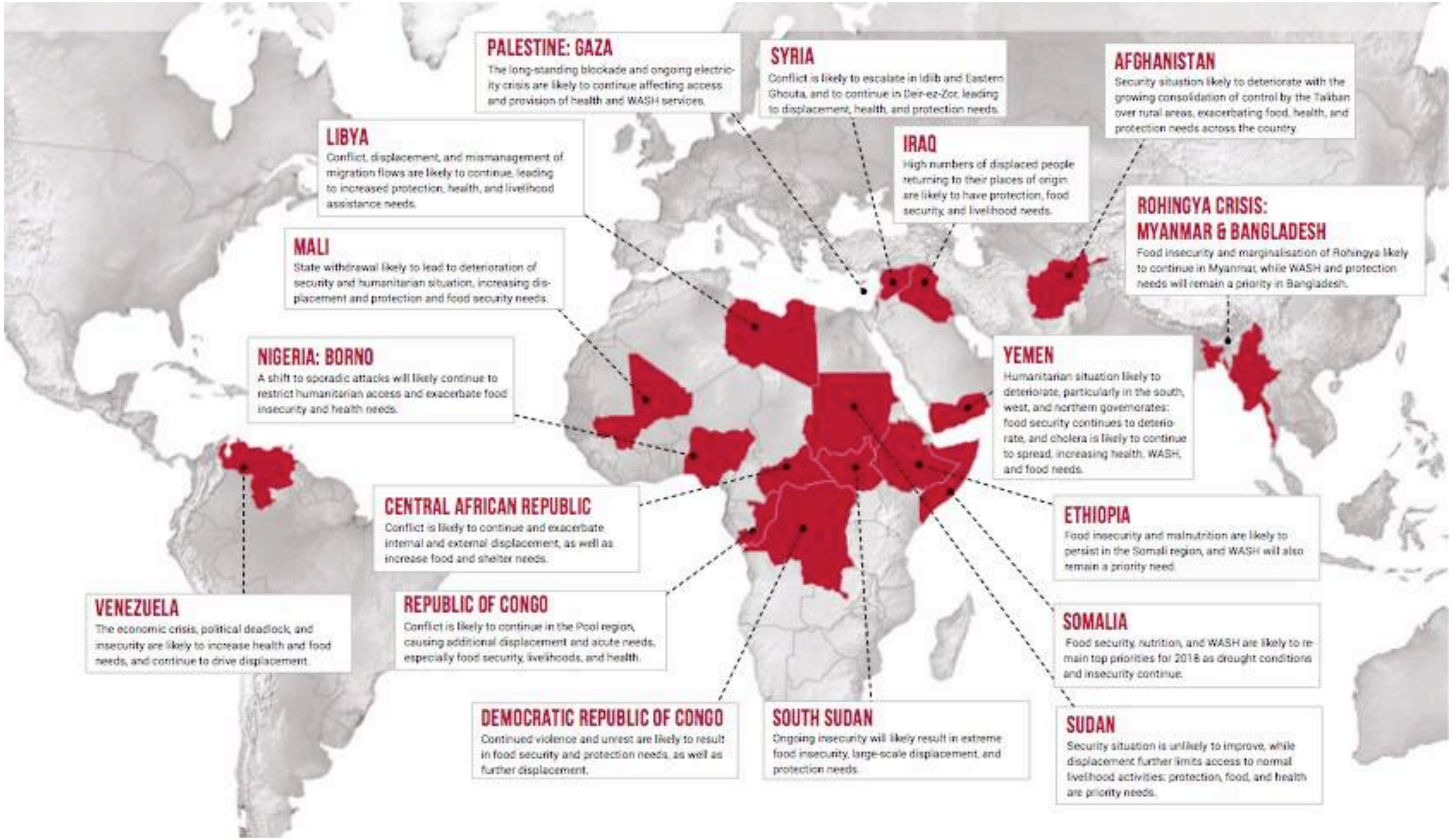
UNHCR
The UN Refugee Agency

OXFAM

# Summary

- The transition from emergency to post emergency situations is notoriously difficult.
- Humanitarian agencies often working in contexts with weak institutions and fragile economies.
- Resources available during the acute phase of an emergency differs considerably to long term situations.

# Humanitarian Overview 2018 (ACAPS 2017)



# Observations on humanitarian situations

# Emergency WASH

- Users demand high quality services, but participation and ability to pay is low.
- Local institutions often have low capacity and sidelined in the acute emergency phase.
- Multiple agencies - standards of service delivery vary.
- We don’t generally know how much it costs to deliver emergency WASH services.

# Conventional management models

Self supply

Community Management +


Public Institutions

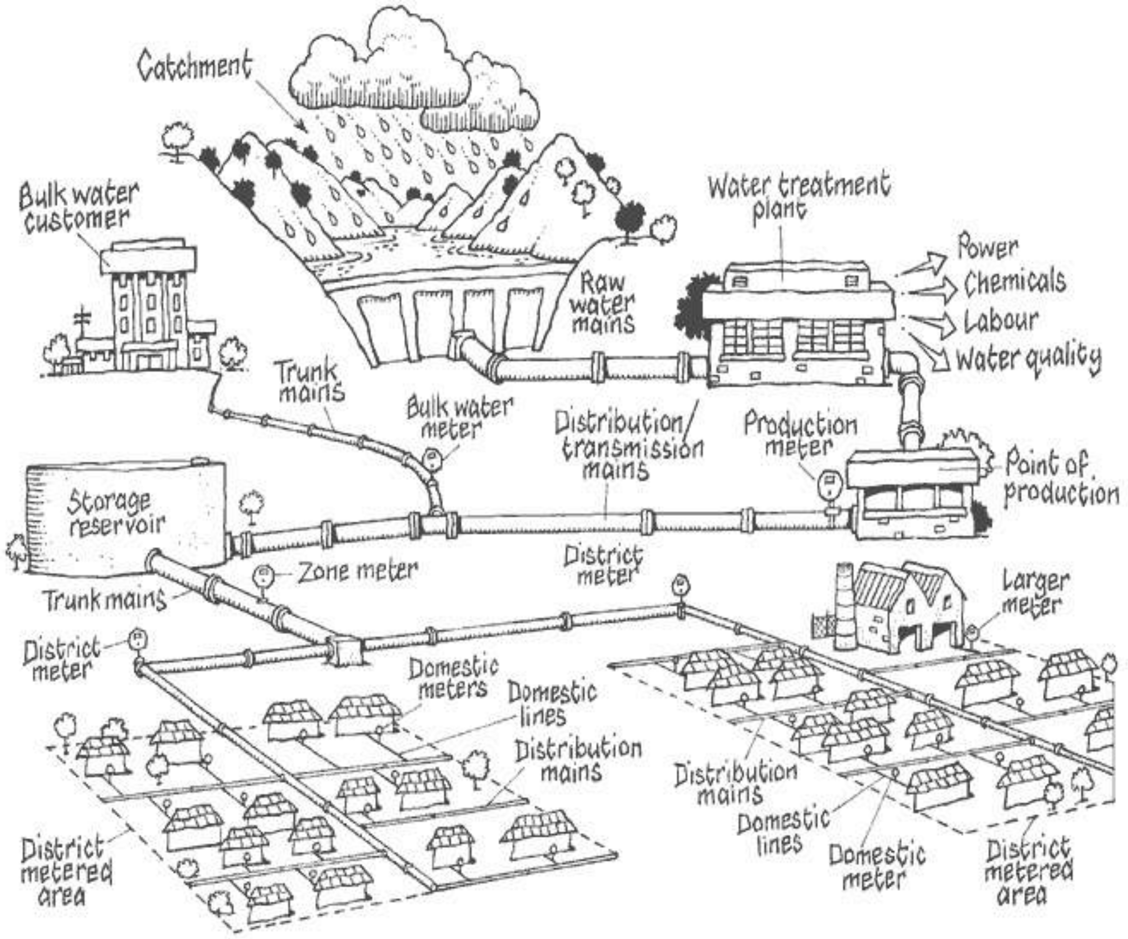
Water Department

Utility

Private Operator

# Alternative models – learning from small town operators

- Engage with small town operators and utilities that are successful.
- Treat the system as a business – in terms of operation, commercial and financial duties.
- Don't be limited to for-profit operators.



# Linking water supply and sanitation

- Communities may contribute labour to construct sanitation facilities.
- Users want to shift from communal to household latrines.
- Systems for faecal sludge disposal often lag behind expansion of water supply systems.


Source: IRC 2017

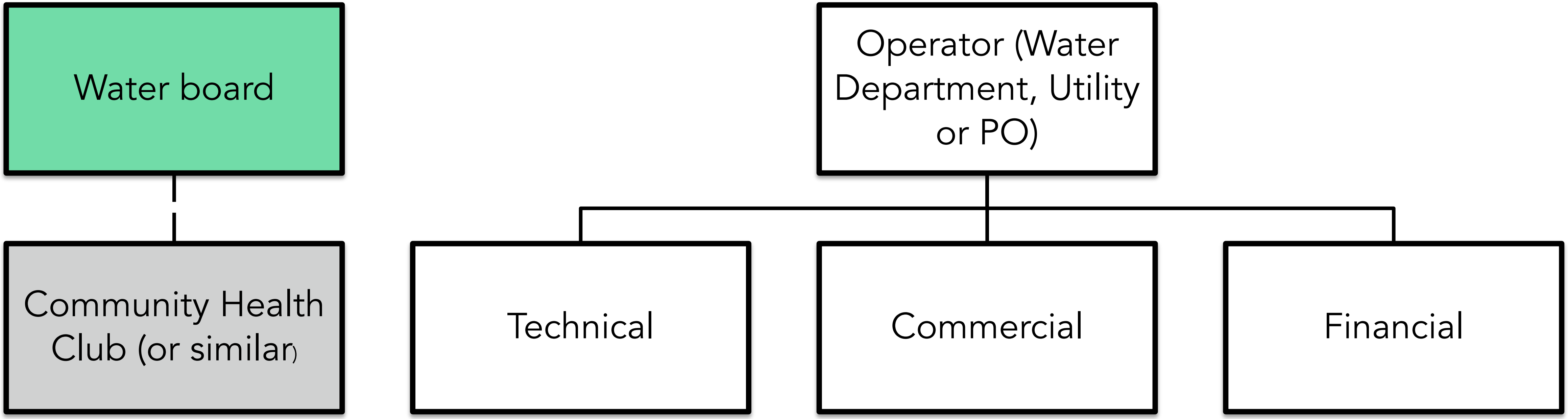
# What needs to change?

1. Plan for permanent services from the outset.
2. Rationalise the number of agencies post emergency.
3. Assess the enabling environment (conditions) for different WASH models.
4. Clear policy direction from Government.
5. Service performance levels – business models and financial plans.


# Recommendations

- Professionalisation in two senses:
    - Service delivery by professionally staffed entities, moving away from community management.
    - Working with qualified and certified personnel.
- Assuring standards of service, while reducing the management burden on communities.
- Designing tariff structures, based on real operating costs that recognise the inability of people to pay.

# Alternative models



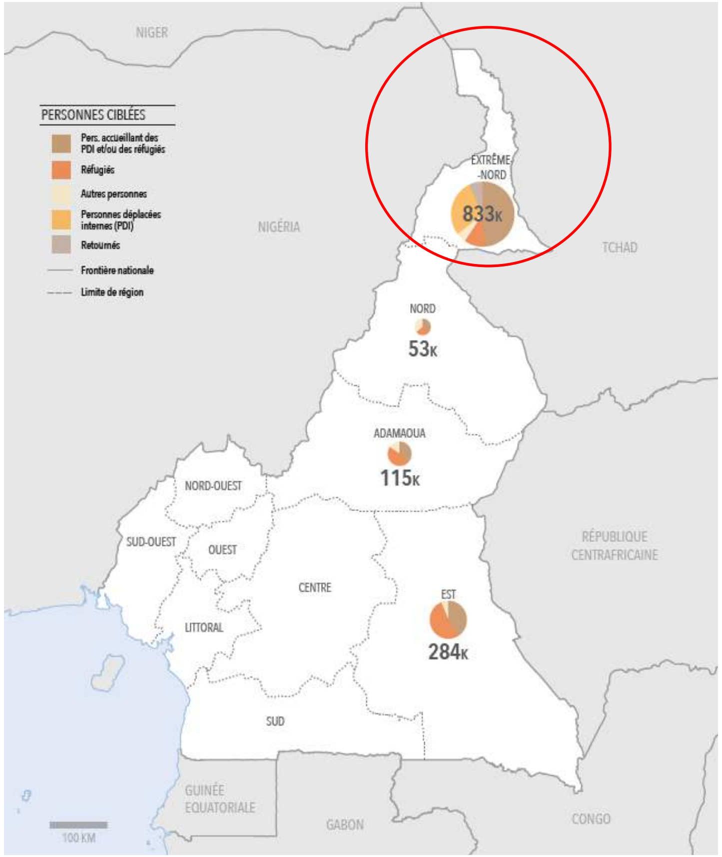
# Thank you for listening!

# Challenges and Constraints of implementing community approaches for total sanitation in conflict area: *case study of the implementation of CLTS in Boko Haram conflict area in Came*

Presented by:

Tim Grieve on behalf of Faustin Ekeh Ekwele

# I. SITUATION




*__Far North of Cameroon:__*

- More than 90,000 refugees and more than 240,000 IDPs.
- Open Defecation: 22% (Far North, MICS 2014), 6% (national, JMP 2015)
- Improved drinking water: 41% (Far North, MICS 2014, 76% (national, JMP 2015)
- Poor hygiene practices
- Cholera: 37.578 cases and 1.695 deaths between (2010 – 2017).
- Limited or no access for humanitarian actors
- Insufficient resource: 49% of HRP 2017
- Cross boarder transmission: Reported case of cholera in neighbour country
- Regular attacks and kidnapping by Boko Haram

unite for children

unicef

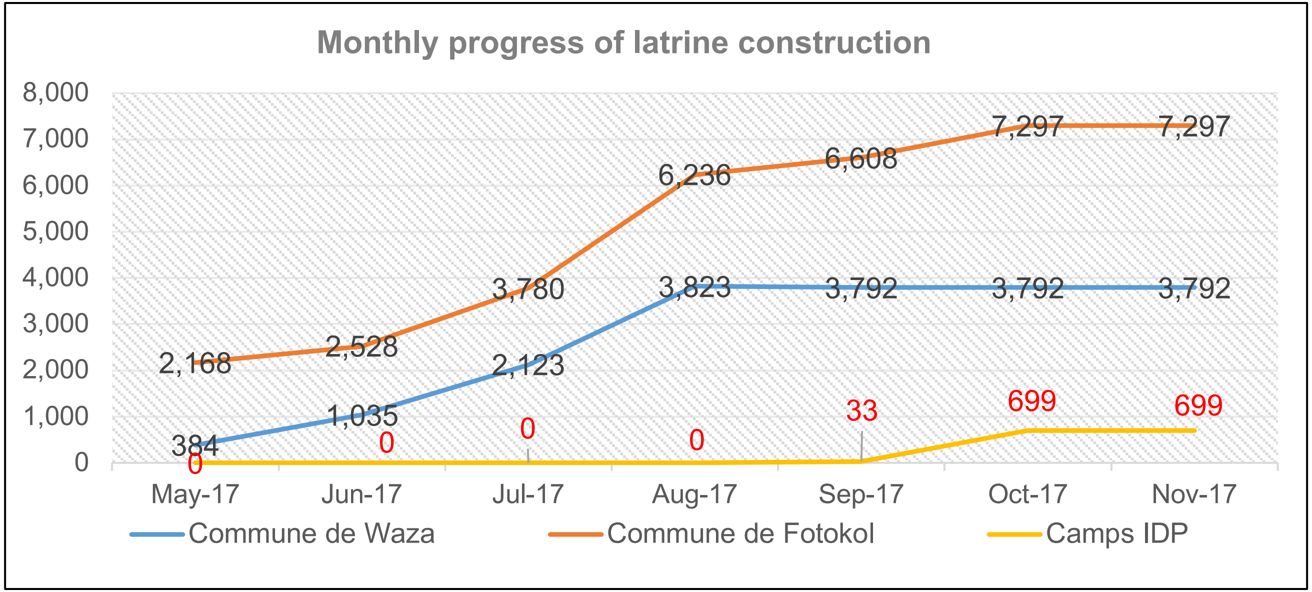
# II. CLTS approach

- Localisation: Partnership between UNICEF and local NGO (ACDC)
- 60% of villages targeted with CLTS (Fotokol and Waza)
  - Baseline: 76% Open Defecation
- CLTS Launched in 126 communities and 7 IDP Camps
  - Target ODF, zero subsidy, household latrines
  - Intervention period: 6 months (2017)
  - 304 community animators trained (36% of women)
  - Motivation: disgust, cholera, security of women/children
  - Beneficiaries: 65,000 people
  - Cost/Beneficiary 1.5 USD/person

# II. Household toilet

# II. Results achieved

- Increase from 24% to 98% access to latrines.
- 9,341 latrines constructed (and equipped with handwashing)
- No cholera case reported




- CLTS Entry point for other WASH intervention: 46 300 persons covered by sensitization activities (cholera, MHM, HWT, Handwashing)

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# II. Constraints and Challenges

- **Limitation of people and vehicle movement**
  - Advocacy : authorisation letter
  - Transport through motorbike, bike and foot
- **Regulars attacks of targeted villages by Boko Haram**
  - Reschedule of activities
  - limitation of presence in village
  - Soldiers accompany staff on mission
  - Respect of security measure defined by communities
  - More door to doors rather than communities meetings
- **Administrative constraint: Government restricting NGO movement**
  - UNICEF advocacy to Government and traditional authorities
- **Displacement/arrivals of populations**
  - Permanent monitoring of the situation
  - Adoption of new social norms in communities

# III. Lessons learnt

- CLTS is a cost effective rapid approach to emergency household sanitation in resource constrained and insecure hosting communities

- CLTS is an entry point for other WASH interventions
- Implementation success was achieved when:
  - local community organized security to protect civilians
  - Collaboration between NGO and local governmental body was formally established
  - Partnership with local NGOs who understand the local culture and security environment
  - Motivation for improving sanitation link disgust, cholera control and women/children security
  - There is quality training of trainers and monitoring systems in place
- Further operational research is required to scale up emergency sanitation programmes in insecure environments to:
  - Determine the sustainability of the approaches/sanitation social norm
  - Understand sanitation as an entry point for other WASH interventions
  - Understand the preconditions and motivations for sanitation behavior

unicef

for every child

# THANK YOU

Credit photo: ACDC

# Vector Control in Humanitarian Emergencies

**8th Emergency Environmental Health Forum**

12-13 April


Roll Back Malaria Vector Control Working Group

Corey Leclair, John Thomas, Richard Allan

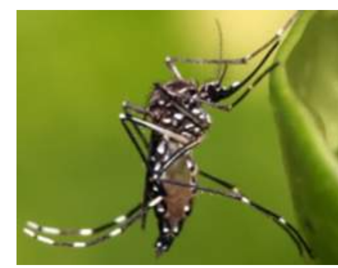
# Vector Borne Diseases: Why We Must Prevent Them

**VBDs constitute the most common cause of death and suffering in many humanitarian crises.**

- Climate change, conflict and population movement are spreading VBDs

- Children are most at risk from VBDs

- Delays in detection, response, and containment of epidemics are a constant threat to life



- *Anopheles* and *Aedes* mosquitoes, plus flies are responsible for most VBDs of importance.

- They breed in water, feaces, rubbish, damaged buildings.
- Their control is part of the WASH Sector responsibility

# UNIQUE CHALLENGES & TAILOR MADE VC SOLUTIONS

**WASH partners may be well placed to contribute to vector control to protect people from malaria, dengue, yellow fever, chikungunya, Zika and diarrheal diseases in precarious situations.**

**Improving water, sanitation and shelter services to reduce vector breeding sites and controlling existing vector breeding sites, will help to reduce disease transmission.**

# **Treated** shelters, tarpaulins, blankets, curtains, wall lining, eaves exist & may improve VC for displaced families


# Malaria: the most common fatal VBD

**Vectors breed in any open clean surface water, bite and rest indoors at night**

*Anopheles gambiae; arabiensis & funestus*


***Displaced populations have specific needs** different from stable populations, and insecticide treatment of materials – **tents, blankets, sheets, clothing and curtains – may be more acceptable and feasible than conventional interventions.***

# Ex. 1
# Complex of malaria & other diseases in South Sudan camp settings, 2017

- Bentiu IDP Camp, Unity State,112,140 IDPs
- Maban Refugee Camps (4), Upper Nile, >130,000
- Main VBD target: *Anopheles* transmitting malaria
- Secondary: diarrhoeal diseases (flies) + Dengue (*Aedes* mosquitoes)
- Delivering an integrated vector management (IVM) package

# Bentui 2017 IVM Package

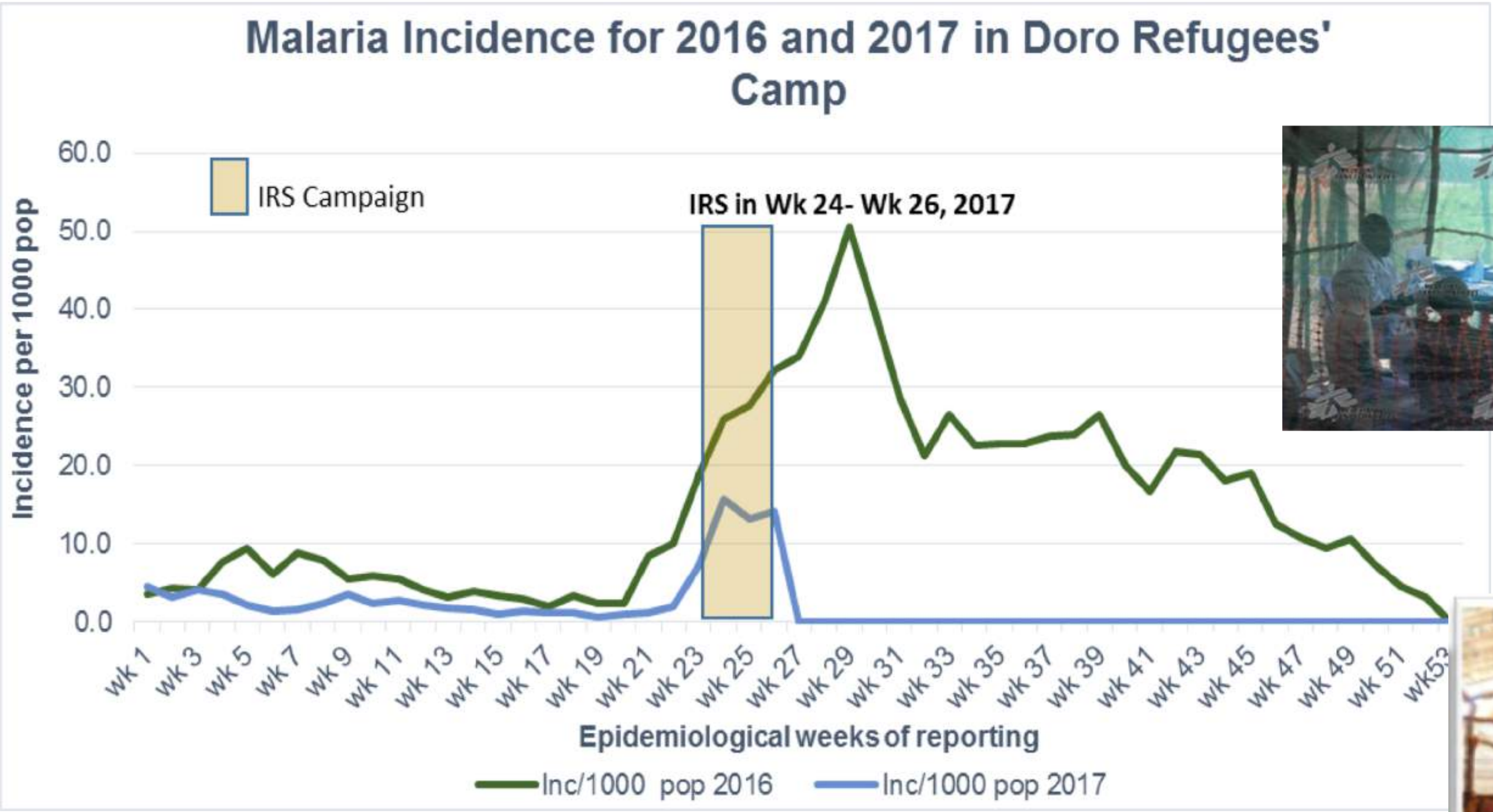
- Mass distribution of LLIN for 30,000 IDPs in sector 1 & part of 2

- Indoor residual spraying (Bendiocarb) in 95% in sectors 2-5
- 3 rounds of larviciding using liquid Abate covered a total of 11,631 breeding sites

- 2 rounds of fly control using Dimilin powder covered a total of 6,567 latrines and 7,092 open defecation sites

# Maban Refugee Camps, Upper Nile, 2017

- 130,000 refugees in 4 camps
- IRS & larvicide resulted in >68% malaria reduction
- Doro camp >




Florian Lems

# Leishmaniasis: most common communicable disease in conflict zones of Syria, neighboring areas in Iraq & Turkey, parts of Yemen

Omar (10 years old)

Fatema (3 years old)

Spread by sandflies, which bite people at night, indoors, causing either Cutanous or Viceral Leishmaniasis.

Sandflies breed and live in cracks of buildings and in piles of domestic waste

# The standard VC strategies for malaria also work for Leishmaniasis as the vectors behaviour is similar

**Smaller netting mesh size is better for sandflies**

**Waste management for sandfly control only**

# Ex. 2: Cutaneous Leishmaniasis - N. Syria

- **Rubble from aerial bombardment**

(*ideal habitat for vector*)

- **Breakdown of municipal waste services**

(*solid waste for vector)*

- **Over 6.5 million IDPs**

*(exposed and mobile reservoir for parasite)*

*Response in 2016:*

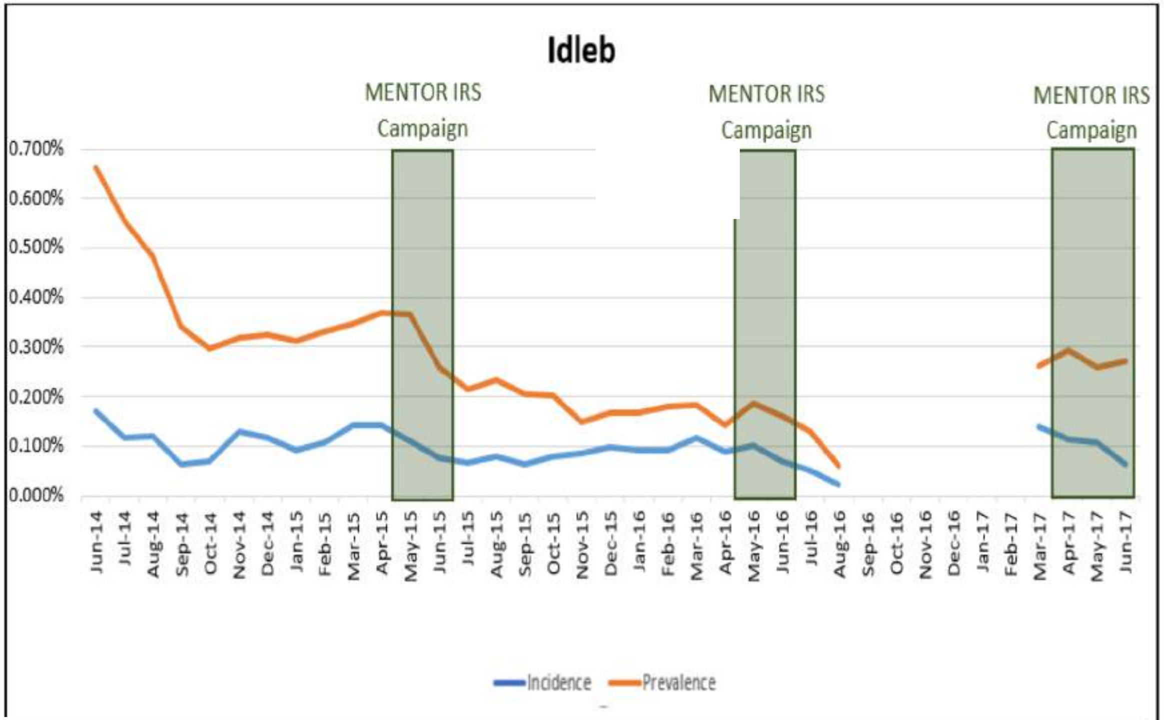
IRS & IEC in over **440,000 households**,

**> 2.6 million beneficiaries**

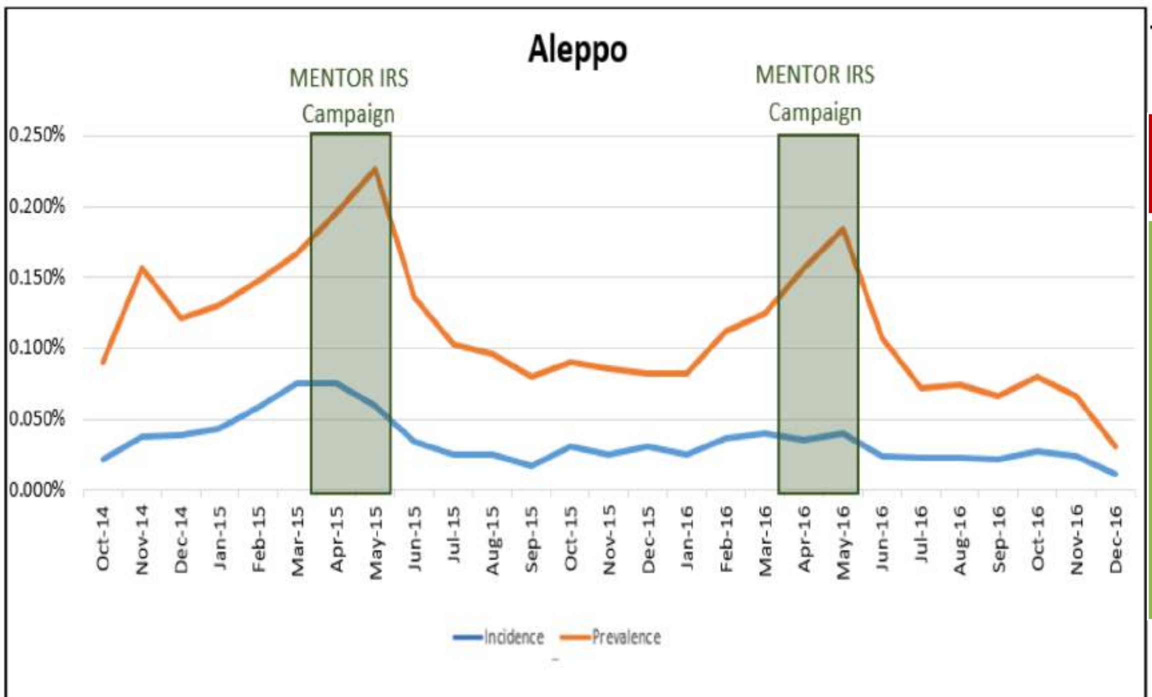
**139,800 LLINs** distributed in 2016,

**> 258,942 beneficiaries**

**Similar VC rounds in 2013, 14 & 15**




| 2015 | 2016 |
|---|---|
| **91,390** households sprayed (**514,346** beneficiaries) | **263,310** households sprayed (**1,572,479** beneficiaries) |

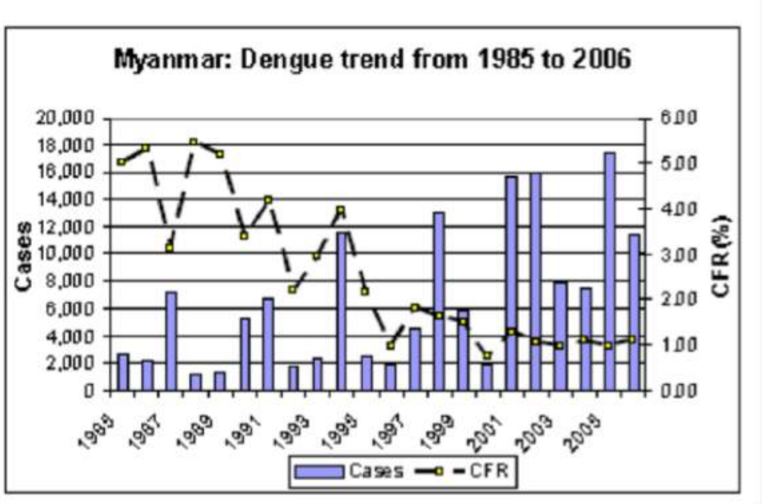



| 2015 | 2016 |
|---|---|
| **260,874** households sprayed (**1,581,479** beneficiaries) | **171,715** households sprayed (**1,120,755** beneficiaries) |

# Dengue Fever and other *Aedes* transmitted diseases

# Ex. 3: Dengue – Burma Cyclone Nargis

- Collaboration with MoH, WHO, UNICEF & 26 NGOs): May 2008 - August 2009
- Yangon Divisions
- Target VBD: Dengue (cyclical outbreaks every 2-3 years, last in 2007)
- Yangon city = highest risk area




# *Aedes* Breeding sites in Burma

Yangon Township – Aedes breeding sites expanded due to cyclone.

Four container types gave 63% of all mosquitoes:

22% water storage

22% spirit worship flower beds

12% house spirit flower vases

7% concrete water storage tanks

# Aedes Control Project

Hlaingtharyar and Insein Townships = 363,106 persons living in 63,187 households:

- Trained 837 people (NGOs, local orgs)
- Trained 2000 dengue prevention assistants from the townships

- Large scale IEC to mobilise households to:
  - Routinely scrub out the water of water storage containers
  - Remove or destroy, or fill with sand/soil containers in garden
  - Monitor for mosquito larvae

# Aedes-Borne Disease Control Impact

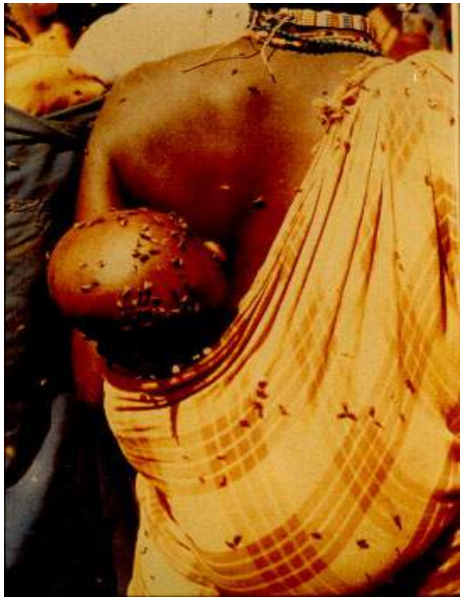
- Entomological impact indicators:
- No Aedes borne disease outbreaks occurred
- Aedes pupae per person: reduced by >80%
- Breteau Index: Reduced by >50%

*Table 1:* Comparison between results of pre-intervention and post-intervention entomological surveys in Insein and Hlaingthayar townships, Yangon Region, May and August 2009

| Indicator | Insein | | Hlaingthayar | |
|---|---|---|---|---|
| | Pre-intervention | Post-intervention | Pre-intervention | Post-intervention |
| Premises visited | 600 | 600 | 600 | 600 |
| Number of residents | 3048 | 3019 | 3811 | 3696 |
| Premises positive for larvae and/or pupae | 249 | 133 | 350 | 181 |
| **House Index**<br>Premises positive for pupae | 42±6.7<br>101 | 22±9.33<br>22 | 58±5.66<br>233 | 30±11.7<br>79 |
| **House Pupae Index**<br>Number of containers with water<br>Containers positive for larvae and/ or pupae | 17±5.01<br>5147<br>514 | 3.6±2.35<br>4939<br>272 | 39±7.84<br>4929<br>827 | 13.1±5.55<br>4777<br>380 |
| **Container Index**<br>Containers positive for pupae | 10±3.28<br>154 | 5.5±2.6<br>30 | 17±1.37<br>372 | 7.9±3.09<br>103 |
| **Container Pupae Index**<br>Total number of pupae | 3±1<br>1216 | 0.6±0.33<br>180 | 8±1.37<br>11 857 | 2.1±0.91<br>1138 |
| **Pupae per Person Index**<br>(Number of pupae per person) | 0.39±0.12 | 0.06 | 3.1±1.48 | 0.31±0.28 |
| **Breteau Index**<br>(Positive containers/100 houses) | 86±23.58 | 45±24.03 | 138±19.17 | 63±28.43 |

# Fly Borne Disease (other than Leishmaniasis)

Mechanical transmission of pathogens from feaces to people, directly or via food.

•Domestic flies, Filth Flies, Blow flies, and Cockroaches mechanically disseminate human pathogens.

- **Filth flies are the worst: 21 species** transmit human gastrointestinal diseases (diarrheal diseases) + trachoma (communicable disease cause of blindness)

•Breed in animal manure, human excrement, garbage, animal bedding and decaying organic matter

# Minimizing fly contact with food

Impact of fly control on childhood diarrhea in Pakistan: community-randomized trial (D. C Chavasse et al., *The Lancet* 1999)

**Results:** Overall, the reduction of diarrheal incidence attributable to fly control (indoor residual spraying) was 23% (95% CI 11–33).
**Indication:** spraying is a very effective method for reducing fly populations where high numbers of flies are associated with high incidence of diarrhea (i.e., in humanitarian crises).

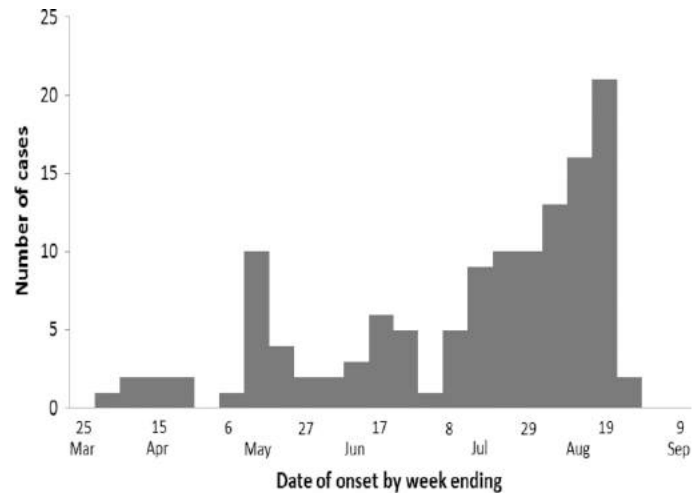
- Keeping flies out of food preparation and eating areas and healthcare facilities is optimal to reduce diarrheal disease.
- Methods:
  - Screening material treated with effective insecticide
  - Fly Abatement Strips (e.g., Quickstrike®)
  - Proper containers for food
  - Fly traps
  - Indoor residual spraying of building walls

# Sanitation and Insecticides

Effective management and prevention requires implementation of basic sanitation and hygiene measures which can be combined with insecticide/rodenticide measures when appropriate

2012 outbreak of epidemic typhus in Rwandan Youth Rehabilitation Centre

- Delousing with insecticide
- Disinfection of bedding and clothing
- Presumptive doxycycline




*The precipitous reduction in cases was more suggestive of disruption of transmission rather than depletion of susceptible persons.* (Umuilsa et al., 2016)

- Effective interventions are available, but generally poorly implemented
- Increased emphasis on systematic and coordinated implementation and surveillance required

# Conclusion

- Vector Control in Humanitarian Emergencies represents great need and opportunity
- RBM and partners UNICEF, MSF and MENTOR building platform for
  - Advocacy, Information exchange, technical support
  - Facilitate linkages among industry, research and implementing partners for new tool development

**Achieving effective control of VBD requires effective cross sectoral collaboration between Health, WASH, Education and Shelter partners**

# A systematic review and meta-analysis of the impact of water, sanitation, and hygiene exposures in case-control studies on cholera transmission

*Marlene Wolfe, Mehar Kaur, Travis Yates, Mark Woodin, Daniele Lantagne*

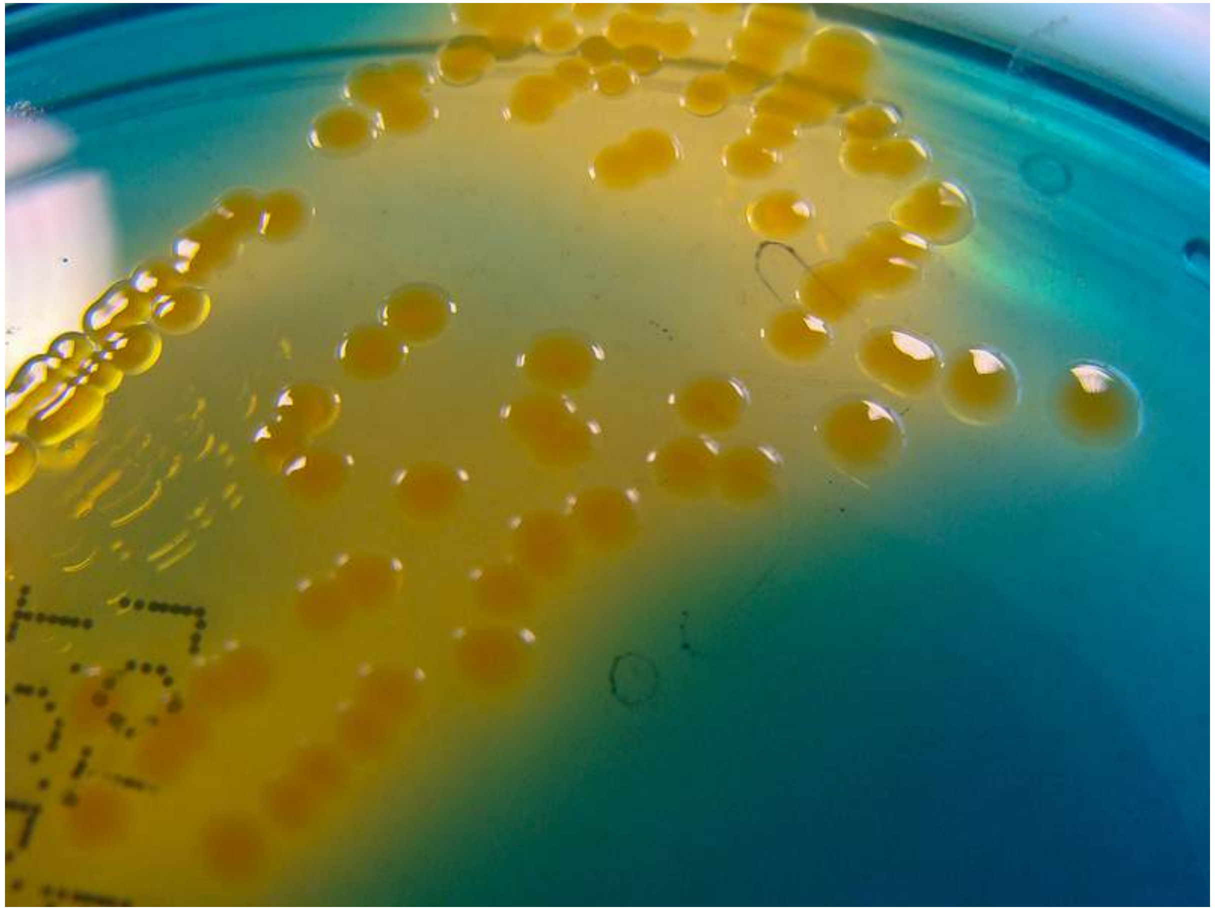
Tufts University

Department of Civil and Environmental Engineering

# Cholera

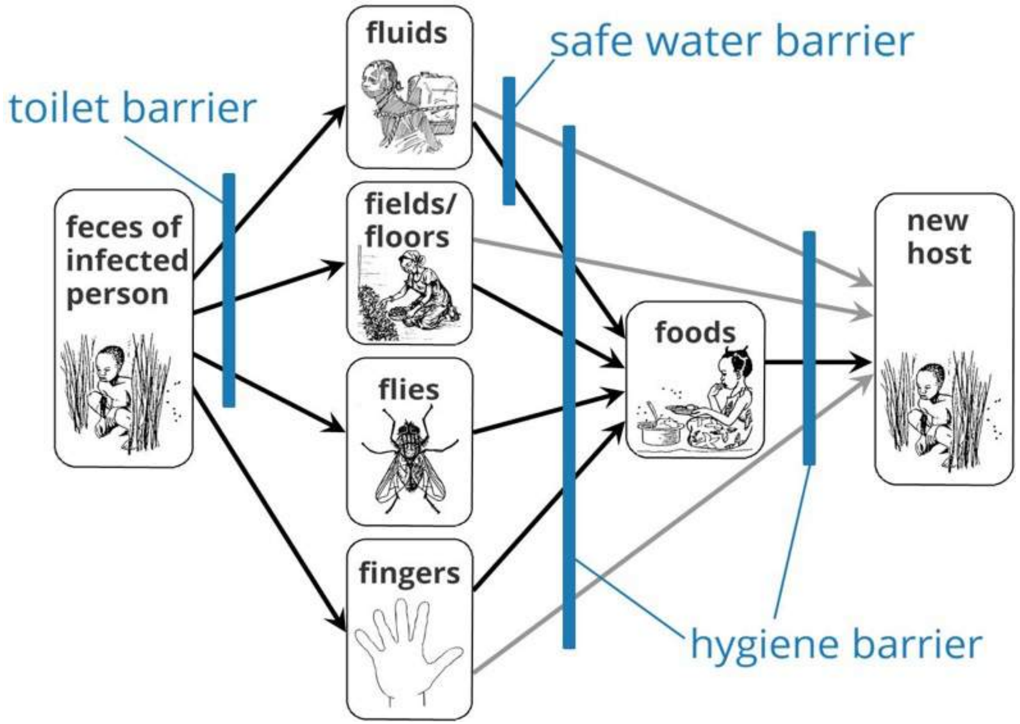
- 1.4-4.3 million cases/year
- 28,000-142,000 deaths/year
- Fecal-oral spread

- Treatment (ORS) has reduced fatality rate
- Prevention needed to reduce morbidity



Vibrio cholerae on T.C.B.S. Agar – Detail by Nathan Reading licensed by CC BY-NC-ND 2.0

# WASH Interventions Interrupt Transmission




Water 1st International (https://water1st.org/problem/f-diagram/)

# Evidence for WASH in Cholera

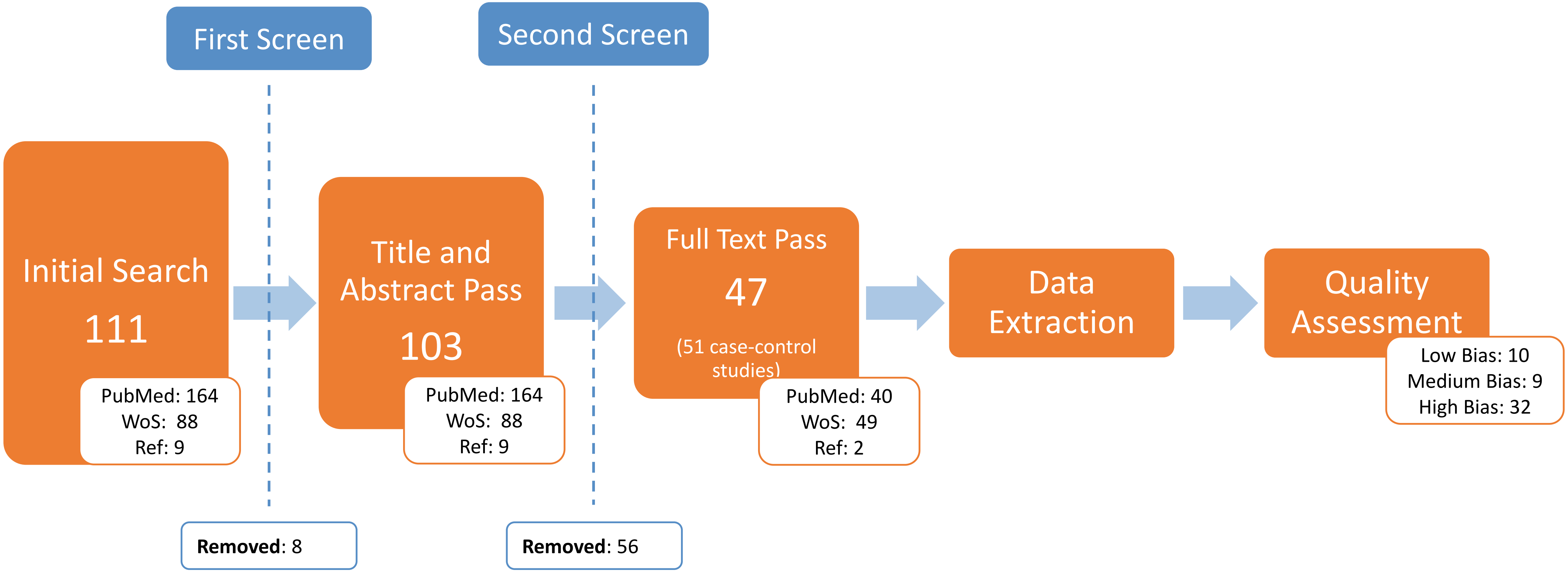
Life saving - drinking water by Julien Harneis licensed by CC BY-SA 2.0

- Health impact evaluations rarely conducted
- Case-control studies commonly conducted
- To our knowledge no summary of evidence from case-control studies

**Aim: to conduct a systematic review of published literature to evaluate the association between WASH exposures and cholera**

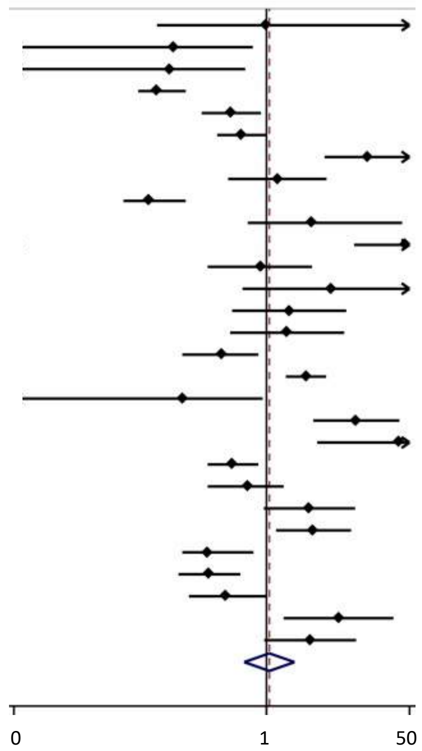
# Systematic Review Methodology and Results

Case control studies quantifying the odds ratio (association) between WASH factors (exposure) and cholera cases (outcome)



| WASH Group | Predicted Protective Factors | Predicted Risk Factors |
|---|---|---|
| Water source | Improved Water Source<br>Bottled Water Source | Unimproved Water Source<br>Surface Water Contact |
| Water treatment | Treated Water | Untreated Water |
| Water management | Safe Water Storage and Transport | Unsafe Water Storage and Transport |
| Sanitation | Improved Sanitation | Open Defecation<br>Unimproved Sanitation<br>Shared Sanitation |
| Hygiene | Self-Reported Good Hygiene<br>Observation of Hygiene Materials | Self-Reported Lack of Hygiene |

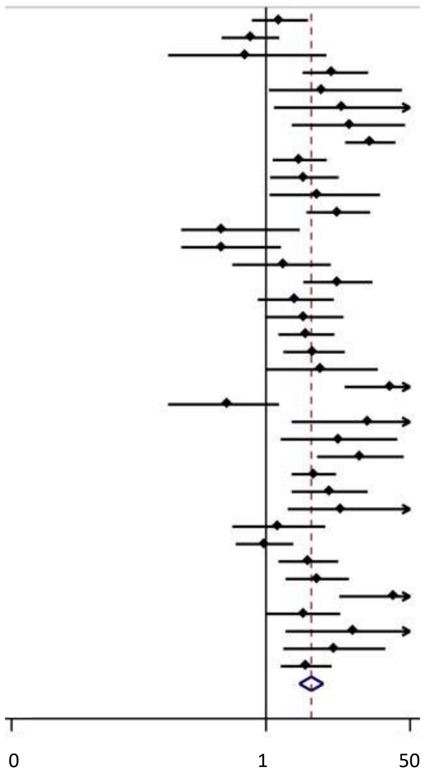
## Improved Water Source




OR = 1.1
$I^2$ = 91%*

The Well/Borehole in Kawale/Sence, south of Lilongwe by khym64 licensed by (CC BY 2.0)

## Unimproved Water Source

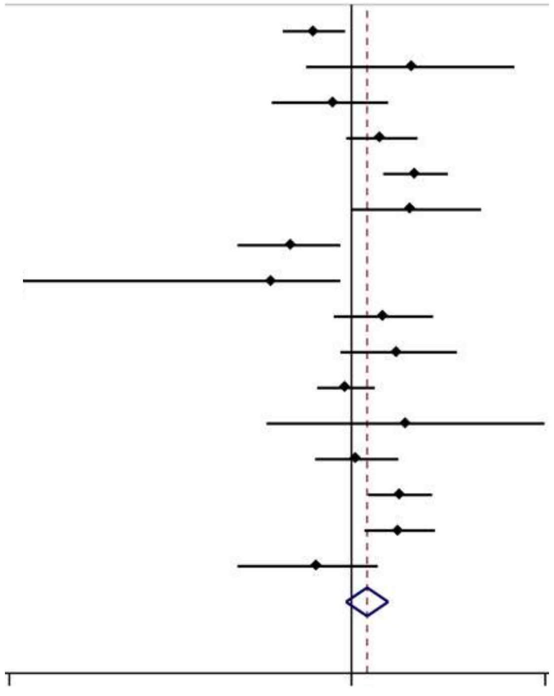



OR = 3.4*
$I^2$ = 71%*

http://www.ch2mhillblogs.com/foundation/assessing-biogas-energy-and-water-supply-in-rural-uganda/

| Predicted Protective Factors | OR (95% CI) | Predicted Risk Factors | OR (95% CI) |
|---|---|---|---|
| Improved water source | **1.08** (0.54-2.15) | Unimproved water source | **3.42** (2.47-4.74) |
| Bottled water source | **0.35** (0.13-0.96) | Surface water contact | **2.27** (1.07-4.80) |
| Treated water | **0.44** (0.35-0.56) | Untreated water | **3.47** (2.76-4.35) |
| Safe water storage and transport | **0.55** (0.39-0.80) | Unsafe water storage and transport | **2.79** (2.13-3.65) |
| Improved sanitation | **1.37** (0.90-2.10) | Open defecation | **5.62** (3.45-9.14) |
| | | Unimproved sanitation | **2.46** (1.22-4.94) |
| | | Shared sanitation | **1.90** (1.49-2.43) |
| Self-report good hygiene | **0.35** (0.27-0.45) | Self-reported lack of hygiene | **3.75** (2.44-5.77) |
| Observation of hygiene materials | **0.34** (0.23-0.49) | | |

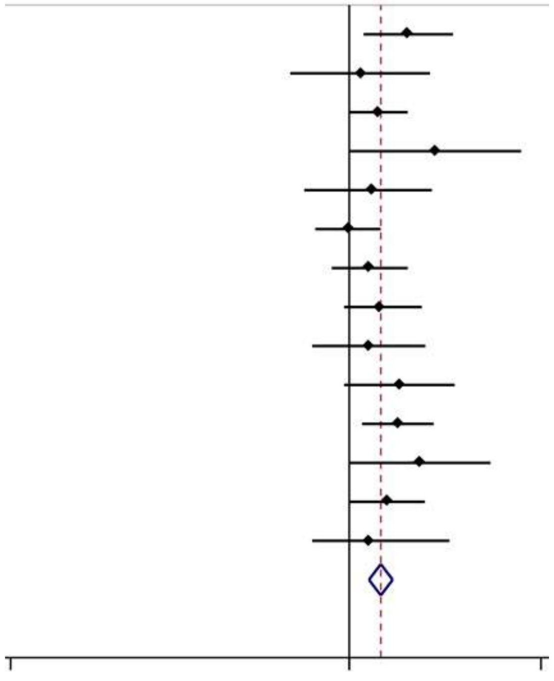
## Improved Sanitation




OR = 1.4
$I^2$ = 68%*

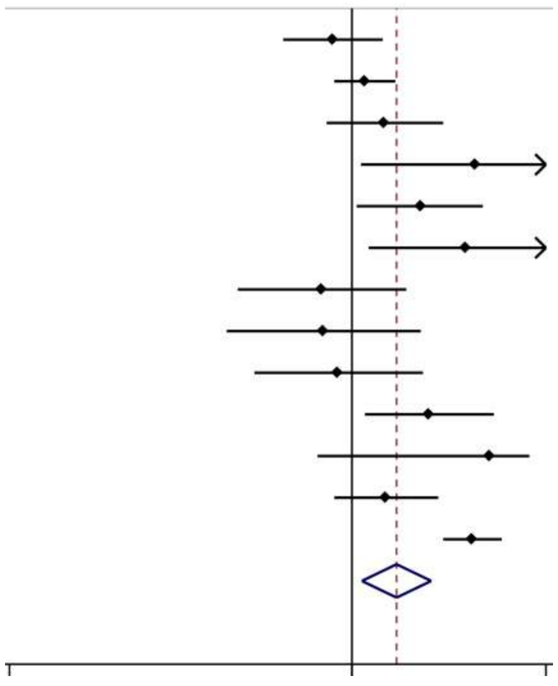


## Shared Sanitation




OR = 1.9*
$I^2$ = 0%

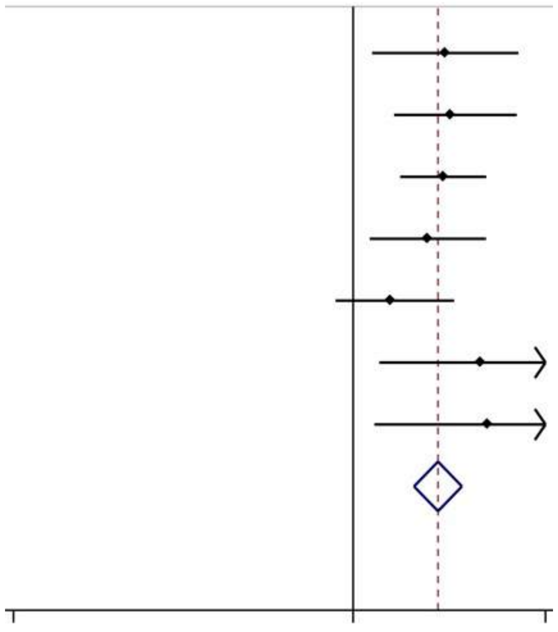
## Unimproved Sanitation




OR = 2.5*
$I^2$ = 76%*



## Open Defecation




OR = 5.6*
$I^2$ = 0%

# Conclusions

- WASH factors are associated with cholera
  - Predicted risk factors are risky
  - Predicted protective factors are variable
- Differences attributed to variation in WASH intervention quality and appropriateness
- Limitations
  - Difficulty classifying exposures
  - Publication bias – case control studies look for outbreak source

# Recommendations

- Hypothesis: Implementation matters
  - Ensure field effectiveness reaches theoretical efficacy
  - Other transmission routes reduce “effectiveness”
- Reports of case studies should:
  - Report details of interventions
  - Report new or preexisting campaigns
  - Use standard definitions (JMP)


An Oxfam cholera prevention float by Oxfam East Africa (CC BY 2.0)

# Acknowledgments


- Karen Vagts, Tufts University Librarian
- Humanitarian Evidence Programme
- 3iE

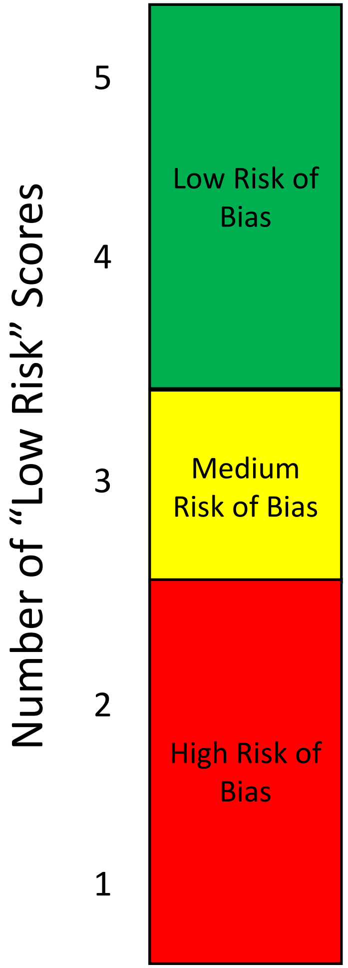
- **Funding**:
- NSF IGERT - Water Diplomacy Fellowship
- Tufts University School of Engineering

Thank you to the many responders working in outbreaks and publishing data that allows us to gain these insights


Tufts UNIVERSITY | School of Engineering

# Bias Risk

- Tool adapted from the Quality Assessment Tool for Quantitative Studies by the Effective Public Health Practice Project and Baird et al's (2013) version of the *Cochrane Handbook* 'Risk of Bias'
- Rate based on likelihood of:
  - selection and confounding
  - spillover and contamination
  - incomplete outcomes
  - selective reporting
  - other bias



# Analysis

- Meta-analysis (random effects) for each risk or protective factor
- $I^2$ test to quantify heterogeneity; significance from Pearson $X^2$

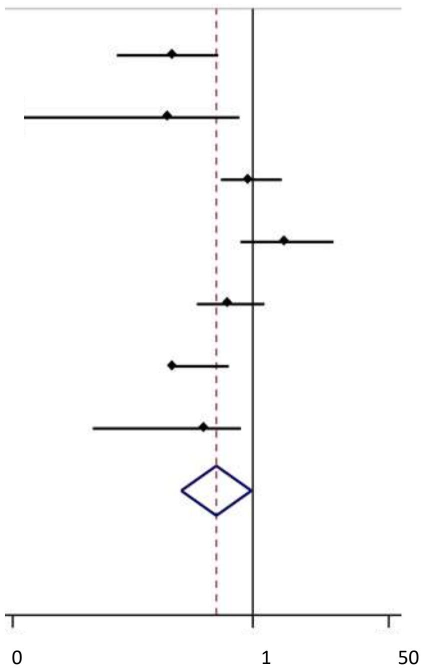
- Sensitivity analysis for subsets of data based on:
  - Bias risk assessment
  - Use of WHO cholera definition

# Summary of Results

| Predicted Protective Factors | OR (95% CI) | $I^2$ | Predicted Risk Factors | OR (95% CI) | $I^2$ |
|---|---|---|---|---|---|
| Improved water source | 1.08 (0.54-2.15) | 91%* | Unimproved water source | 3.42 (2.47-4.74) | 71%* |
| Bottled water source | 0.35 (0.13-0.96) | 77%* | Surface water contact | 2.27 (1.07-4.80) | 92% |
| Treated water | 0.44 (0.35-0.56) | 61%* | Untreated water | 3.47 (2.76-4.35) | 48%* |
| Safe water storage and transport | 0.55 (0.39-0.80) | 57%* | Unsafe water storage and transport | 2.79 (2.13-3.65) | 45%* |
| Improved sanitation | 1.37 (0.90-2.10) | 68%* | Open defecation | 5.62 (3.45-9.14) | 0% |
| Self-report good hygiene | 0.35 (0.27-0.45) | 67%* | Unimproved sanitation | 2.46 (1.22-4.94) | 76%* |
| Observation of hygiene materials | 0.34 (0.23-0.49) | 65%* | Shared sanitation | 1.90 (1.49-2.43) | 0% |
| | | | Self-reported lack of hygiene | 3.75 (2.44-5.77) | 43% |

* Indicates statistically significant heterogeneity (Pearson's $X^2$)

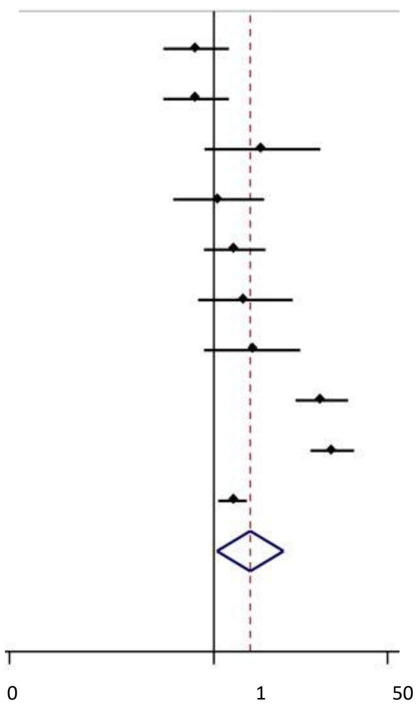
## Bottled Drinking Water




OR = 0.35*
$I^2$ = 77%*

WFP delivers Water to Storm Victims by United Nations Photo licensed by **(CC BY-NC-ND 2.0)**

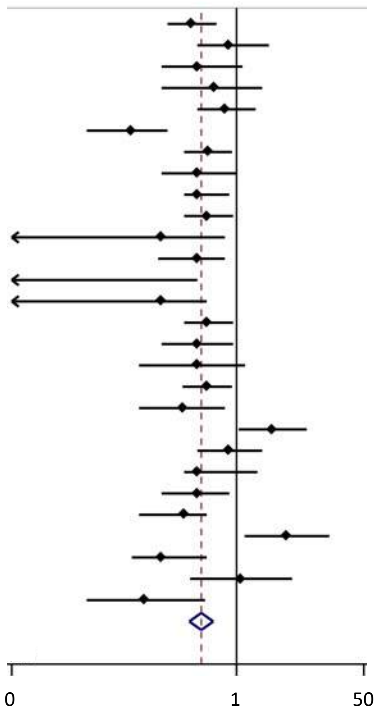
## Surface Water Contact




OR = 2.3*
$I^2$ = 92%*

**Unimproved drinking water source by** mproved or Not Improved - Wat/San Photo Catalogue licensed by **(CC BY 2.0)**

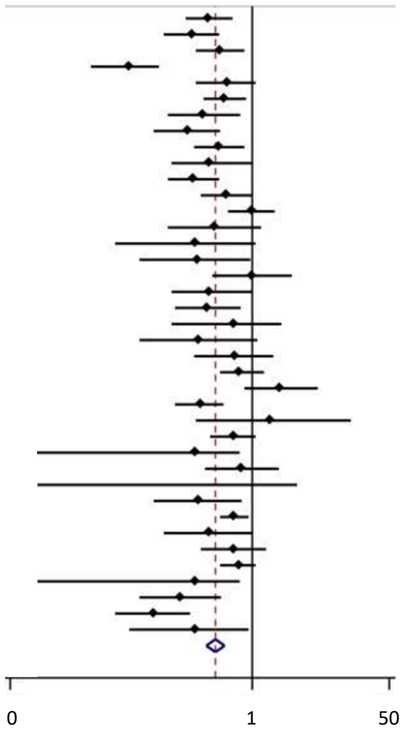
Self-reported
Good Hygiene




OR = 0.35*
$I^2 = 65\%$*

PHASE: Children washing their hands by GSK licensed by (CC BY-SA 2.0)

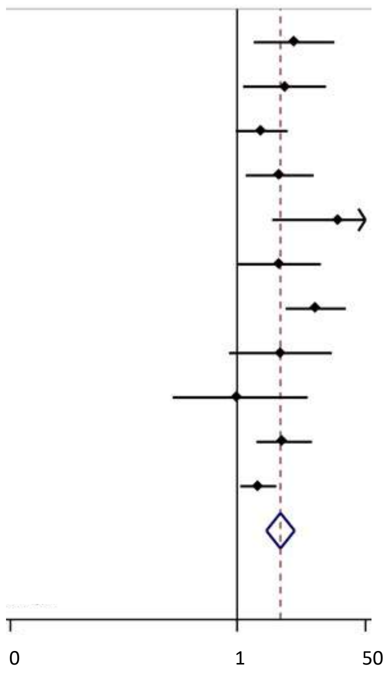
Observation of
Hygiene Materials




OR = 0.34*
$I^2 = 67\%$*

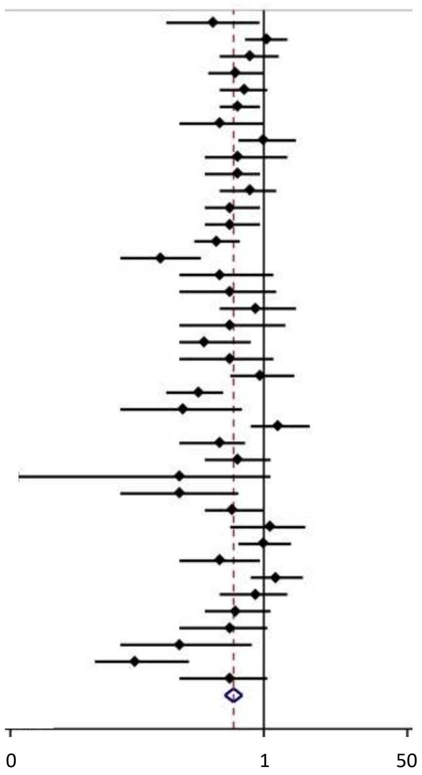
A woman washes her hands from a tippy tap by World Bank Photo Collection licensed by (CC BY-NC-ND 2.0)

Self-reported
Lack of Hygiene




OR = 3.8*
$I^2 = 43\%$

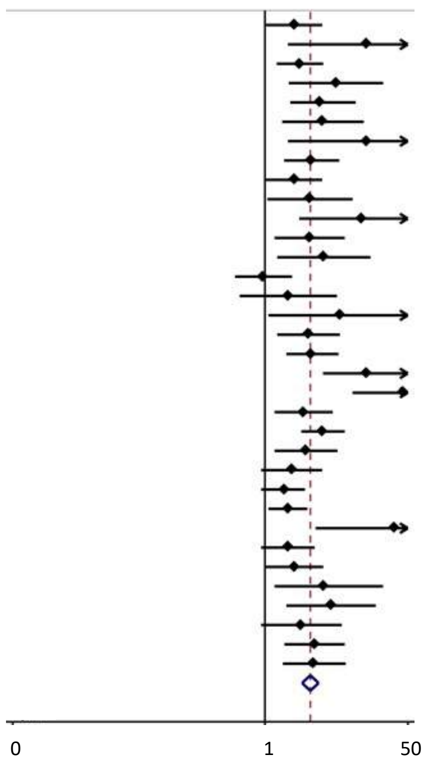
## Treated Water




OR = 0.44*
$I^2$ = 61%*


International Water and Health Alliances
http://waterinternational.org/?page_id=272

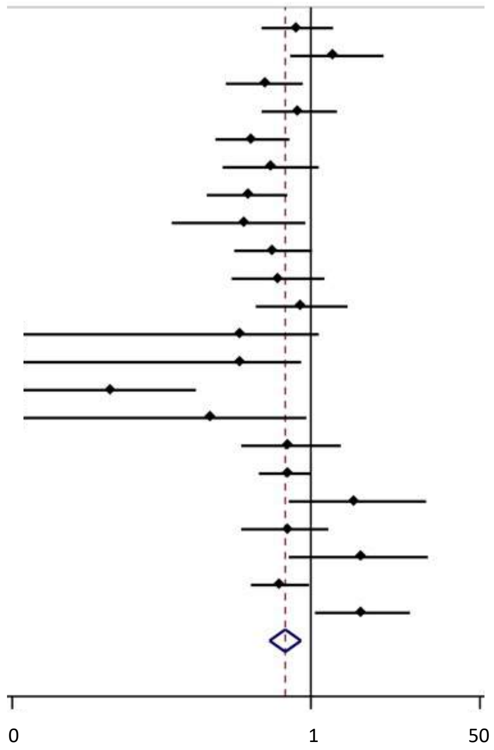
## Untreated Water




OR = 3.5*
$I^2$ = 48%*

Drinking by ssilberman licensed by (CC BY 2.0)

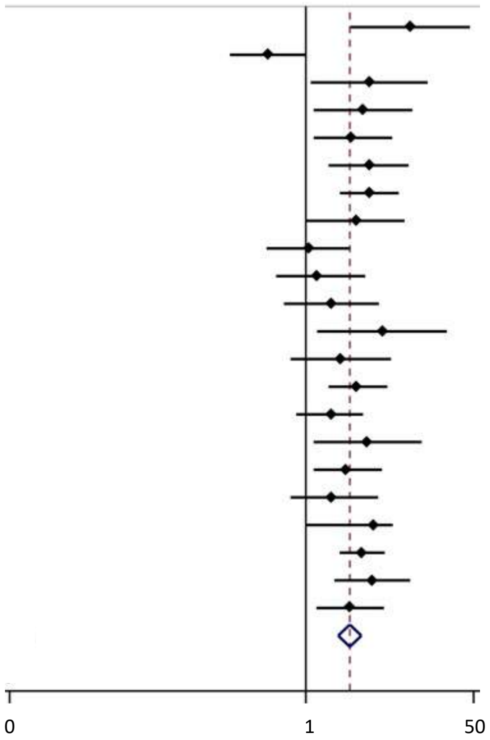
## Safe Water Storage and Transport




**OR = 0.55***
**$I^2$ = 57%***

Darfurians refugees in Eastern Chad by European Commission DG Echo licensed by (CC BY-SA 2.0)

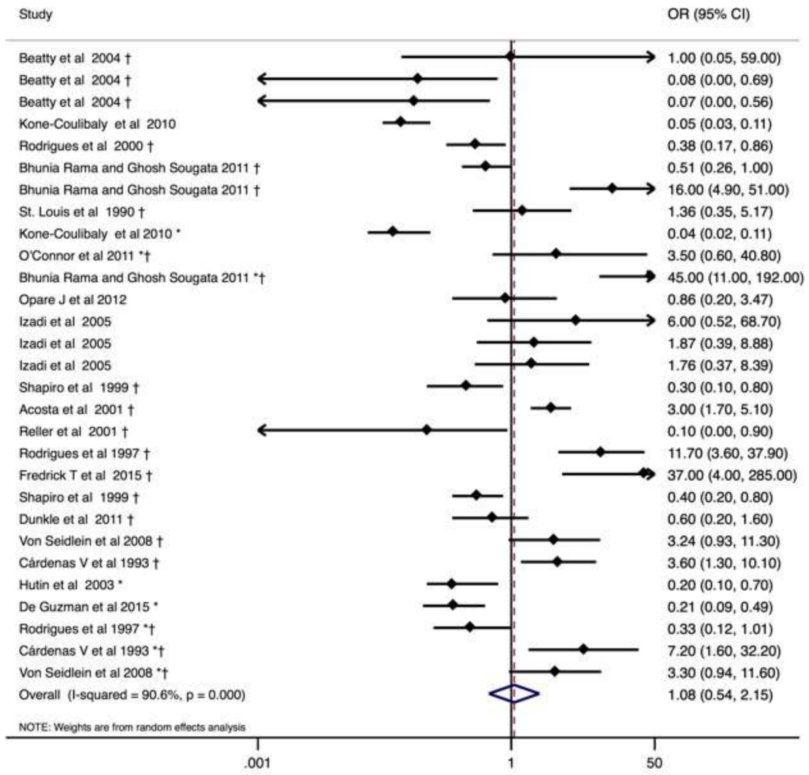
## Unsafe Water Storage and Transport



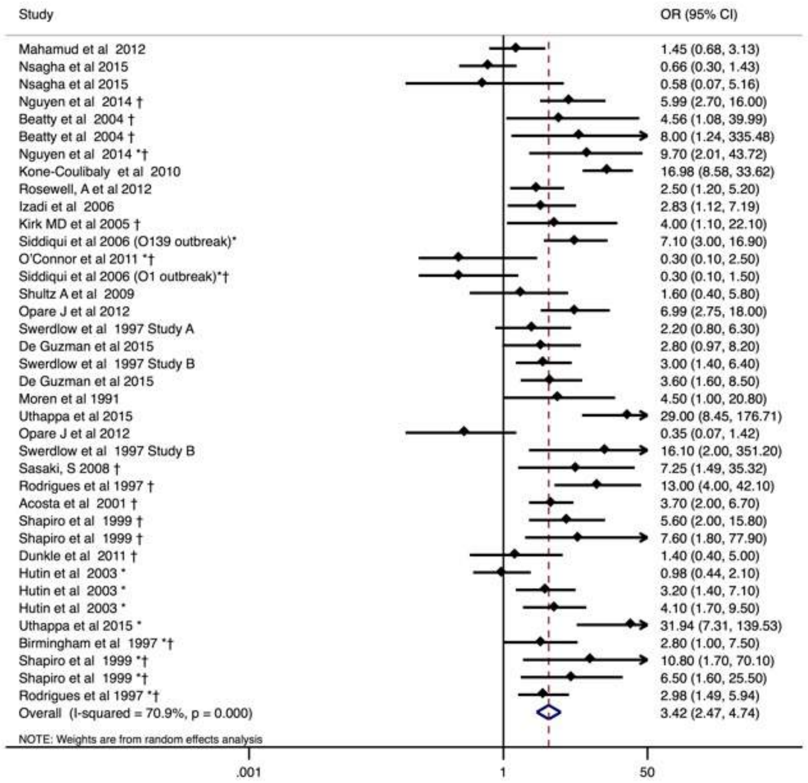

**OR = 2.8***
**$I^2$ = 45%***

http://www.humanosphere.org/world-politics/2014/12/tanzania-failed-fix-water-access-problem/

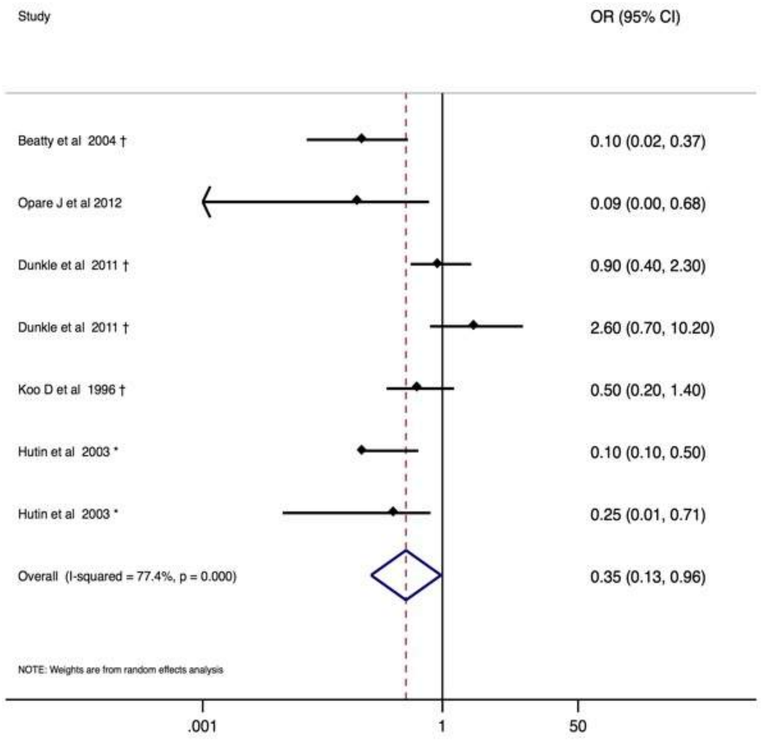
## Improved Water Source



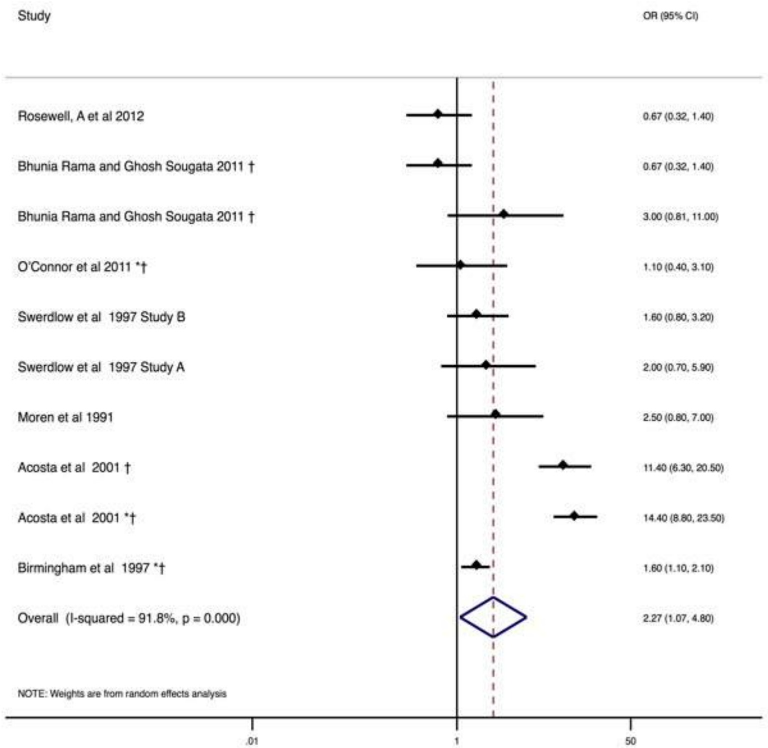

## Unimproved Water Source

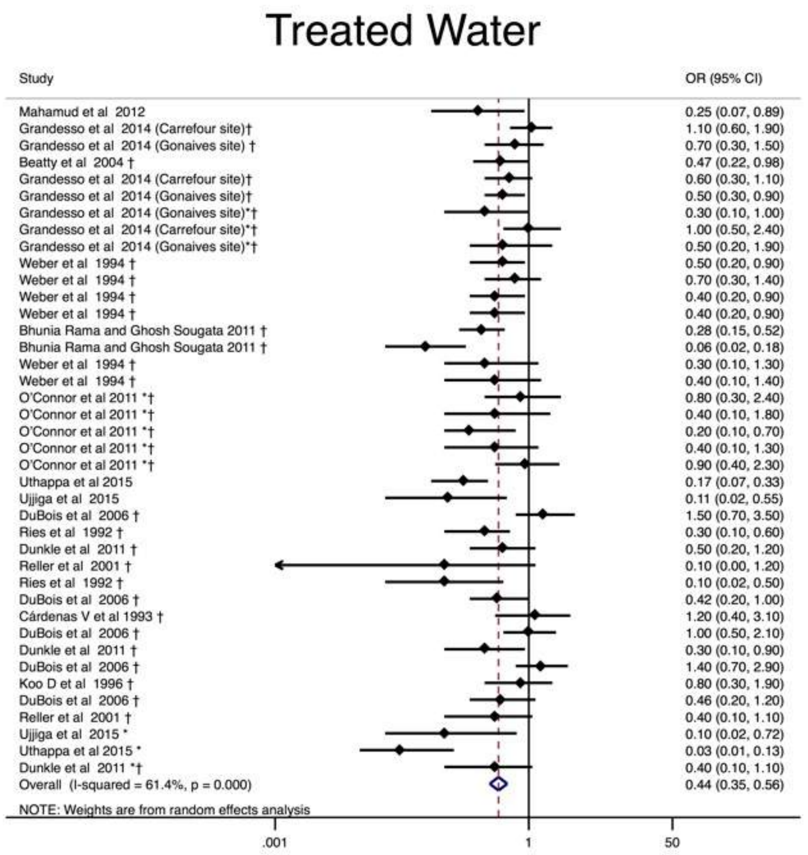


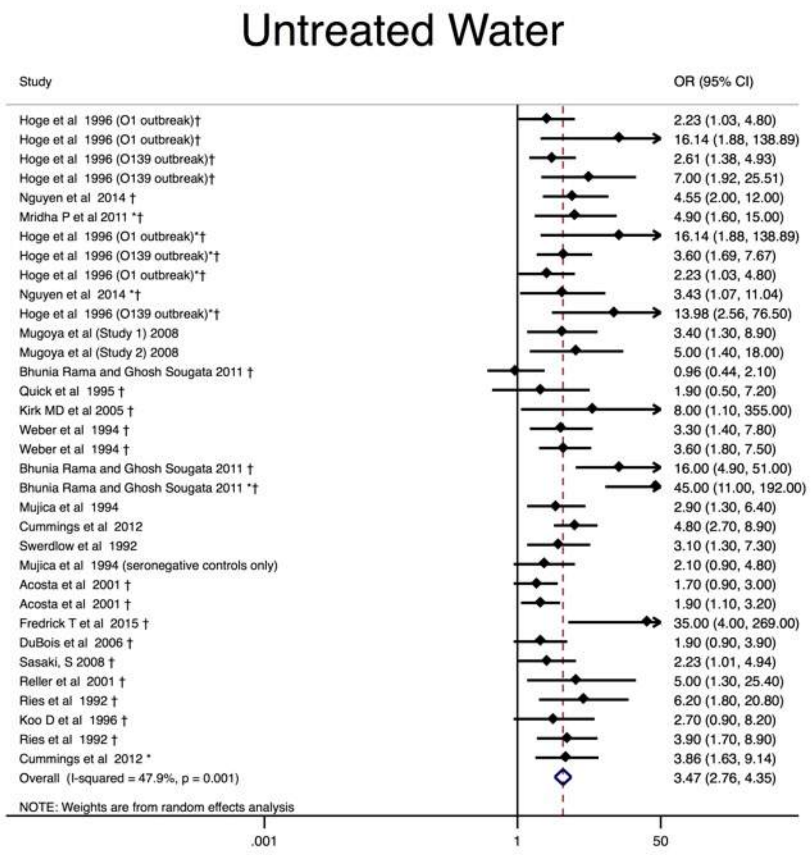
## Bottled Drinking Water

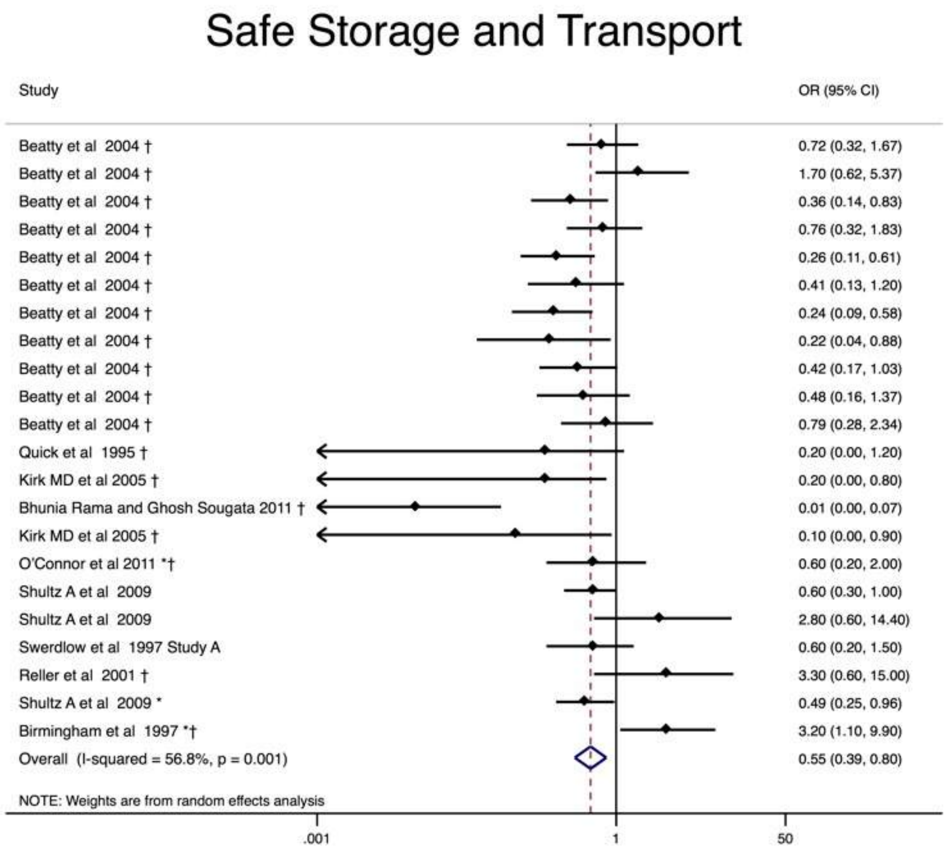


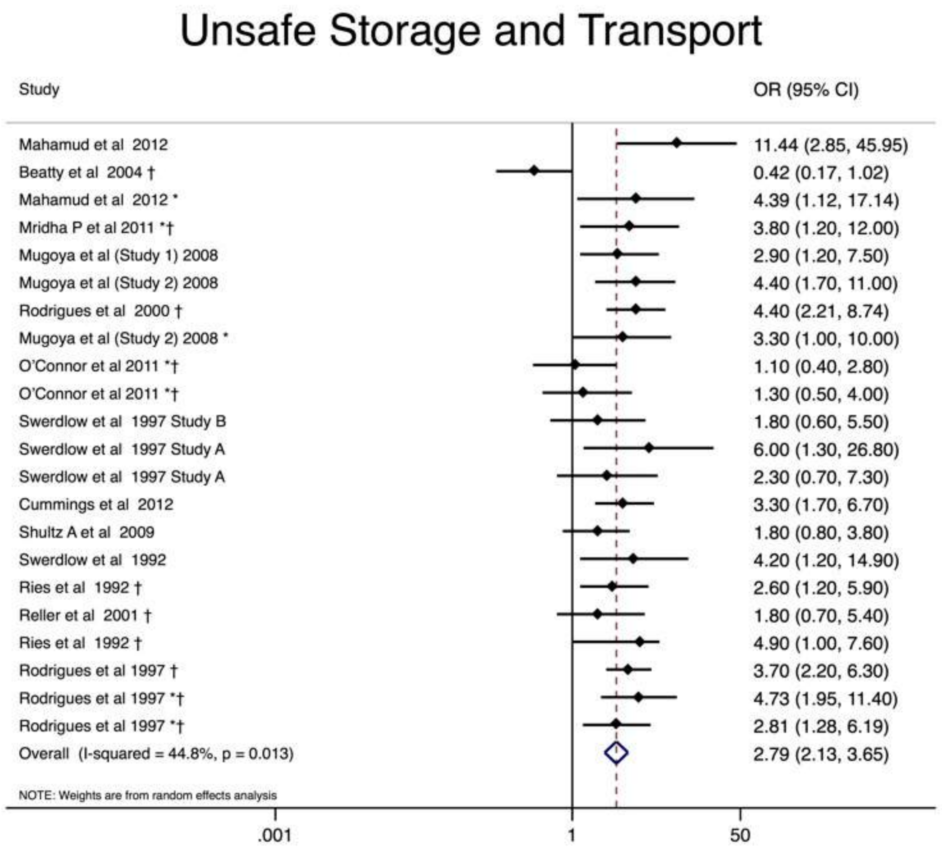

## Contact with Surface Water

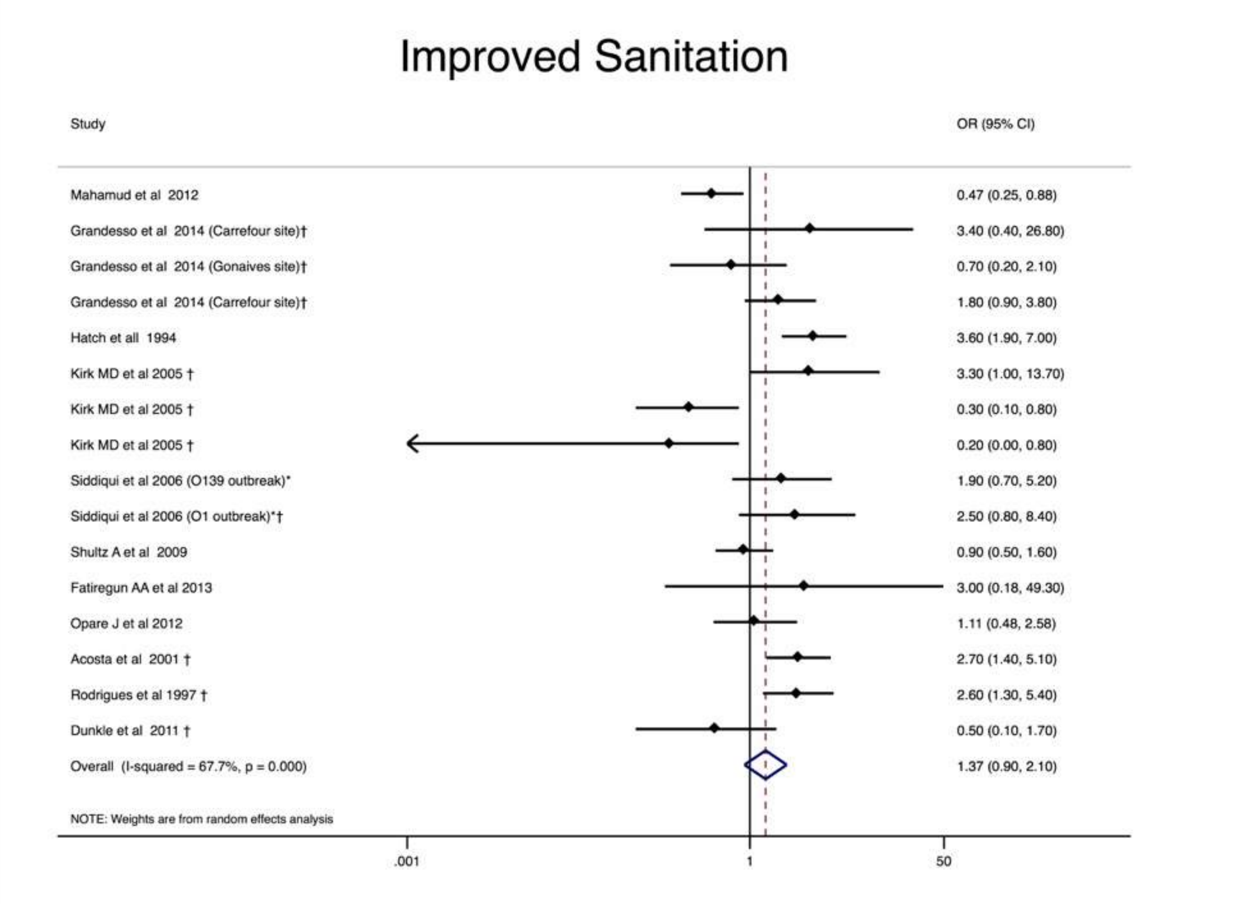


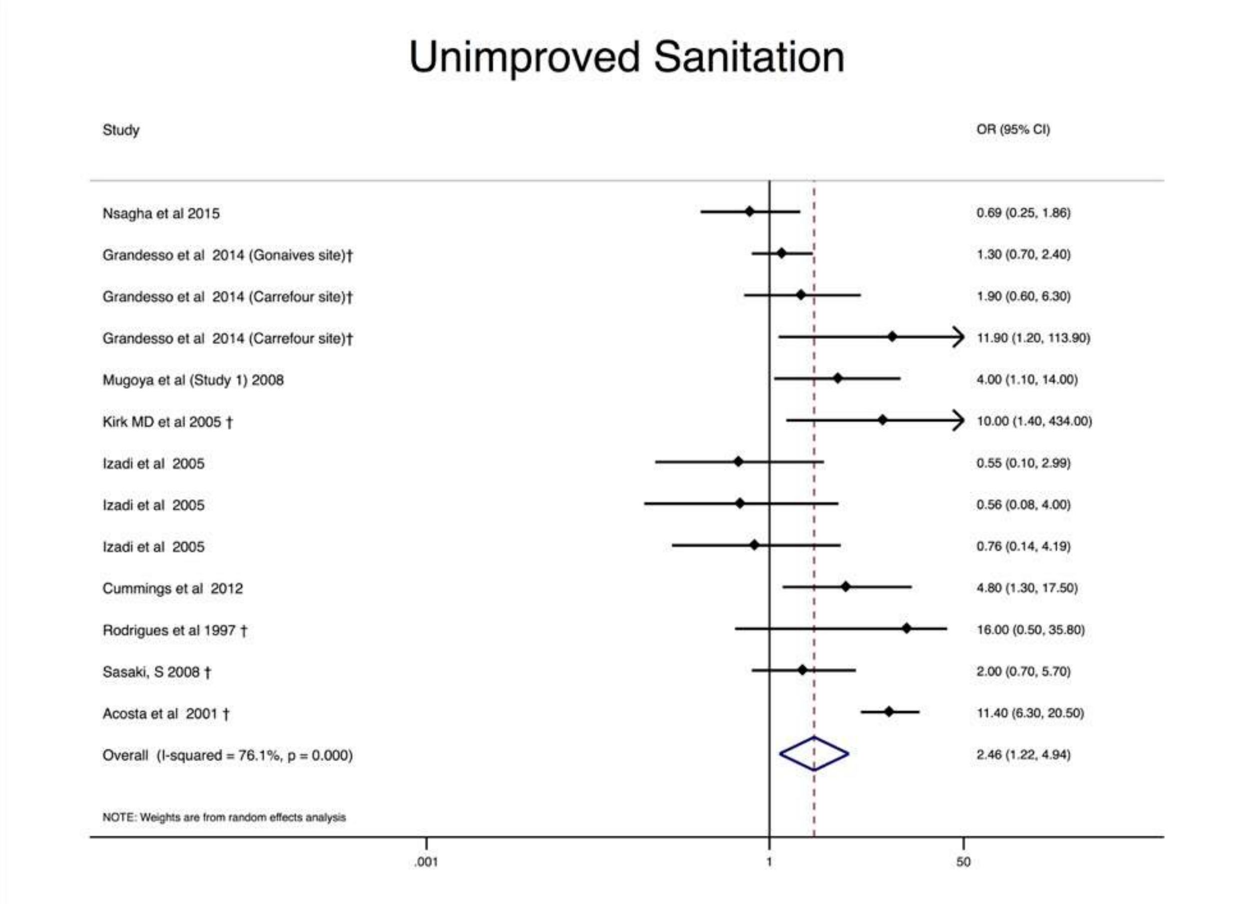

Treated Water
Study
OR (95% CI)
Mahamud et al 2012 0.25 (0.07, 0.89)
Grandesso et al 2014 (Carrefour site)† 1.10 (0.60, 1.90)
Grandesso et al 2014 (Gonaives site) † 0.70 (0.30, 1.50)
Beatty et al 2004 † 0.47 (0.22, 0.98)
Grandesso et al 2014 (Carrefour site)† 0.60 (0.30, 1.10)
Grandesso et al 2014 (Gonaives site)† 0.50 (0.30, 0.90)
Grandesso et al 2014 (Gonaives site)*† 0.30 (0.10, 1.00)
Grandesso et al 2014 (Carrefour site)*† 1.00 (0.50, 2.40)
Grandesso et al 2014 (Gonaives site)*† 0.50 (0.20, 1.90)
Weber et al 1994 † 0.50 (0.20, 0.90)
Weber et al 1994 † 0.70 (0.30, 1.40)
Weber et al 1994 † 0.40 (0.20, 0.90)
Weber et al 1994 † 0.40 (0.20, 0.90)
Bhunia Rama and Ghosh Sougata 2011 † 0.28 (0.15, 0.52)
Bhunia Rama and Ghosh Sougata 2011 † 0.06 (0.02, 0.18)
Weber et al 1994 † 0.30 (0.10, 1.30)
Weber et al 1994 † 0.40 (0.10, 1.40)
O'Connor et al 2011 *† 0.80 (0.30, 2.40)
O'Connor et al 2011 *† 0.40 (0.10, 1.80)
O'Connor et al 2011 *† 0.20 (0.10, 0.70)
O'Connor et al 2011 *† 0.40 (0.10, 1.30)
O'Connor et al 2011 *† 0.90 (0.40, 2.30)
Uthappa et al 2015 0.17 (0.07, 0.33)
Ujjiga et al 2015 0.11 (0.02, 0.55)
DuBois et al 2006 † 1.50 (0.70, 3.50)
Ries et al 1992 † 0.30 (0.10, 0.60)
Dunkle et al 2011 † 0.50 (0.20, 1.20)
Reller et al 2001 † 0.10 (0.00, 1.20)
Ries et al 1992 † 0.10 (0.02, 0.50)
DuBois et al 2006 † 0.42 (0.20, 1.00)
Cárdenas V et al 1993 † 1.20 (0.40, 3.10)
DuBois et al 2006 † 1.00 (0.50, 2.10)
Dunkle et al 2011 † 0.30 (0.10, 0.90)
DuBois et al 2006 † 1.40 (0.70, 2.90)
Koo D et al 1996 † 0.80 (0.30, 1.90)
DuBois et al 2006 † 0.46 (0.20, 1.20)
Reller et al 2001 † 0.40 (0.10, 1.10)
Ujjiga et al 2015 * 0.10 (0.02, 0.72)
Uthappa et al 2015 * 0.03 (0.01, 0.13)
Dunkle et al 2011 *† 0.40 (0.10, 1.10)
Overall (I-squared = 61.4%, p = 0.000) 0.44 (0.35, 0.56)
NOTE: Weights are from random effects analysis
.001
1
50

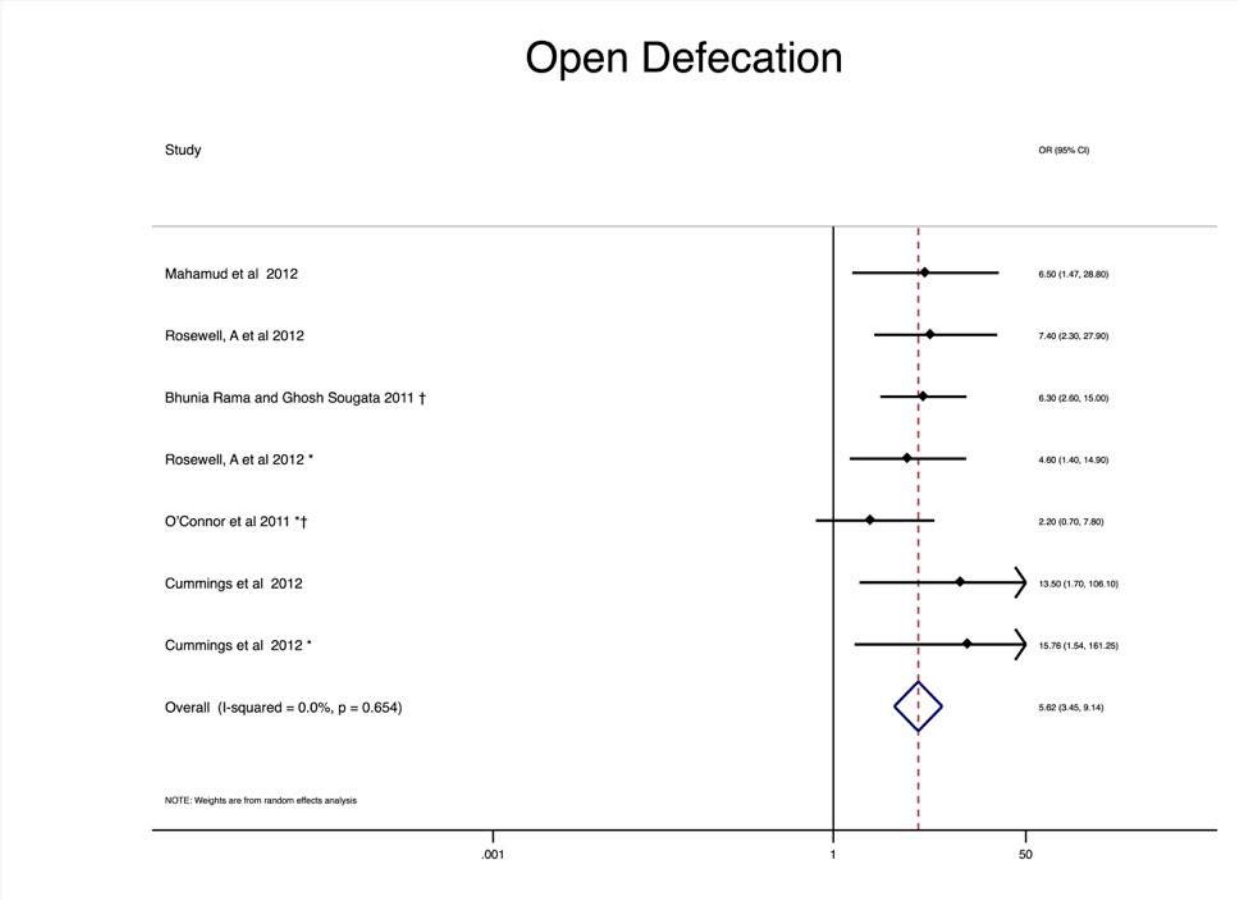

Untreated Water
Study
OR (95% CI)
Hoge et al 1996 (O1 outbreak)† 2.23 (1.03, 4.80)
Hoge et al 1996 (O1 outbreak)† 16.14 (1.88, 138.89)
Hoge et al 1996 (O139 outbreak)† 2.61 (1.38, 4.93)
Hoge et al 1996 (O139 outbreak)† 7.00 (1.92, 25.51)
Nguyen et al 2014 † 4.55 (2.00, 12.00)
Mridha P et al 2011 *† 4.90 (1.60, 15.00)
Hoge et al 1996 (O1 outbreak)*† 16.14 (1.88, 138.89)
Hoge et al 1996 (O139 outbreak)*† 3.60 (1.69, 7.67)
Hoge et al 1996 (O1 outbreak)*† 2.23 (1.03, 4.80)
Nguyen et al 2014 *† 3.43 (1.07, 11.04)
Hoge et al 1996 (O139 outbreak)*† 13.98 (2.56, 76.50)
Mugoya et al (Study 1) 2008 3.40 (1.30, 8.90)
Mugoya et al (Study 2) 2008 5.00 (1.40, 18.00)
Bhunia Rama and Ghosh Sougata 2011 † 0.96 (0.44, 2.10)
Quick et al 1995 † 1.90 (0.50, 7.20)
Kirk MD et al 2005 † 8.00 (1.10, 355.00)
Weber et al 1994 † 3.30 (1.40, 7.80)
Weber et al 1994 † 3.60 (1.80, 7.50)
Bhunia Rama and Ghosh Sougata 2011 † 16.00 (4.90, 51.00)
Bhunia Rama and Ghosh Sougata 2011 *† 45.00 (11.00, 192.00)
Mujica et al 1994 2.90 (1.30, 6.40)
Cummings et al 2012 4.80 (2.70, 8.90)
Swerdlow et al 1992 3.10 (1.30, 7.30)
Mujica et al 1994 (seronegative controls only) 2.10 (0.90, 4.80)
Acosta et al 2001 † 1.70 (0.90, 3.00)
Acosta et al 2001 † 1.90 (1.10, 3.20)
Fredrick T et al 2015 † 35.00 (4.00, 269.00)
DuBois et al 2006 † 1.90 (0.90, 3.90)
Sasaki, S 2008 † 2.23 (1.01, 4.94)
Reller et al 2001 † 5.00 (1.30, 25.40)
Ries et al 1992 † 6.20 (1.80, 20.80)
Koo D et al 1996 † 2.70 (0.90, 8.20)
Ries et al 1992 † 3.90 (1.70, 8.90)
Cummings et al 2012 * 3.86 (1.63, 9.14)
Overall (I-squared = 47.9%, p = 0.001) 3.47 (2.76, 4.35)
NOTE: Weights are from random effects analysis
.001
1
50

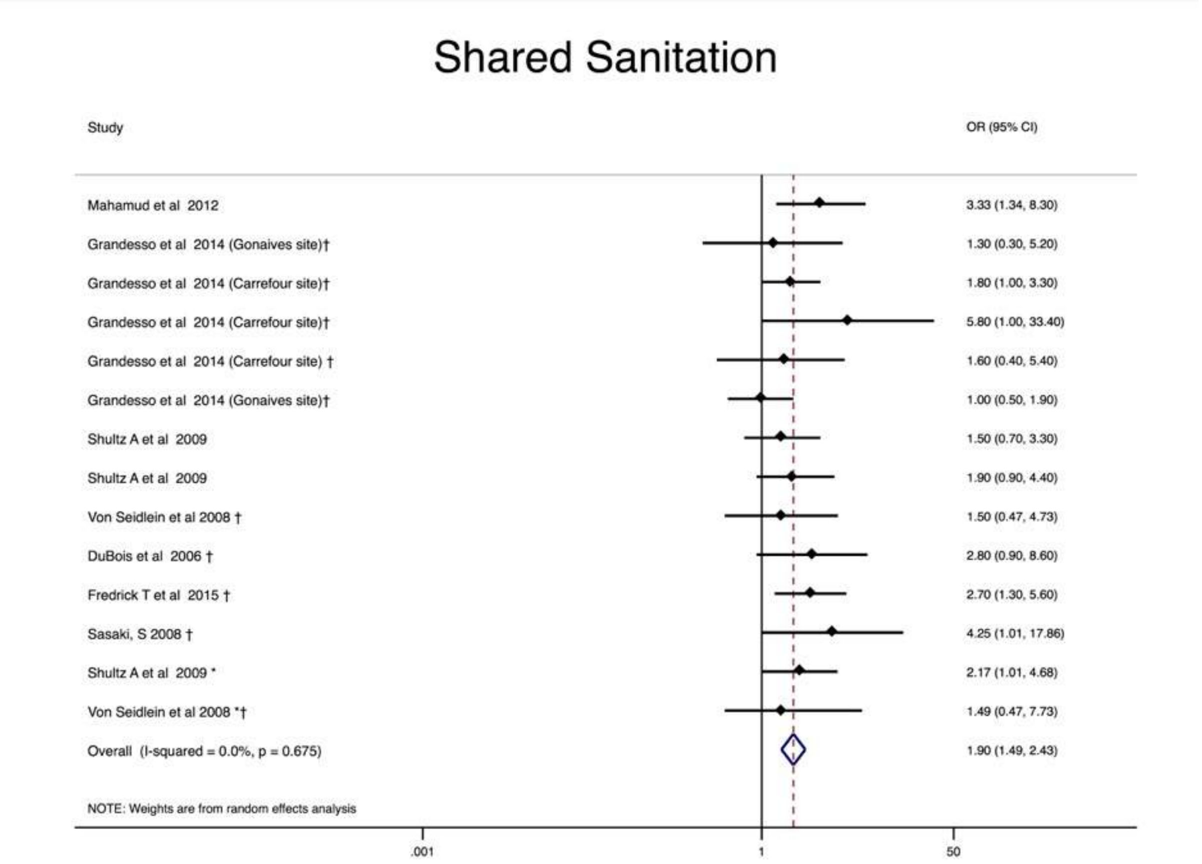

Safe Storage and Transport
Study
OR (95% CI)
Beatty et al 2004 † 0.72 (0.32, 1.67)
Beatty et al 2004 † 1.70 (0.62, 5.37)
Beatty et al 2004 † 0.36 (0.14, 0.83)
Beatty et al 2004 † 0.76 (0.32, 1.83)
Beatty et al 2004 † 0.26 (0.11, 0.61)
Beatty et al 2004 † 0.41 (0.13, 1.20)
Beatty et al 2004 † 0.24 (0.09, 0.58)
Beatty et al 2004 † 0.22 (0.04, 0.88)
Beatty et al 2004 † 0.42 (0.17, 1.03)
Beatty et al 2004 † 0.48 (0.16, 1.37)
Beatty et al 2004 † 0.79 (0.28, 2.34)
Quick et al 1995 † 0.20 (0.00, 1.20)
Kirk MD et al 2005 † 0.20 (0.00, 0.80)
Bhunia Rama and Ghosh Sougata 2011 † 0.01 (0.00, 0.07)
Kirk MD et al 2005 † 0.10 (0.00, 0.90)
O'Connor et al 2011 *† 0.60 (0.20, 2.00)
Shultz A et al 2009 0.60 (0.30, 1.00)
Shultz A et al 2009 2.80 (0.60, 14.40)
Swerdlow et al 1997 Study A 0.60 (0.20, 1.50)
Reller et al 2001 † 3.30 (0.60, 15.00)
Shultz A et al 2009 * 0.49 (0.25, 0.96)
Birmingham et al 1997 *† 3.20 (1.10, 9.90)
Overall (I-squared = 56.8%, p = 0.001) 0.55 (0.39, 0.80)
NOTE: Weights are from random effects analysis
.001
1
50

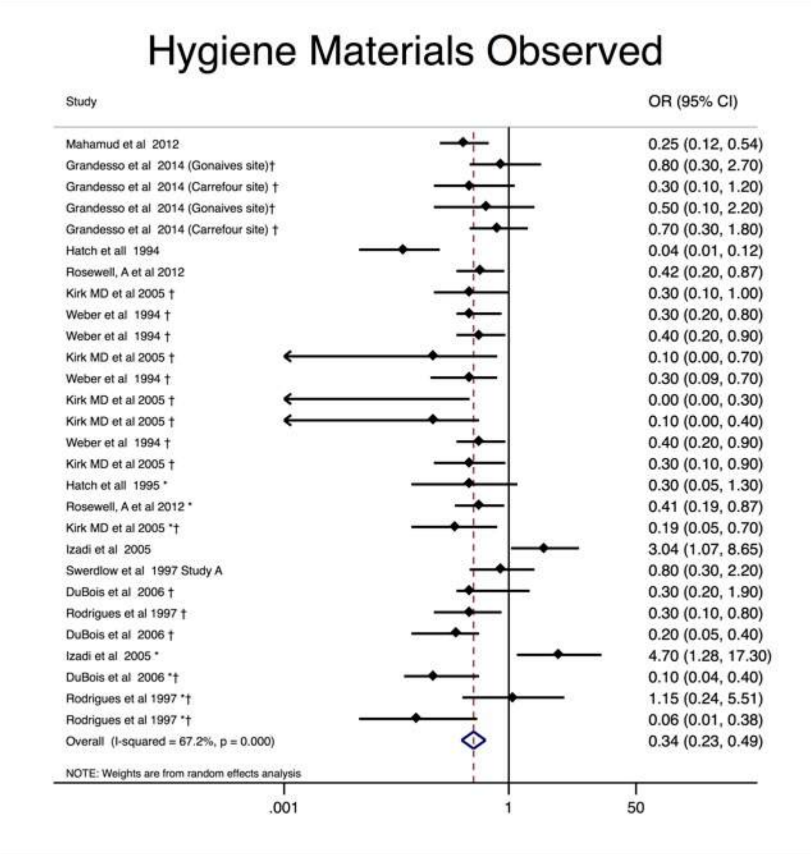

Unsafe Storage and Transport
Study
OR (95% CI)
Mahamud et al 2012 11.44 (2.85, 45.95)
Beatty et al 2004 † 0.42 (0.17, 1.02)
Mahamud et al 2012 * 4.39 (1.12, 17.14)
Mridha P et al 2011 *† 3.80 (1.20, 12.00)
Mugoya et al (Study 1) 2008 2.90 (1.20, 7.50)
Mugoya et al (Study 2) 2008 4.40 (1.70, 11.00)
Rodrigues et al 2000 † 4.40 (2.21, 8.74)
Mugoya et al (Study 2) 2008 * 3.30 (1.00, 10.00)
O'Connor et al 2011 *† 1.10 (0.40, 2.80)
O'Connor et al 2011 *† 1.30 (0.50, 4.00)
Swerdlow et al 1997 Study B 1.80 (0.60, 5.50)
Swerdlow et al 1997 Study A 6.00 (1.30, 26.80)
Swerdlow et al 1997 Study A 2.30 (0.70, 7.30)
Cummings et al 2012 3.30 (1.70, 6.70)
Shultz A et al 2009 1.80 (0.80, 3.80)
Swerdlow et al 1992 4.20 (1.20, 14.90)
Ries et al 1992 † 2.60 (1.20, 5.90)
Reller et al 2001 † 1.80 (0.70, 5.40)
Ries et al 1992 † 4.90 (1.00, 7.60)
Rodrigues et al 1997 † 3.70 (2.20, 6.30)
Rodrigues et al 1997 *† 4.73 (1.95, 11.40)
Rodrigues et al 1997 *† 2.81 (1.28, 6.19)
Overall (I-squared = 44.8%, p = 0.013) 2.79 (2.13, 3.65)
NOTE: Weights are from random effects analysis
.001
1
50

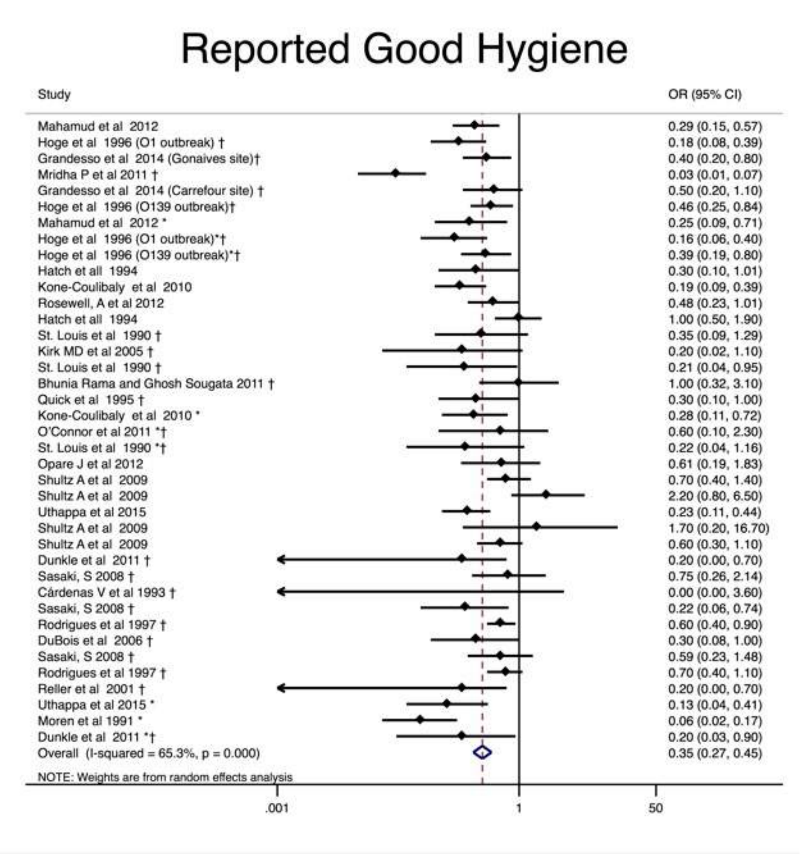

Improved Sanitation
Study
OR (95% CI)
Mahamud et al 2012 0.47 (0.25, 0.88)
Grandesso et al 2014 (Carrefour site)† 3.40 (0.40, 26.80)
Grandesso et al 2014 (Gonaives site)† 0.70 (0.20, 2.10)
Grandesso et al 2014 (Carrefour site)† 1.80 (0.90, 3.80)
Hatch et all 1994 3.60 (1.90, 7.00)
Kirk MD et al 2005 † 3.30 (1.00, 13.70)
Kirk MD et al 2005 † 0.30 (0.10, 0.80)
Kirk MD et al 2005 † 0.20 (0.00, 0.80)
Siddiqui et al 2006 (O139 outbreak)* 1.90 (0.70, 5.20)
Siddiqui et al 2006 (O1 outbreak)*† 2.50 (0.80, 8.40)
Shultz A et al 2009 0.90 (0.50, 1.60)
Fatiregun AA et al 2013 3.00 (0.18, 49.30)
Opare J et al 2012 1.11 (0.48, 2.58)
Acosta et al 2001 † 2.70 (1.40, 5.10)
Rodrigues et al 1997 † 2.60 (1.30, 5.40)
Dunkle et al 2011 † 0.50 (0.10, 1.70)
Overall (I-squared = 67.7%, p = 0.000) 1.37 (0.90, 2.10)
NOTE: Weights are from random effects analysis
.001
1
50

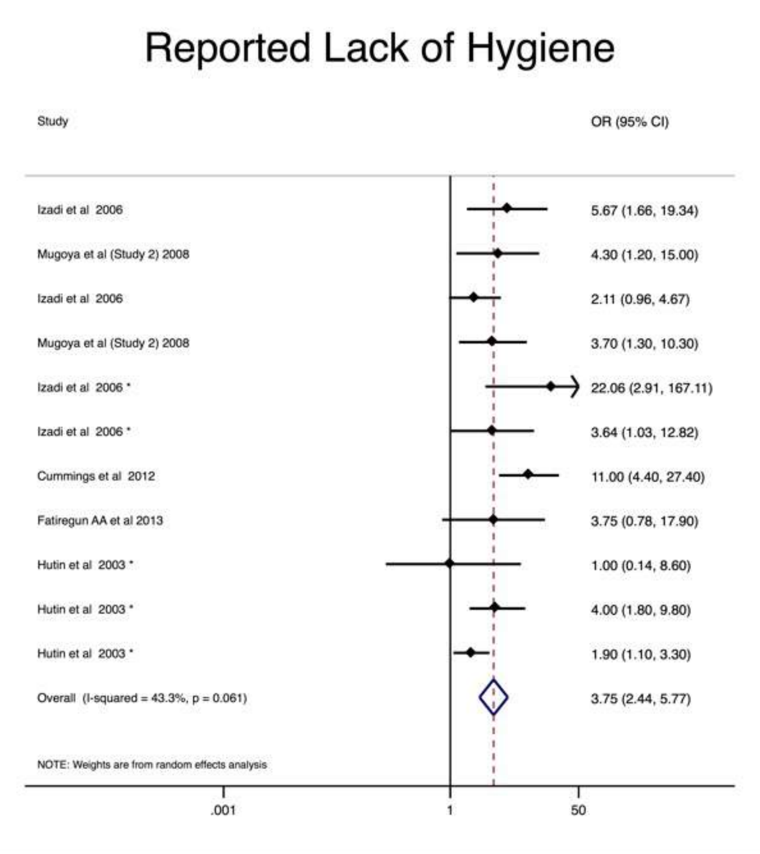

Unimproved Sanitation
Study
OR (95% CI)
Nsagha et al 2015 0.69 (0.25, 1.86)
Grandesso et al 2014 (Gonaives site)† 1.30 (0.70, 2.40)
Grandesso et al 2014 (Carrefour site)† 1.90 (0.60, 6.30)
Grandesso et al 2014 (Carrefour site)† 11.90 (1.20, 113.90)
Mugoya et al (Study 1) 2008 4.00 (1.10, 14.00)
Kirk MD et al 2005 † 10.00 (1.40, 434.00)
Izadi et al 2005 0.55 (0.10, 2.99)
Izadi et al 2005 0.56 (0.08, 4.00)
Izadi et al 2005 0.76 (0.14, 4.19)
Cummings et al 2012 4.80 (1.30, 17.50)
Rodrigues et al 1997 † 16.00 (0.50, 35.80)
Sasaki, S 2008 † 2.00 (0.70, 5.70)
Acosta et al 2001 † 11.40 (6.30, 20.50)
Overall (I-squared = 76.1%, p = 0.000) 2.46 (1.22, 4.94)
NOTE: Weights are from random effects analysis
.001
1
50


Open Defecation
Study
OR (95% CI)
Mahamud et al 2012
6.50 (1.47, 28.80)
Rosewell, A et al 2012
7.40 (2.30, 27.90)
Bhunia Rama and Ghosh Sougata 2011 †
6.30 (2.60, 15.00)
Rosewell, A et al 2012 *
4.60 (1.40, 14.90)
O'Connor et al 2011 *†
2.20 (0.70, 7.80)
Cummings et al 2012
13.50 (1.70, 106.10)
Cummings et al 2012 *
15.76 (1.54, 161.25)
Overall (I-squared = 0.0%, p = 0.654)
5.62 (3.45, 9.14)
NOTE: Weights are from random effects analysis
.001
1
50


Shared Sanitation
Study
OR (95% CI)
Mahamud et al 2012
3.33 (1.34, 8.30)
Grandesso et al 2014 (Gonaives site)†
1.30 (0.30, 5.20)
Grandesso et al 2014 (Carrefour site)†
1.80 (1.00, 3.30)
Grandesso et al 2014 (Carrefour site)†
5.80 (1.00, 33.40)
Grandesso et al 2014 (Carrefour site) †
1.60 (0.40, 5.40)
Grandesso et al 2014 (Gonaives site)†
1.00 (0.50, 1.90)
Shultz A et al 2009
1.50 (0.70, 3.30)
Shultz A et al 2009
1.90 (0.90, 4.40)
Von Seidlein et al 2008 †
1.50 (0.47, 4.73)
DuBois et al 2006 †
2.80 (0.90, 8.60)
Fredrick T et al 2015 †
2.70 (1.30, 5.60)
Sasaki, S 2008 †
4.25 (1.01, 17.86)
Shultz A et al 2009 *
2.17 (1.01, 4.68)
Von Seidlein et al 2008 *†
1.49 (0.47, 7.73)
Overall (I-squared = 0.0%, p = 0.675)
1.90 (1.49, 2.43)
NOTE: Weights are from random effects analysis
.001
1
50


Hygiene Materials Observed
Study
OR (95% CI)
Mahamud et al 2012 0.25 (0.12, 0.54)
Grandesso et al 2014 (Gonaives site)† 0.80 (0.30, 2.70)
Grandesso et al 2014 (Carrefour site) † 0.30 (0.10, 1.20)
Grandesso et al 2014 (Gonaives site)† 0.50 (0.10, 2.20)
Grandesso et al 2014 (Carrefour site) † 0.70 (0.30, 1.80)
Hatch et all 1994 0.04 (0.01, 0.12)
Rosewell, A et al 2012 0.42 (0.20, 0.87)
Kirk MD et al 2005 † 0.30 (0.10, 1.00)
Weber et al 1994 † 0.30 (0.20, 0.80)
Weber et al 1994 † 0.40 (0.20, 0.90)
Kirk MD et al 2005 † 0.10 (0.00, 0.70)
Weber et al 1994 † 0.30 (0.09, 0.70)
Kirk MD et al 2005 † 0.00 (0.00, 0.30)
Kirk MD et al 2005 † 0.10 (0.00, 0.40)
Weber et al 1994 † 0.40 (0.20, 0.90)
Kirk MD et al 2005 † 0.30 (0.10, 0.90)
Hatch et all 1995 * 0.30 (0.05, 1.30)
Rosewell, A et al 2012 * 0.41 (0.19, 0.87)
Kirk MD et al 2005 *† 0.19 (0.05, 0.70)
Izadi et al 2005 3.04 (1.07, 8.65)
Swerdlow et al 1997 Study A 0.80 (0.30, 2.20)
DuBois et al 2006 † 0.30 (0.20, 1.90)
Rodrigues et al 1997 † 0.30 (0.10, 0.80)
DuBois et al 2006 † 0.20 (0.05, 0.40)
Izadi et al 2005 * 4.70 (1.28, 17.30)
DuBois et al 2006 *† 0.10 (0.04, 0.40)
Rodrigues et al 1997 *† 1.15 (0.24, 5.51)
Rodrigues et al 1997 *† 0.06 (0.01, 0.38)
Overall (I-squared = 67.2%, p = 0.000) 0.34 (0.23, 0.49)
NOTE: Weights are from random effects analysis
.001
1
50


Reported Good Hygiene
Study
OR (95% CI)
Mahamud et al 2012 0.29 (0.15, 0.57)
Hoge et al 1996 (O1 outbreak) † 0.18 (0.08, 0.39)
Grandesso et al 2014 (Gonaives site)† 0.40 (0.20, 0.80)
Mridha P et al 2011 † 0.03 (0.01, 0.07)
Grandesso et al 2014 (Carrefour site) † 0.50 (0.20, 1.10)
Hoge et al 1996 (O139 outbreak)† 0.46 (0.25, 0.84)
Mahamud et al 2012 * 0.25 (0.09, 0.71)
Hoge et al 1996 (O1 outbreak)*† 0.16 (0.06, 0.40)
Hoge et al 1996 (O139 outbreak)*† 0.39 (0.19, 0.80)
Hatch et all 1994 0.30 (0.10, 1.01)
Kone-Coulibaly et al 2010 0.19 (0.09, 0.39)
Rosewell, A et al 2012 0.48 (0.23, 1.01)
Hatch et all 1994 1.00 (0.50, 1.90)
St. Louis et al 1990 † 0.35 (0.09, 1.29)
Kirk MD et al 2005 † 0.20 (0.02, 1.10)
St. Louis et al 1990 † 0.21 (0.04, 0.95)
Bhunia Rama and Ghosh Sougata 2011 † 1.00 (0.32, 3.10)
Quick et al 1995 † 0.30 (0.10, 1.00)
Kone-Coulibaly et al 2010 * 0.28 (0.11, 0.72)
O'Connor et al 2011 *† 0.60 (0.10, 2.30)
St. Louis et al 1990 *† 0.22 (0.04, 1.16)
Opare J et al 2012 0.61 (0.19, 1.83)
Shultz A et al 2009 0.70 (0.40, 1.40)
Shultz A et al 2009 2.20 (0.80, 6.50)
Uthappa et al 2015 0.23 (0.11, 0.44)
Shultz A et al 2009 1.70 (0.20, 16.70)
Shultz A et al 2009 0.60 (0.30, 1.10)
Dunkle et al 2011 † 0.20 (0.00, 0.70)
Sasaki, S 2008 † 0.75 (0.26, 2.14)
Cárdenas V et al 1993 † 0.00 (0.00, 3.60)
Sasaki, S 2008 † 0.22 (0.06, 0.74)
Rodrigues et al 1997 † 0.60 (0.40, 0.90)
DuBois et al 2006 † 0.30 (0.08, 1.00)
Sasaki, S 2008 † 0.59 (0.23, 1.48)
Rodrigues et al 1997 † 0.70 (0.40, 1.10)
Reller et al 2001 † 0.20 (0.00, 0.70)
Uthappa et al 2015 * 0.13 (0.04, 0.41)
Moren et al 1991 * 0.06 (0.02, 0.17)
Dunkle et al 2011 *† 0.20 (0.03, 0.90)
Overall (I-squared = 65.3%, p = 0.000) 0.35 (0.27, 0.45)
NOTE: Weights are from random effects analysis
.001
1
50


Reported Lack of Hygiene
Study
OR (95% CI)
Izadi et al 2006 5.67 (1.66, 19.34)
Mugoya et al (Study 2) 2008 4.30 (1.20, 15.00)
Izadi et al 2006 2.11 (0.96, 4.67)
Mugoya et al (Study 2) 2008 3.70 (1.30, 10.30)
Izadi et al 2006 * 22.06 (2.91, 167.11)
Izadi et al 2006 * 3.64 (1.03, 12.82)
Cummings et al 2012 11.00 (4.40, 27.40)
Fatiregun AA et al 2013 3.75 (0.78, 17.90)
Hutin et al 2003 * 1.00 (0.14, 8.60)
Hutin et al 2003 * 4.00 (1.80, 9.80)
Hutin et al 2003 * 1.90 (1.10, 3.30)
Overall (I-squared = 43.3%, p = 0.061) 3.75 (2.44, 5.77)
NOTE: Weights are from random effects analysis
.001
1
50

# Evaluating the effect of an MSF hygiene kit intervention on domestic transmission of cholera among household contacts of cholera-infected patients: a study protocol

Lauren D'Mello-Guyett[1&2], Rob D'Hondt[2], Rafael Van Den Bergh[3], Robert Dreibelbis[1], Adam Biran[1], Francesco Checchi[4], Peter Maes[2] and Oliver Cumming[1]

1 Department for Disease Control, Faculty of Infectious and Tropical Diseases, London School of Hygiene and Tropical Medicine, London, UK
2 Water and Sanitation Unit, Médecins Sans Frontières, Brussels, Belgium
3 LuxOR, Médecins Sans Frontières, Luxembourg
4 Department for Infectious Disease Epidemiology, Faculty of Epidemiology and Population Health, London School of Hygiene and Tropical Medicine, London, UK

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# Introduction

- Household contacts of cholera cases:
    - ✓100 times risk of cholera [21, 29-36]
    - ✓Hyperinfective first 7-10 days
    - ✓Human-to-human transmission
    - ✓Sharing water and food
    - ✓Care responsibilities

- WASH interventions to reduce intra-household transmission between cases and household contacts

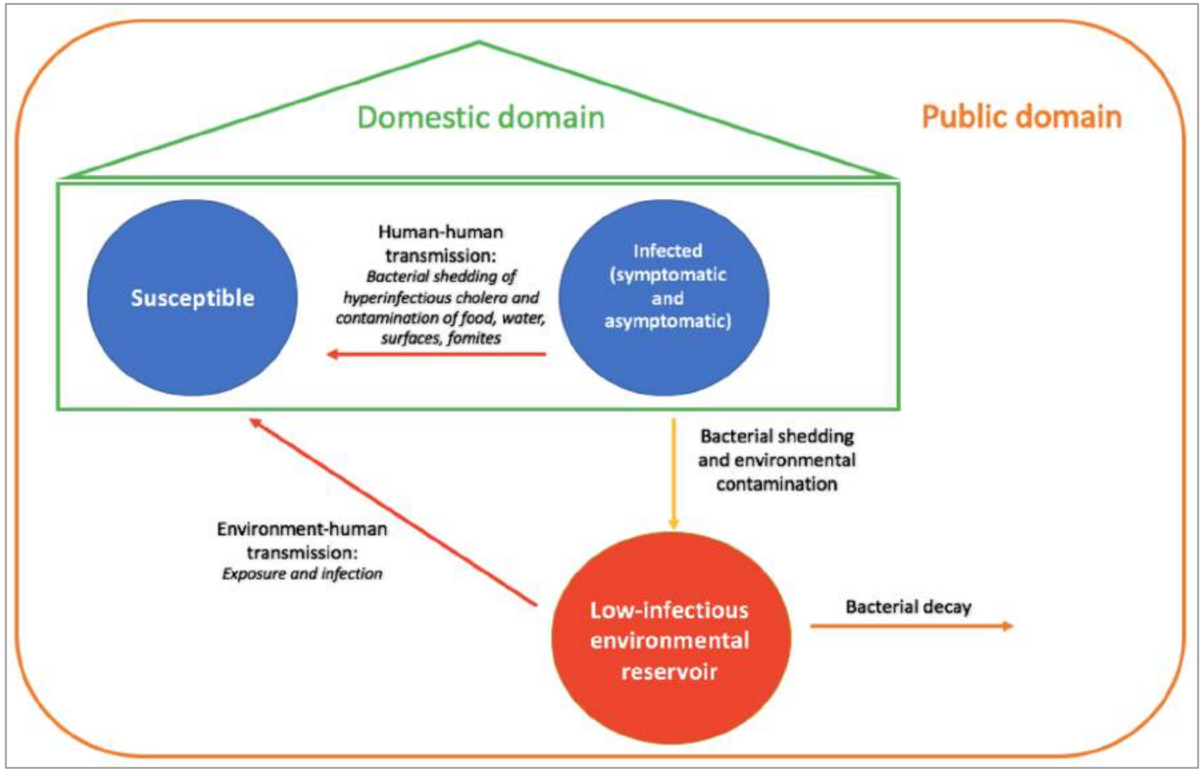


*Figure 1. Schematic for domestic and public domains of transmission. Source: Sugimoto (2014)[37].*


21. Weil et al. Am J Trop Med Hyg 2014; 91: 738-42
29. Weil et al. Clin Inf Dis 2009; 49: 1473-9
30. George et al. Emerg Inf Dis 2016; 22: 233-41
31. Hughes et al. Bull WHO 1982; 38: 395-404
32. Mosely et al. Bull WHO 1968; 38:335-46
33. Glass et al. Am J Epidemiol 1982; 116: 959-70
34. Spira et al. Bull WHO 1985; 58: 731-40
35. Dizon et al. Bull WHO 1967; 37: 737-43
36. Burrowes et al. Am J Trop Med Hyg 2017
37. Sugimoto et al. PloS NTD 2014; 8

# Introduction

Distribution of hygiene kits to household contacts of admitted cholera patients **from the point of care at the CTC**

- Fast
- Activity by default that is context independent
- WASH included from the start of the response
- Allows for 7-day vaccine immunoprotection
- Improve health seeking behaviour
- Improve quality of care by reduction of inflow

Reduce domestic transmission of cholera through improved hygiene practices and water quality[38]

*38. George et al (2016) Emerg Inf Dis*

# MSF's WASH Cholera Prevention and Control: A five tiered strategy

1. **Health Care Facilities**: WASH for Infection Prevention and Control (IPC)
2. **Domestic settings of household contacts**: Cholera prevention and control to reduce intra-household transmission
3. **Ring Strategy:** WASH to reduce inter-household transmission
4. Context specific quick-win WASH activities for timely control of high risk transmission routes in **high risk groups and high risk places**
5. **Recurrent outbreaks in endemic settings**: WASH for cholera prevention and control in endemic settings with recurrent outbreaks

# Methodology

**Study design**: Prospective cohort study

**Study population**: Choléra cases + all of their respective household contacts

**Sample size**: 250 Choléra cases + all of their respective household contacts (approximately 1325 personnes)

**Study location:** Democratic Republic of Congo

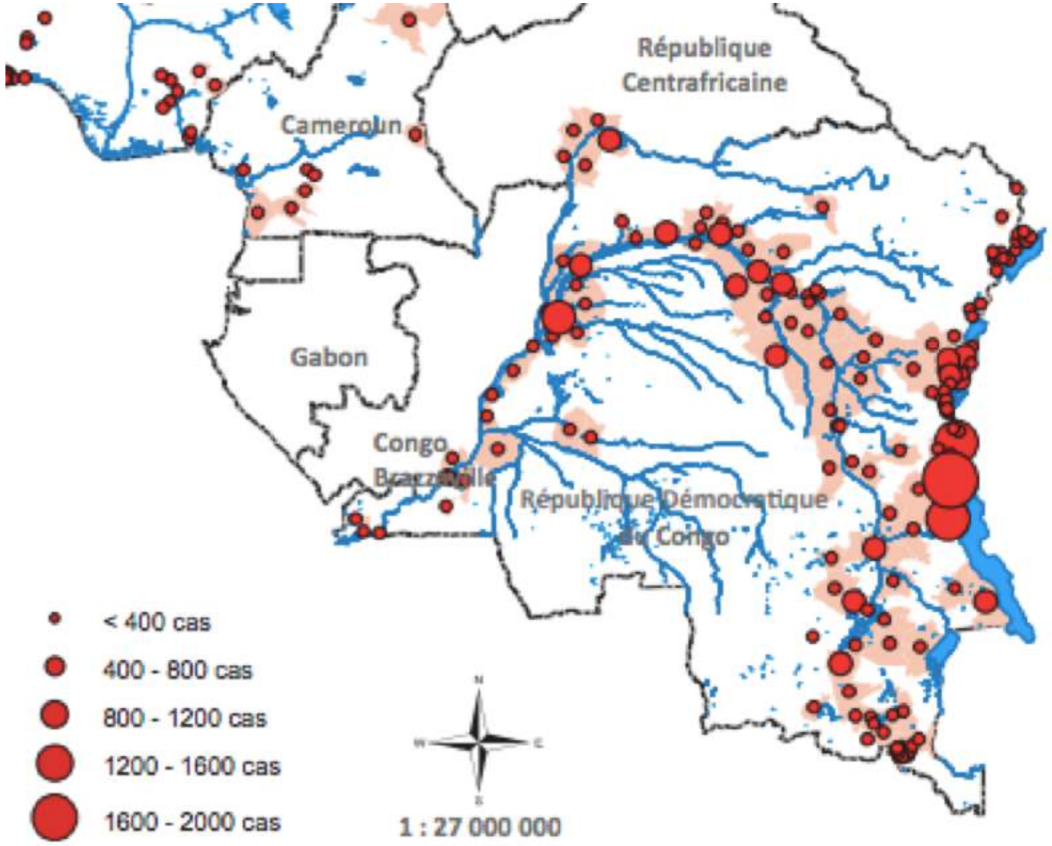


*Figure 2: Cholera hotpsots in West and Central Africa 2016. Source: UNICEF www.platformecholera.info*

# MSF Hygiene kit

**Intervention de l'étude:** le kit d'hygiène (savon 250g par personne, traitement de l'eau pendant 2 mois, seau avec robinet, 20l jerrycan)


# Data collection

**Day 0 (enrolment):**

- Enrolment of cholera cases at the MSF CTC
- Case ascertainment through RDT
- Distribution of the hygiene kit to case and accompanying contact

**Day 0-2 (enrolment of household contacts):**

- Enrolment of accompanying contacts at the CTC
- Visit to and enrolment of household contacts at the household
- Interview (SES, WASH, cholera symptoms/disease)
- Environmental samples (stored water, source water, food)

Day 0 | Day 0-2 | Day 7 | Day 21

# Data collection

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**Day 7*:**

- Assessment of hygiene kit use
- Environmental samples (stored water, source water and food)
- Reported symptoms of cholera and/or confirmed secondary cases

**Day 21**:**

- Assessment of hygiene kit use
- Reported symptoms of cholera and/or confirmed secondary cases
- Qualitative interviews of kit use (barriers, facilitators, maintained use) and overall reception of CTC-based delivery

Day 0 | Day 0-2 | Day 7 | Day 21

# Outcomes and Analysis

**Primary endpoints:**

- Incidence of cholera in household contacts

**Intermediary endpoints:**

- *Vibrio cholerae* presence in water and food

**Analysis:**

Assumption that the risk of cholera infection between case and contacts is 20% and kit use will reduce risk by 50% (0.5 relative risk). Analyses with:

- Student t-tests at $p<0.05$
- Multivariate regression models
- Generalising Estimating Equations (GEE) and Hierarchical Models

# Challenges experienced

- Financial resources
  - Estimated costs for study >USD$100,000
- Human resources
  - 17 PAX Team (Coordinators, data collectors, laboratory technician, drivers)
- Ethical approval
  - Issues with national and international ERB
- Unpredictability of outbreaks
  - Not possible in high risk/security areas
  - Requires matching to a WASH response
  - Outbreak is a size to allow for adequate sample size (>0.5 attack rate)
  - Team trained and ready in place

Thank you

lauren.dmello-guyett@lshtm.ac.uk

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# Motivators and Barriers to Handwashing Behavior during Humanitarian Emergencies

Lauren S. Blum[1], Anicet Yemweni[2], Victoria Trinies[1], Mimi Kambere[3], Foyeke Tolani[4], Marion O'Reilly[4], Jelena V. Allen[1], Thomas Handzel[5], Susan Cookson[5], Pavani K. Ram[6]

*[1]Consultant, University at Buffalo, Buffalo, NY, United States; [2]University of Kinshasa, Kinshasa, Democratic Republic of Congo; [3]OXFAM, Goma, Democratic Republic of Congo; [4]OXFAM, Oxford, United Kingdom; [5]Centers for Disease Prevention and Control, Atlanta, GA, United States; [6]University at Buffalo, Buffalo, NY, United States*

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CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

University at Buffalo
The State University of New York

# Background

Diarrhea and acute respiratory infections (ARI) account for 30% of deaths among children displaced during humanitarian emergencies

Promotion of handwashing with soap reduces ARI by 16-21% and diarrhea by 23-47%

In non-emergency context, socially- and emotionally-driven factors motivate handwashing

Limited understanding of motivators and barriers to handwashing in emergency settings

# Promoting handwashing in humanitarian emergencies

Key informant interviews with 12 global water, sanitation and hygiene (WASH) experts working on technical or behavioral issues in humanitarian emergencies (2013)

# Complexities of humanitarian emergencies

Different phases

- Acute (chaotic, traumatized, basic needs)
- Post-acute (social structures, cash economy)

Varying socioeconomic, cultural, religious, linguistic backgrounds

Variability in handwashing pre-emergency

- Knowledge and practices
- Exposure to messages and strategies
- Social norms

Often located in remote locations

Continually evolving

http://www.fao.org/emergencies/appeals/detail/en/c/149392

http://www.msf.org.au/resources/special-features/dadaab-refugee-camp.html

# Global behavior change strategies

Household visits

- Health-related messages
- Appropriate handwashing

Target women

Materials used by WASH community

- Not tested or adapted for local context
- Limited understanding of use and acceptability
- Wealth of communication aides not shared

Same messages used for several years

Minimal baseline or formative research

- Pre-existing behaviors and attitudes
- Variability in population
- Even when research conducted, not clear how data results are analyzed or used

# Challenges to behavior change communication

- Target objectives, audiences and timelines not defined
- Lack of expertise at all levels
- Emphasis on technical aspects, not on behavior change
- Lack of understanding of psychosocial motivators and barriers for handwashing
- Communication strategy based on anecdote & convenience, not evidence

Failure to adapt strategies to unique and evolving camp setting

# Investigating drivers of handwashing behavior in an emergency context

Qualitative data collection in a camp for internally displaced people in Rubaya, North Kivu Province, Democratic Republic of Congo (DRC), June to August, 2015

# Research methods

Key informant interviews

- NGO staff working in WASH (N=4)
- Camp hygiene committee members (N=2)
- Hygiene promoters (N=3)

In-depth interviews and rating exercises

- Mothers of children under five years old (N=18)

Group discussions

- Female caregivers of young children (N=1)
- Male household heads (N=1)
- Residents overseeing hygiene promotion activities (N=1)

# Rubaya camp context

Established between 2012 and 2013

Densely populated, comprised of 6360 residents previously engaged in war

Poor, diverse ethnic and linguistic backgrounds

Limited exposure to handwashing messages prior to coming to camp

Few inhabitants received food; work outside camp sought daily

Periodic diarrhea outbreaks

Soap highly valued as cleansing agent for handwashing

# WASH conditions in DRC camp

| Recall of Conditions at Start (2012-13) | Reported Conditions During Study (2015) |
|---|---|
| • Water systems and latrines set up | • Receiving 5 liters of water daily, many latrines non-functional |
| • WASH committee trained, hygiene promoters oriented | • Not receiving training or materials |
| • Water dispensing taps and soapy water set up next to latrines | • Handwashing stations in disrepair or non-existent; soapy water replaced by ash |
| • Hardware distributed to households | • Household hardware not useable, stolen |
| • Standard health-related messages, no communication aides used | • Awareness raising sporadic, always using same messages |
| • Hygiene rules with fines instituted | • Fines for not following camp rules |

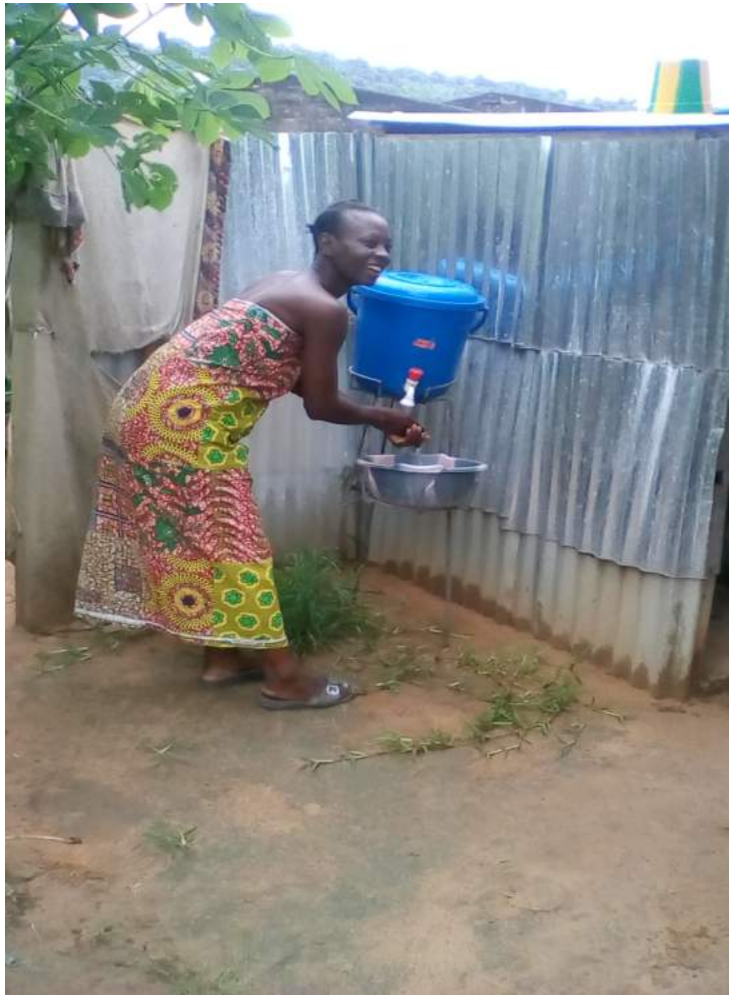
# Motivators to handwashing with soap

## Health-related

- Remove dirty substances
- Prevent illness transmission, particularly diarrhea
- Protect against uncleanliness in congested camp

## Emotional- and social-

- Enable hands to
    - smell good
    - feel light, smooth, and soft
    - look clean and pretty
- Feel good, confident, proud when hands are free of dirt
- Enhance image, set example to others
- Respond to social pressure



*When you use soap you smell good, the hands are smooth, and when you are with others, you feel you smell good and are not concerned about emitting a bad odor.* (In-depth interview mother-respondent)

*We feel happy, this is the sentiment you feel washing the hands (with soap) after using the latrine, the feeling of joy and pride. It gives us a peace of mind and we do not feel guilty, you will not have any concern about infecting someone else when shaking their hand on the road.* (Male group discussion participant)

*The instructions we receive (*in the camp*) do not permit us to eat without washing our hands, which we follow out of fear that the community is going to condemn or make fun of us.* (Male group discussion participant)

# Barriers to handwashing

- Handwashing hardware damaged, unavailable
- Ash not known as cleanser, culturally unacceptable
- More pressing issues
- People working outside camp
  - Limited exposure to messages
  - Lack access to materials
- Hygiene approaches oppose belief systems
- Time and budgetary constraints

*Now it is ash, since the departure of X (previous NGO), we do not have soap available. Maybe it is for this reason that many people are no longer interested in washing their hands each time (they use the latrine). Lack of soap discourages people from washing their hands.* (In-depth interview mother-respondent)

*I lose my mind when my children don't eat at night and I don't know how we will eat. I start wondering how the children will survive; it isn't possible to think about handwashing….people cannot think clearly when they don't have anything to eat.* (In-depth interview mother-respondent)

# Conclusion

- Limitations raised by global experts confirmed in DRC camp setting
  - Failure to develop evidence-based, objective-oriented behavioral change strategies
  - Lack of use of functional and culturally acceptable hardware
  - Neglected to contextualize communication messages
- Illness-based messages may be more effective in camp settings where overcrowding and suboptimal WASH conditions heighten the risk of infectious disease transmission
- Failure to explore and use emotive and social motivators may present missed opportunities proven effective in development settings
- Basic survival needs take precedence, rendering hygiene practices secondary
- Need for WASH community to extend behavioral change expertise to humanitarian emergencies

# Acknowledgements


Study participants

University at Buffalo: Jessica Scates, Amanda Scates-Priesinger, Swapna Kumar

Funding support from CDC Emergency Response and Recovery Branch: Cooperative Agreement with Research Foundation of the State University of New York (5U01GH000801)


# Pre-test Findings of a New Interactive Handwashing Promotion Program – Mum's Magic Hands in Emergencies using Emotional and Health Motivators.

**Foyeke C. Tolani[1], Sonya Sagan[2] and Marion O'Reilly[1]**

1 – Oxfam, Oxford, UK; 2 – Independent consultant

Emergency Environmental Health Forum (12-13 April, 2018)

# Mums Magic Hands – a new approach to motivating handwashing practice in emergencies through storytelling

# Background

- Handwashing can reduce the risk of diarrhoeal disease by up to 50%[1]
- Emotional motivators have been used in handwashing promotion in development context but not really used in emergencies.
- Oxfam, Unilever’s Lifebuoy soap and Unilever’s Chief Sustainability Office conducted formative research with emergency affected mothers in Philippines, Pakistan and Nepal (2014)
  - to better understand what motivates mothers to wash their hands in emergencies.
- Nurture and affiliation were cross cutting motivators in the 3 research areas and these were used to develop a set of materials called “Mum’s Magic Hands” designed for  handwashing promotion in first phase emergencies.

# Mums Magic Hands – Concept and Aim

**Concept**

- Use of story telling, demonstrations (interactive activities) and nudges
- Story based on the fact that Mums' hands play a positive role in their children's lives and help nurture them, yet if not kept clean, the same hands can play a role in transmitting diseases

**Aim**

- Increase the practice of handwashing with soap and water at 2 occasions:
  – before contact with food (eating, preparing food, before feeding your child)
  – after contact with faeces (going to the toilet, cleaning your child's faeces)

# Methodology

Focus group discussions (FGD)

- Mothers/female care givers of children, men, children, community health mobilizers/hygiene promoters in Za-atari camp, Jordan (N = 18) and Bidibidi settlement, Uganda (N = 15)

Key informant interviews

- Community mobilizers/hygiene promoters, health workers in both camps

Key questions on the main tool (MMH storyboard)

- Cultural proximity, comprehension, appropriateness, appeal and persuasion

FGD with men in Za-Atari camp, Jordan

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# Some Mums Magic Hands  Activities Tested

Routine dial exercise with children in Bidibidi camp

Circle of cleanliness exercise with mothers in Bidibidi camp

Coloured powder exercise

Mum’s Magic Hands Storyboard images (Asia Version)

OXFAM

# Key findings

- Mothers in both contexts understood the story and were able to recall two key handwashing occasions slogan – 2 fingers 2 occasions.
- Most mothers found the storyboard materials attractive, **persuasive**, and could identify with the narrative.
- Some mothers felt that some of the  storyboard visuals did not accurately reflect their cultural/religious environment.
- All the complementary activities were found appropriate amongst mothers targeted in Bidibidi camp, Uganda.
- All but circle of cleanliness exercise were found to be appropriate amongst mothers targeted in Za-Atari camp, Jordan.
- Men liked the concept but felt left out of the story.

OXFAM

# Modifications to MMH (Asian version) based on Pre-test findings

**Resulted in 3 new MMH:**

1. MMH Africa (low literate)

- Visuals adapted, images in storyboard more contextual

2. MMH Global (multicultural)

- Multicultural images that speak to different groups/somewhat literate groups, features more male character in storyboard

**Both now include more activities for men (role play, competitions) and children (playing cards)**

OXFAM

# Modifications to MMH (Asian version) based on Pre-test findings

**Resulted in:**

3. MMH for rapid response (acute emergency)

- Fewer activities
- Implemented faster
- Key component: storyboards; coloured powder exercise to illustrate that visibly clean is not clean; key visuals; implementation and training guide; monitoring tools
- Key implementers – local champions
- Available on Oxfam Policy and Practice website by end of May



OXFAM

# Discussions, conclusion, recommendations and next steps

- Pre-testing the MMH materials in additional contexts proved significant in verifying its versatile possible applications in different contexts.
- Different interactive activities provide means to shift common message-based promotional methods to consultative dialogue approach with target population - resulting in more target population buy in.
- The research reinforces the need to better understand motivators and barriers around good hygiene practices in emergency contexts as health-based approaches may not be the most effective when it comes to improving practices.

OXFAM

# Discussions, conclusion, recommendations and next steps

- Oxfam is scaling up and trialing different MMH versions in different places (Ethiopia refugee camp, Nigeria IDP site, Pakistan slum area and Tanzania refugee camp).

Next steps –

- All practitioners should promote the need to understand motivators and barriers to different hygiene practices even in emergency context.
- Use materials for MMH where applicable and join Handwashing community of practice to share experience.
  - (MMH materials available on Oxfam Policy and Practice website and handwashing community of practice enquiries can be forwarded to handwashing@oxfam.org).

OXFAM

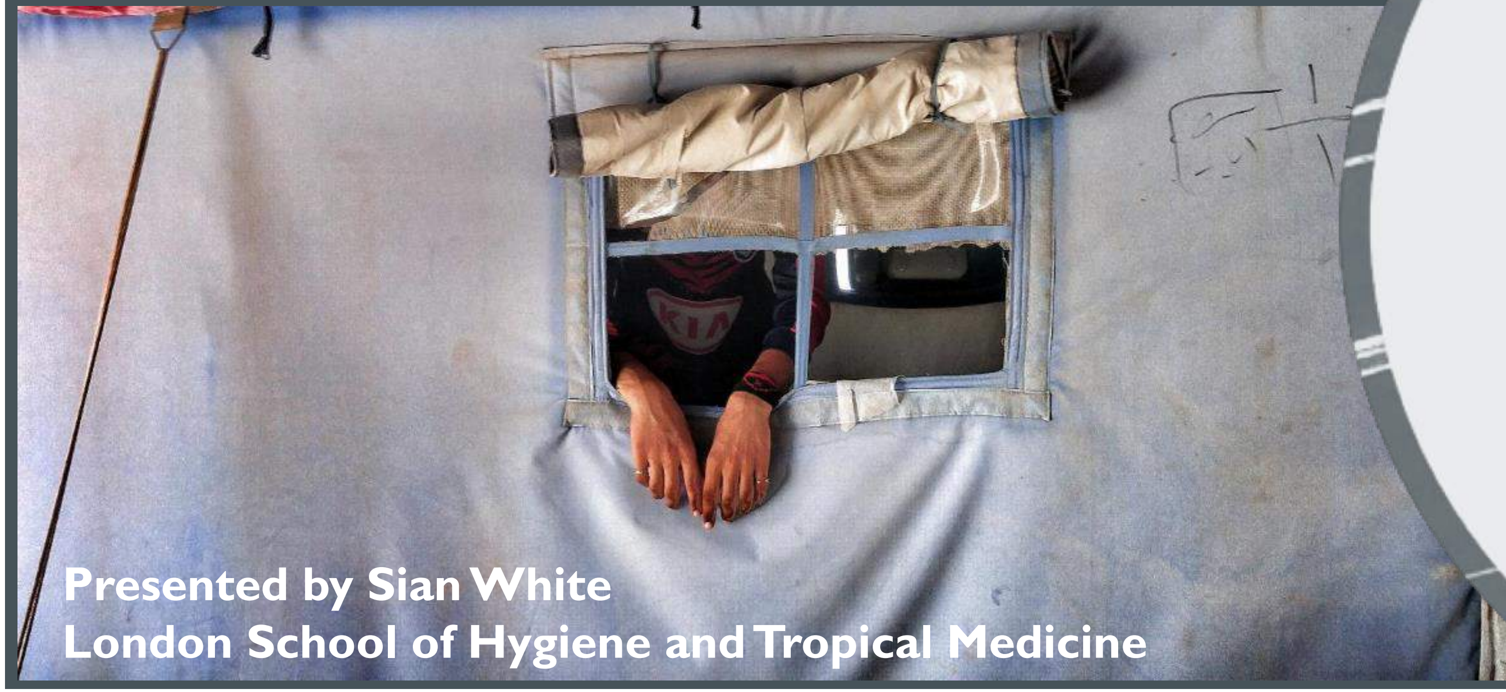
# Acknowledgements


- Claudia Codsi, Hina West and Cat Batchelor, Corporate partnerships, Oxfam
- Aarti Daryanani, Lifebuoy Global
- Arathi Unni, CMI, Lifebuoy Global
- Eric Ostern and Jonathan Gill, Chief Sustainability Office, Unilever


Wash'Em

# DO WE NEED TO DO HYGIENE PROMOTION DIFFERENTLY IN HUMANITARIAN EMERGENCIES?

## FINDINGS FROM IRAQ AND THE DRC.



Presented by Sian White
London School of Hygiene and Tropical Medicine

# HYGIENE PROMOTION IN HUMANITARIAN EMERGENCIES

- **What is done?**
  - Provision of soap, hygiene kits or handwashing facilities
  - Hygiene education – medicalised approach
- **Conclusions from systematic reviews and stakeholders:**
  - More sociological and anthropological studies
  - A better understanding of what influences handwashing behaviour
  - Tools that are more practical and rapid

*Sources: Ramesh, A. et al. (2015), Vujcic, J., et al. (2014), & Yates, T. (2017)*

*Photos: Oxfam and British Red Cross*

# WHY ARE WE STRUGGLING TO DO HYGIENE BEHAVIOUR CHANGE PROGRAMS IN EMERGENCIES?

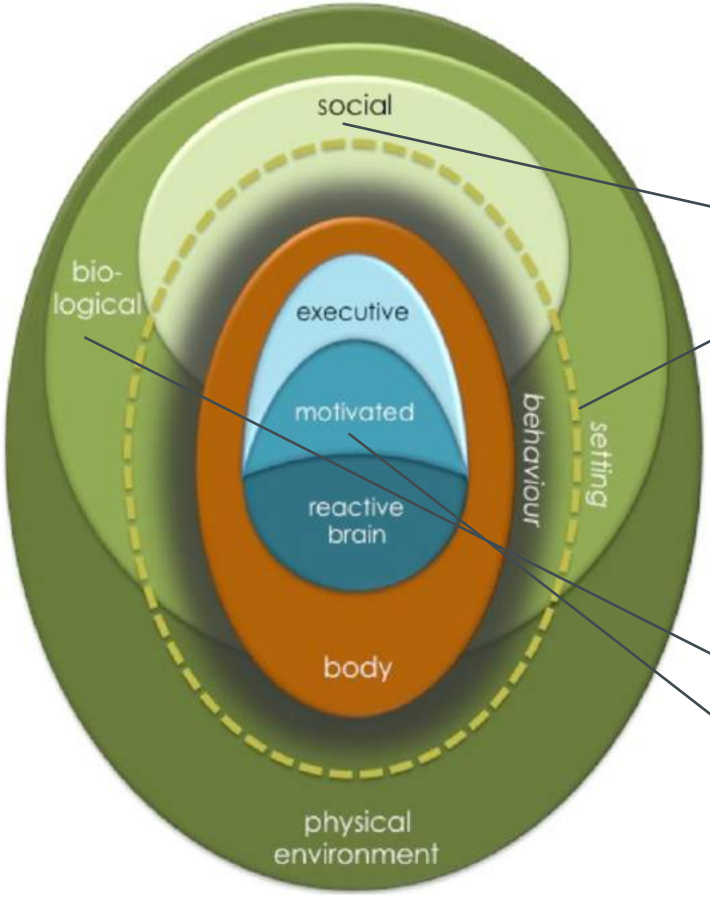
- Behaviour change guides are really long and theoretical
- Behaviour change guides are too generic and hard to adapt to suit different contexts
- The evidence we have about behaviour change remains poor and almost all of it is from non-emergency settings
- We conduct needs assessments but there is no clear process for translating data into programmatic recommendations for behaviour change.

1. **Are the determinants of hygiene in emergencies?**
2. **Can we design hygiene projects that are:**
   - Rapid
   - Effective (theory and evidence based)
   - Acceptable/do not do harm
   - Context-specific
3. **Can we do all this within the existing constraints?**

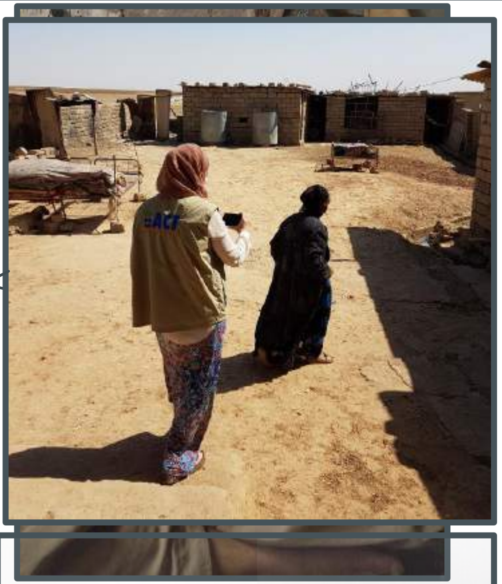
# OUR METHODS

Armed conflict: Iraq

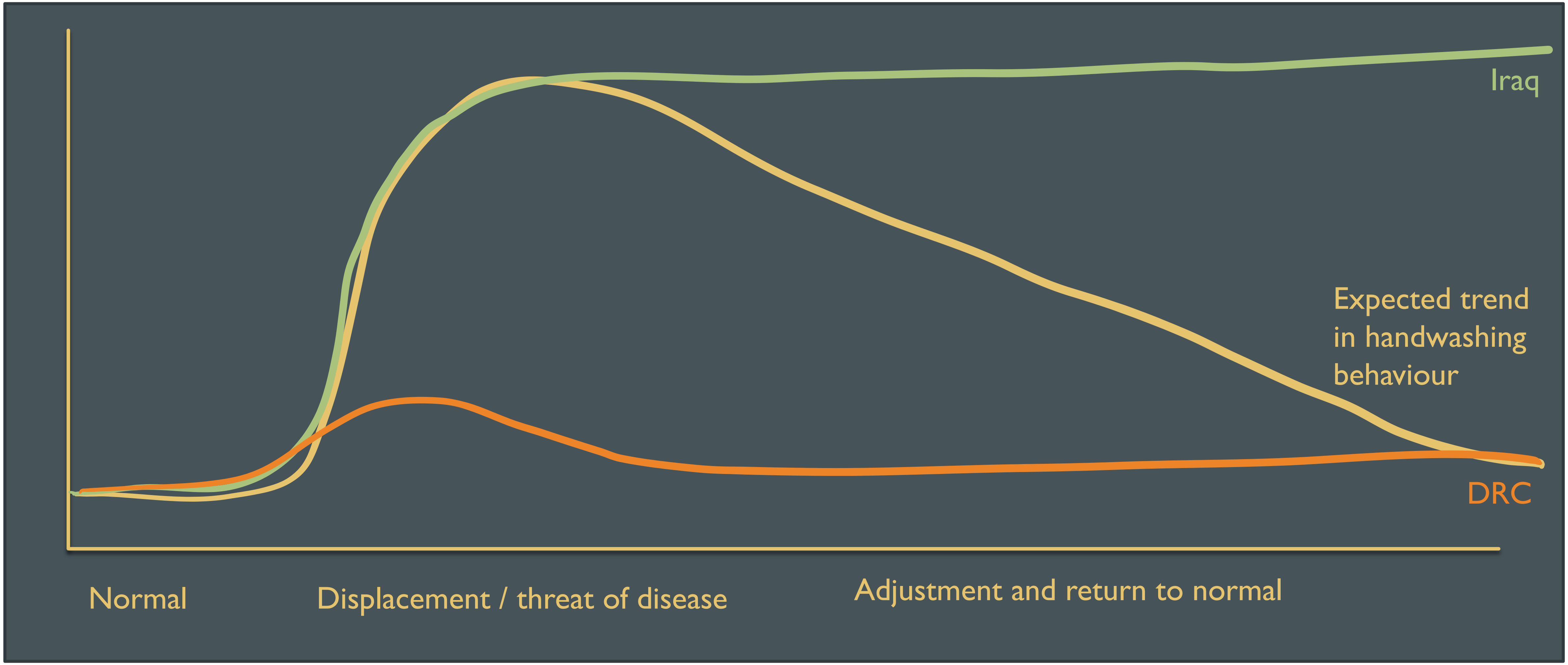
Disease outbreak: DRC




Behaviour Centred Design



# PREDICTED VS ACTUAL BEHAVIOUR



# HANDWASHING BEHAVIOUR IN IRAQ

- Hygiene behaviour suspended while people were besieged and fleeing
- Upon arrival in camps people prioritise hygiene and the establishment of prior routines
- When people return home to their communities people are complacent about hygiene

Exposure to trauma

Hot weather

Hyper-hygienic norm

Lack of agency

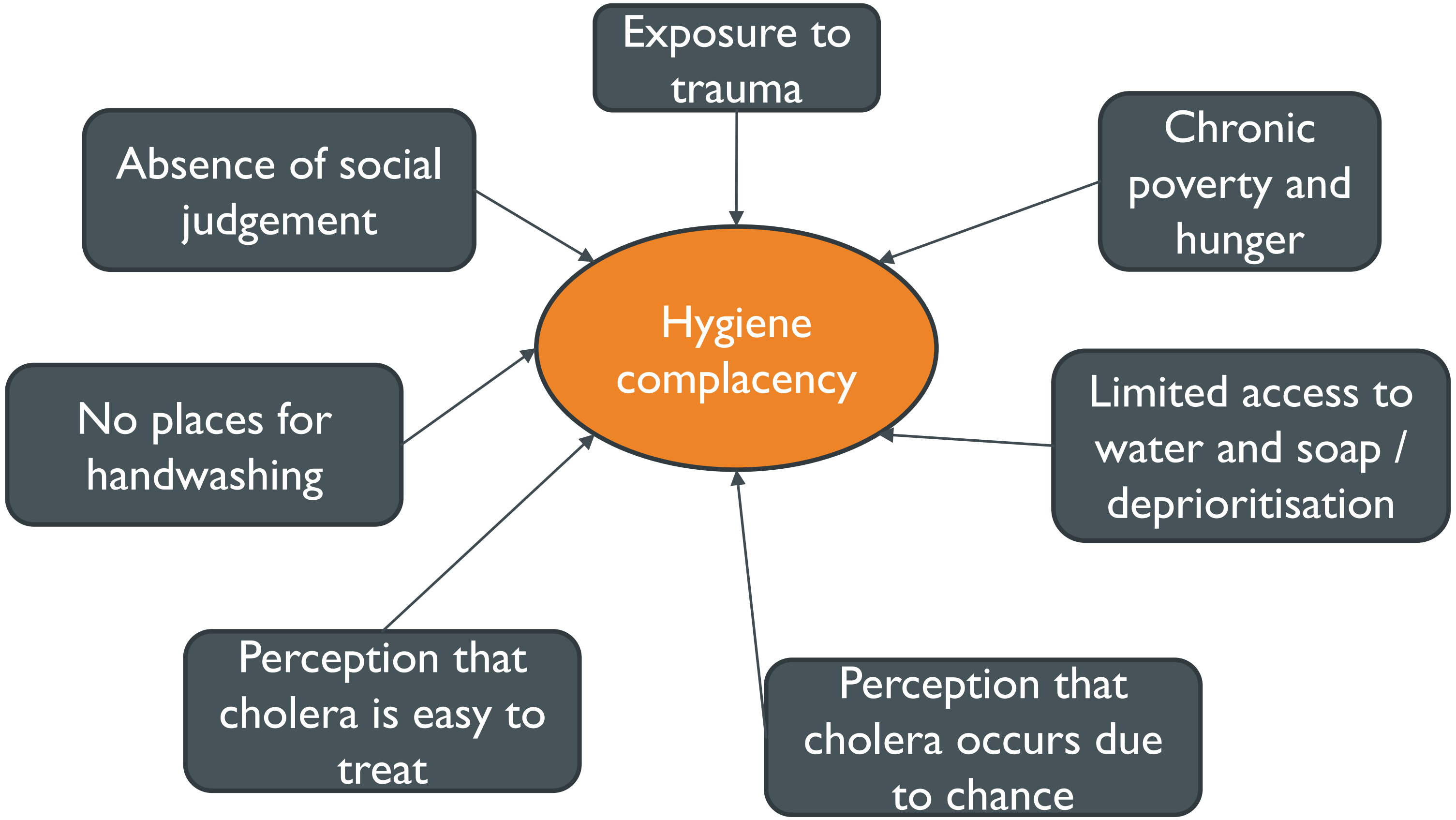
Unlimited supply of water

Nothing else to do

Reduction in standards of living

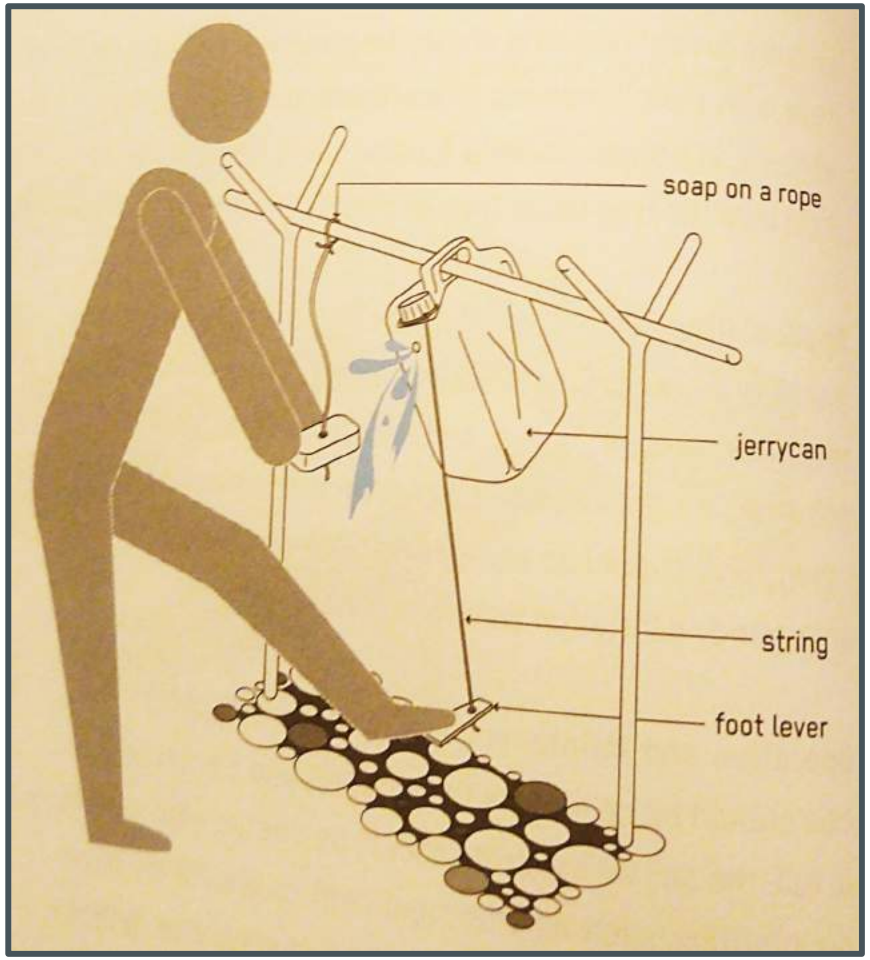
Increased perceived risk

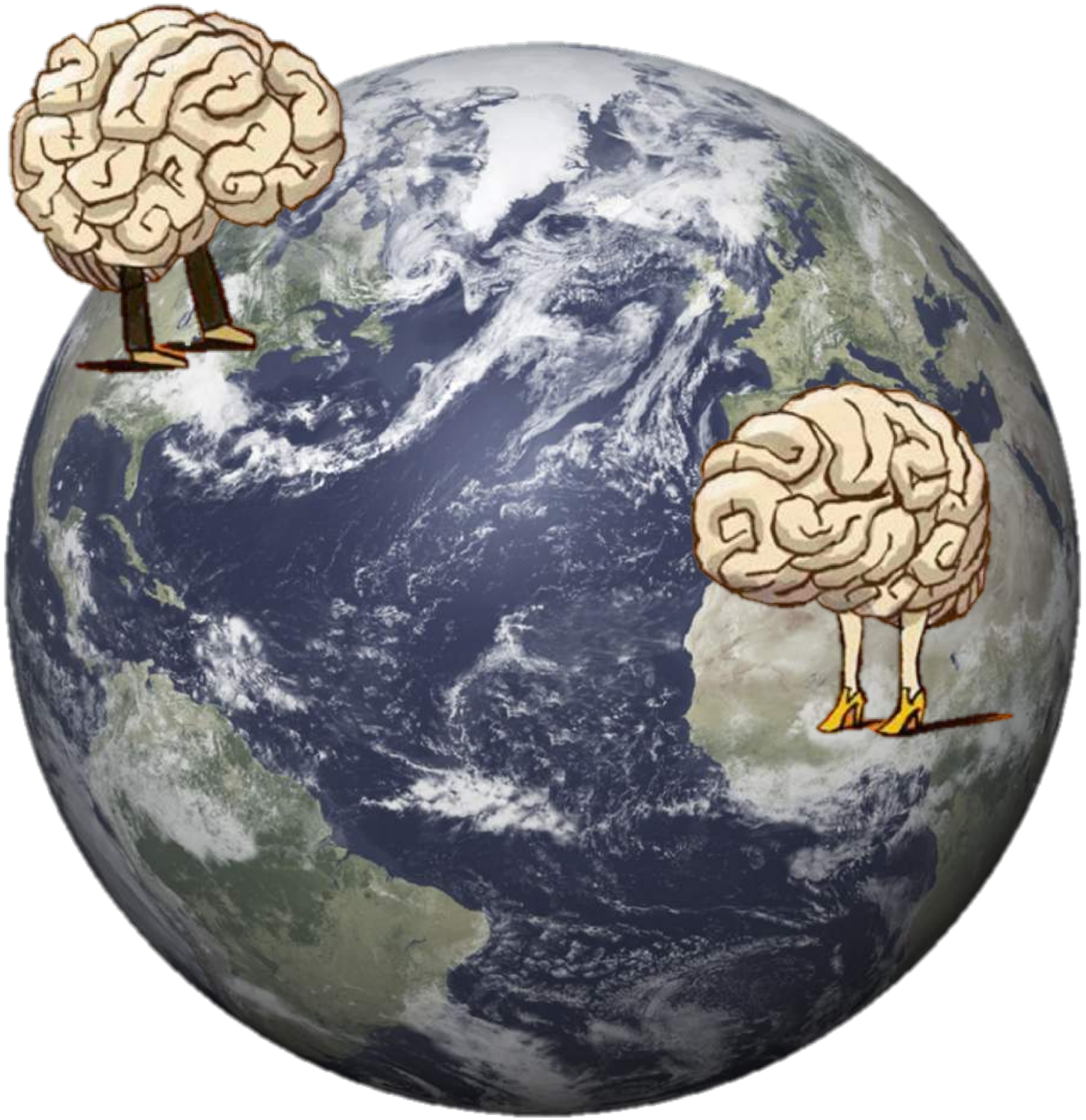
# HANDWASHING BEHAVIOUR IN DRC




# INSIGHTS COMMON TO BOTH COUNTRIES

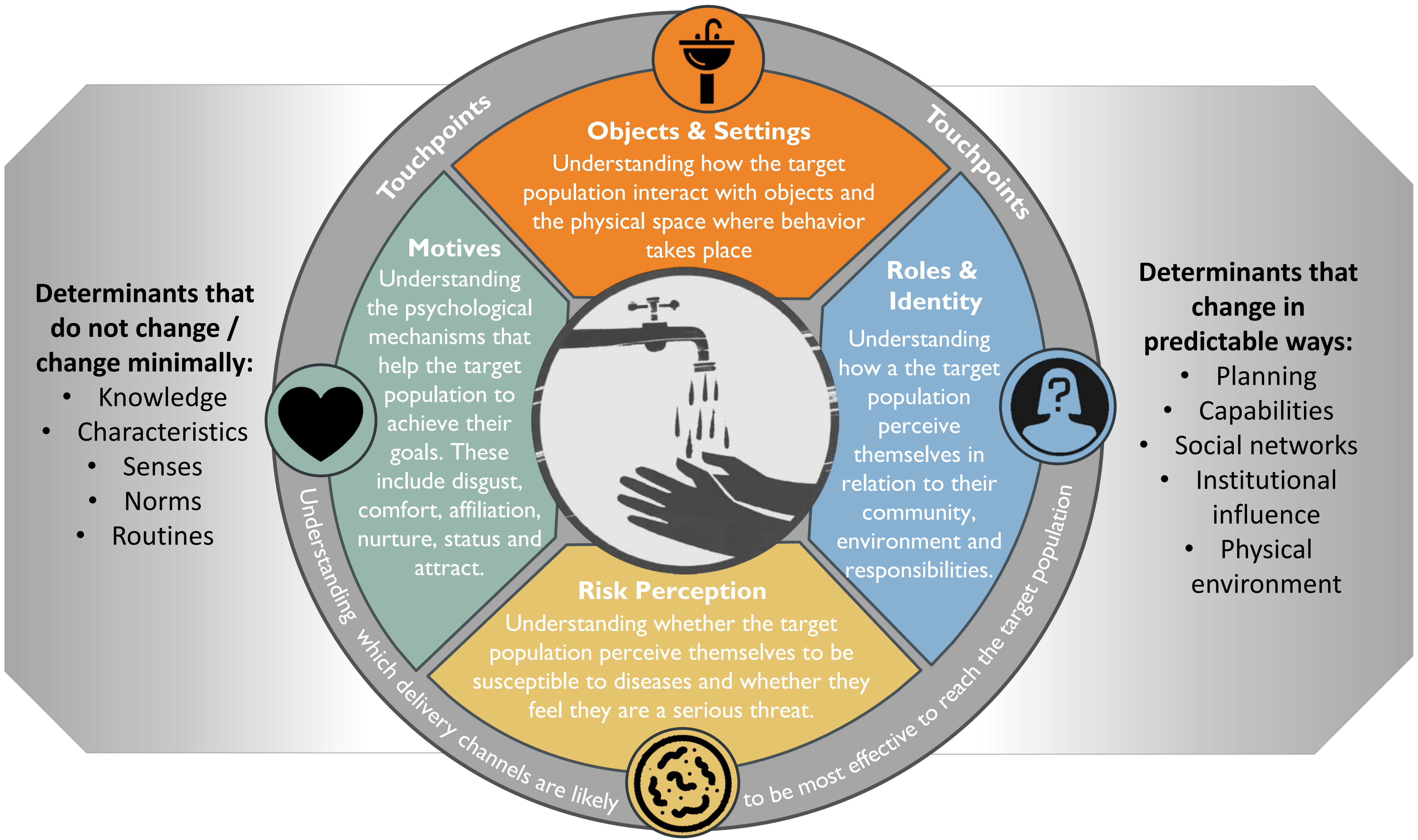
- Everyone already knows the health benefits of handwashing (99% and 98% of people could explain disease transmission)
- Design infrastructure in a way that cues handwashing and makes it more desirable. Use mirrors, soap dishes and liquid soap.
- Hygiene programs need to consider psycho-social wellbeing. If designed well could contribute positively to rebuilding people's sense of dignity, agency, and desire to participate in social life post crisis.



If we are going to design hygiene programs more rapidly we need to know what determinants of behaviour are predictable irrespective of context and which determinants vary the most.

Luckily as humans we have more in common than divides us.


Determinants that do not change / change minimally:
• Knowledge
• Characteristics
• Senses
• Norms
• Routines
Touchpoints
Objects & Settings
Understanding how the target population interact with objects and the physical space where behavior takes place
Touchpoints
Motives
Understanding the psychological mechanisms that help the target population to achieve their goals. These include disgust, comfort, affiliation, nurture, status and attract.
Roles & Identity
Understanding how a the target population perceive themselves in relation to their community, environment and responsibilities.
Risk Perception
Understanding whether the target population perceive themselves to be susceptible to diseases and whether they feel they are a serious threat.
Understanding which delivery channels are likely to be most effective to reach the target population
Determinants that change in predictable ways:
• Planning
• Capabilities
• Social networks
• Institutional influence
• Physical environment

# WHAT DOES ALL OF THIS MEAN FOR FUTURE HYGIENE PROGRAMS?



1 Learn rapid formative research methods

2 Do rapid formative research

3 Input data in WASH'Em software

4 Get context-specific and evidence-based program recommendations

**Wash'Em software is available on USB stick, on the web and offline.**

Support hub (connect with an expert)

Learn more and sign-up at **washem.info**

# The need for low cost & sustainable wastewater treatments in protracted emergencies
# A case study from Rakhine State, Myanmar

**Berlin 12-13 April 2018**
**Kris Cahyanto**

unicef for every child

# Introduction


Figure 1. Study area in four townships of Rakhine State (MIMU, 2017)

Sectarian conflicts in Rakhine State in 2012 & displacement of over 140,000 into internally displaced people (IDP) camps.

Security crisis in northern Rakhine in 2016/2017 & displacement of over 700,000 people to Bangladesh.

Over 124,026 stateless people inside 27 IDP Camps in Pauktaw, Myebon, Kyauk Taw, Kyauk Phyu, and Sittwe Townships (WC, 2017).

6188 latrines in all IDP camps in 5 townships (WC, 2017).

**WASH agencies:** DRC, Oxfam, CDN, Relief Int., Solidarites Int., SCI, ACF, MAUK, & UNICEF.

# Objectives & methods

**OBJECTIVES:**

- To review current practices on wastewater management.
- Options for low cost wastewater treatments in protracted crisis situation.

**METHODS:**

- Review and analysis of the current wastewater management practices.
    - Types of collection point,
    - Desludging & removal, transport,
    - wastewater treatment, and disposal.
- Field visits.
- Discussion with communities and WASH agencies on Desluding TWG
- Conclusion

# Wastewater management Practice (i)

Figure 2. School Latrine designs 2016

Figure 3. School Latrines 2016

Figure 3. Latrine design in 2017

Figure 4. Latrine pan, plastic pour flush (Oxfam, 2017)

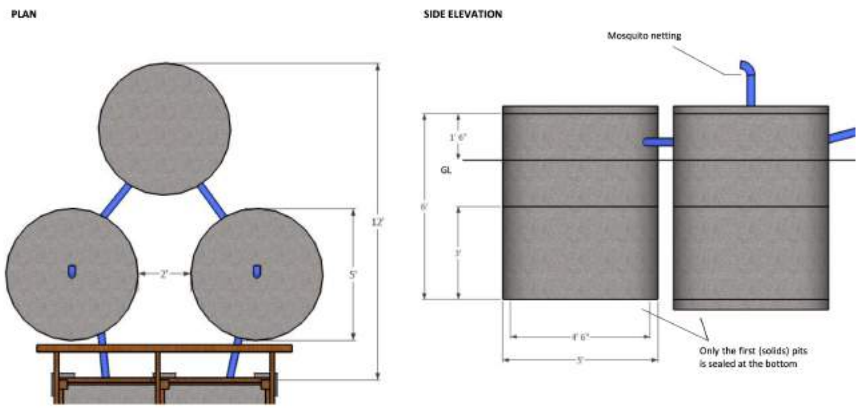



Figure 5. Latrine pit design (Knight, 2017)

# Wastewater management Practice (ii)

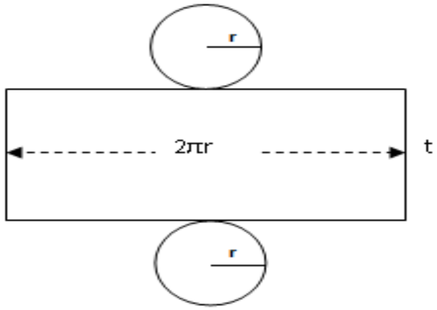
## Proposed Technical Design of concrete pit liner with used steel oil drum

### Dimensions

Material: Carbon steel
Diameter: 22.5 inches; equal to 57,15 cm
High: 32.8 inches, equal to 82,55 m
Wight: 60 lbs

### Formula

Material: Carbon steel
Wight: 40 lbs
r: 11,25 inches
equal to: 28,57 inches
Length: 70,65 inches,
equal to 179,5 cm
High: 30 inches,
equal to 82,55 m

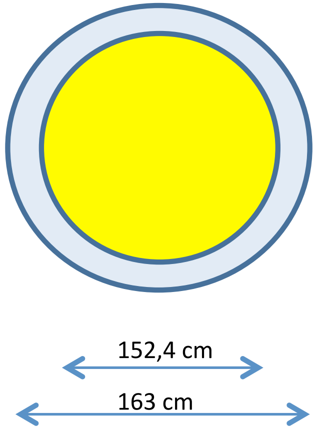


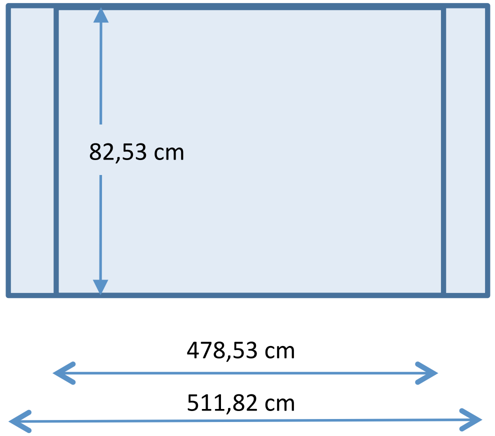

### Tools

1) Hammer
2) Steel cutter
3) Grinder
4) Timber 2x4
5) Welding machine

### Concrete

1 unit of concrete pit liner consists 2 piles of concrete rings as follows:
a). Height: 165,06 cm
b). Thickness: 5 cm
c). 1st Diameter: 163 cm
d). 2nd diameter: 152,4 cm
e). Volume for 1 unit : **0.89 m3 / unit**




# Wastewater management Practice (iii)

1. Latrines
- Sittwe Township: 5678 latrines
- Kyawtaw Townships: 10 latrines
- Pauktaw Townships: 1513 latrines
- Kyauk Phyu Townships: 90 latrines
- Myebon Townships: 179 latrines

2. Latrine pits
- 3 feet diameter
- 5 feet diameter

3. Pumping into barrels (WC, 2015)

4. Transport into Sludge Treatment Systems (WC, 2015). 9 tractors are available

Direct Pumpings

5. Sludge Treatment Systems

Sludge Treatment Systems

Sludge treatment system in Sittwe Township

Sludge treatment systems in Pauktaw Township
1. ANY Camp
2. KNP Camp
3. Nget Chaung 1
4. Nget Chaung 2
5. Sit Tet Maw

Wastewater stabilisation pond Kyauktaw Township

Wastewater stabilisation pond Myebon Township

Sludge treatment system in Kyauk Phyu Township

# Wastewater management Practice (iv)

Figure 6. ABR Systems in Sin Tet Maw, Pauktaw


Figure 7. Front view of Sludge Treatment Systems in Sin Set Maw, Pauktaw (SCI, 2015)

Figure 8. Front view of Sludge Treatment Systems in Sin Tet Maw, Pauktaw

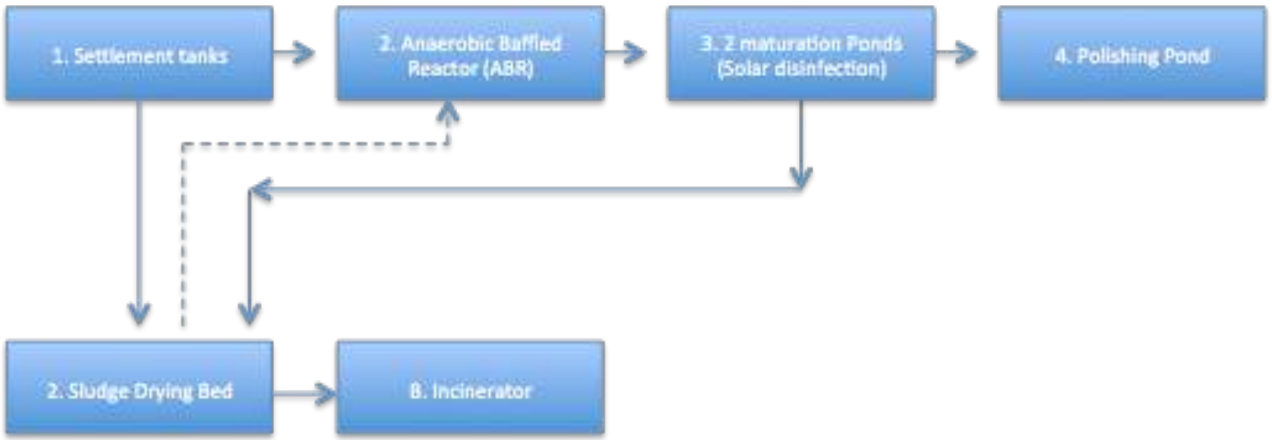



Figure 9. Sludge Treatment Plant in Sin Thet Maw, Pauktaw (SCI, 2015)

# Wastewater management Practice (v)

Figure 10. Settler and Aerobic Baffle Reactor within STS Sittwe  (Pageud, 2017)


Figure 11. Site location of STS Sittwe (Google Earth, 2018)

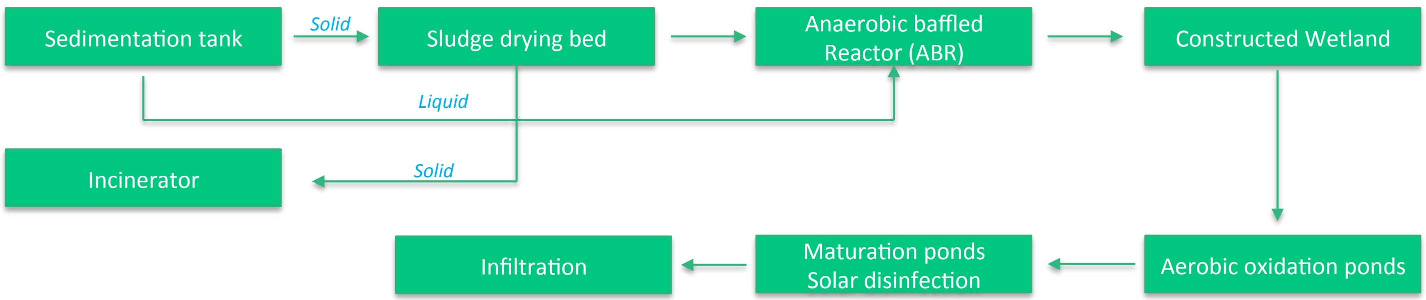
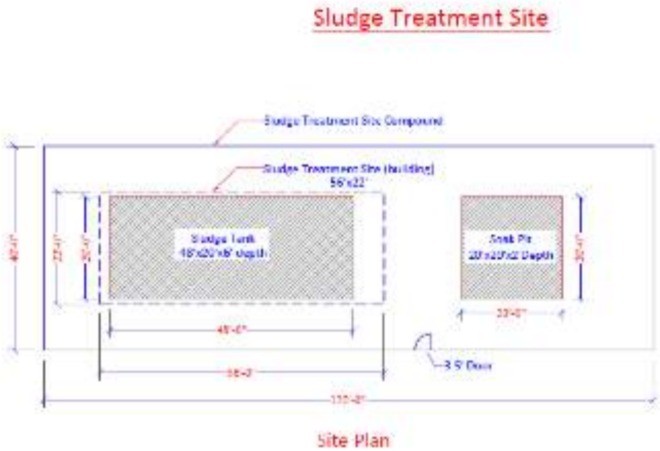
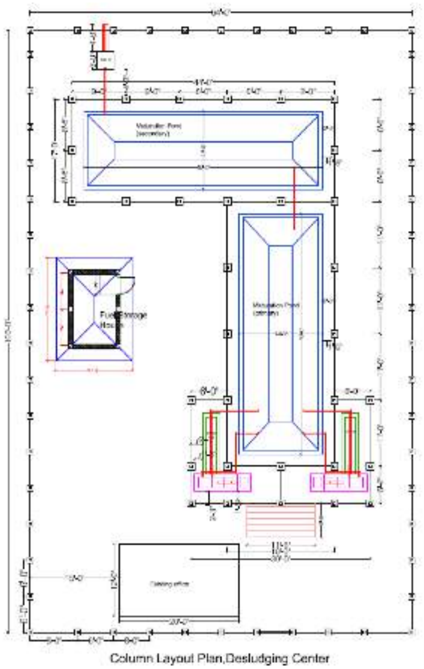



Figure 12. Sludge Treatment Plant in Sittwe
(Solidarites International, 2018)




Latrines & desludging → Sludge drying bed → Soak pit

Figure 13. Sludge drying bed & oxidation ponds in Kyauk Phyu; Site Plan; and treatment process.




Hopper-bottomed clarifier → Sludge drying bed → Maturation pond 1 → Maturation pond 2

Figure 14. Sludge treatment facilities in Kyein Ni Phin, Pauktaw; site plan; and sludge treatment process (DRC, 2018)

# Wastewater management Practice (vii)

| Description | Say Tha Mar Gyi, Sittwe. | Kyein Ni Pyin (recent) | Myebon | Nget Chaung 1 | Nget Chaung 2 | Kyauk Ta Lone | Sin Tet Maw | ANY |
|---|---|---|---|---|---|---|---|---|
| **IDP** | **110,135 IDP.** | **5865 IDP** | **1760 IDP** | **3853 IDP** | **4239 IDP** | **1500 IDP** | **3818 IDP** | **4012 IDP.** |
| Facilities | Drying bed, Constructed wetland, Maturation ponds. | Primary & Secondary maturation ponds. Hopper bottom clarifier. | 3 waste stabilisation ponds in series. | 3 waste stabilisation ponds | 2 waste stabilisation ponds | 1 oxidation pond | Settler. ABR, Maturation ponds. Settlement tank with filtration chamber. | 1 waste stabilisation ponds |
| Drying bed | Sludge drying bed | Slude Drying bed. | NA | NA | NA | Sludge Drying bed & lime stabilisation | Sludge Drying bed. | NA |
| Cover | Removable roof cover | Roof cover. | NA | Removable roof cover | Removable roof cover | Roof cover | Roof cover | NA |
| Helminth eggs | 0 | | | | | | NA | |
| BOD | Inlet: 5000 Outlet: < 500 | NA | NA | NA | NA | NA | *Expected no more than 20 mg/L | |
| COD | Inlet: 20,000 Outlet: < 500 mg/L (Maturation pond). | NA | NA | NA | NA | NA | *Between 150-1000 mg/L | NA |
| E-coli | Dry sludge after 3 months < 100 n/g. | NA | NA | NA | NA | NA | | |
| Staff | 12 | 13 | 20 | 1 | 1 | 11 | 7 | 1 |
| Capacity | 60 m3/day | 5 m3/d | 10 M3 | 10 M3 | 10 M3 | 5 M3 | 5 m3/d | 5 M3 |
| Construction cost | **350,000 - 400,000 USD** | **15,000 - 20,000 USD** | **+/- 5,000 US** | **5,000 - 7,000 USD** | **5,000 - 7,000 USD** | **5,000 - 10,000 USD** | **100,000 -200,000 USD** | **5,000 - 7,000 USD** |

# Conclusions

**Constraints and challenges**

Logistical challenges due to road access.
Limited space within the camps.
Large number of pit latrines.
Vulnerable security situation.
Geographical area & settings.
Authorisation and access to IDP camps.
Government commitment.

**Wastewater management & treatment systems**

Containment, emptying, transport, treatment & disposal.
2 *off-site* decentralised wastewater treatment systems based on (primary treatment, anaerobic, aerobic & post treatment).
4 *off-site* waste stabilisation ponds in Pauktaw (primary & aerobic).
3 stabilisation pond in Pauktaw, Kyauk Taw, and Myebon (primary).

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# Ongoing Desludging TWG

- Minimum standard and guidelines on wastewater management.
- Cost benefits analysis between *off-site* treatment compared to *on-site* treatment systems
- Replication and/or possibility for scale up:
  - Decentralised wastewater treatment systems.
  - Bio digester systems & septic tank systems.
  - Scale up of tiger worm toilet (TWT).
  - Constructed Wetlands etc.

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Thank you

# Wastewater Strategy for UNICEF-Lebanon

Improvement of wastewater services

Informal Tented Settlements,

Lebanon

Ghada Zeidan, Gert de Bruijne, Jan Spit  November 2016

# Dutch Surge Support

DSS water

## Rapid deployment of Dutch experts to water related emergency relief and ongoing disasters

- 6 standby partner agreements UNICEF, UNHCR, UNOCHA, IOM, WHO & Oxfam GB
- 25 countries visited and 52 missions since 2015
- Mostly WASH-related experts (65%) and geohydrologists (30%)

# Crisis in Lebanon

- 25% of the population in Lebanon is refugee
- 1.5 million official registered Syrian refugees (plus more 400,000 Palestinians)
- 15 % of Syrians refugees live in one of the 4300 ITSs
- Total population of ITS is around 250,000
- Average population per ITS: 60

# Environmental Impact of ITSs

- Surface and ground water pollution is a immense problem in Lebanon
- Many ITSs already existed before the refugee crisis
- Many informal settlement contribute to this: 1.5 – 2 %
- MoE sees an opportunity to address the issue by addressing the impact of ITSs

# ITSs Yamouneh and Zahleh Mualaqa 019

# ITS Zahleh 001

# Tanked water and ‘traditional’ pit

# toilets provided by INGOs

# Holding tanks: emptied by tanker when full

# Discharge into surface water or by tankers to WWTPs

# Purpose of the Assignment

1. Identify lowest cost and environmental sound solutions for the wastewater management in / from ITSs

<u>However</u>:

- *Not permanent!*
- *No concrete, pipes, pumps*

2. Classify ITSs according to their risk of polluting the ground water and recommend most effective immediate solutions

# Main findings

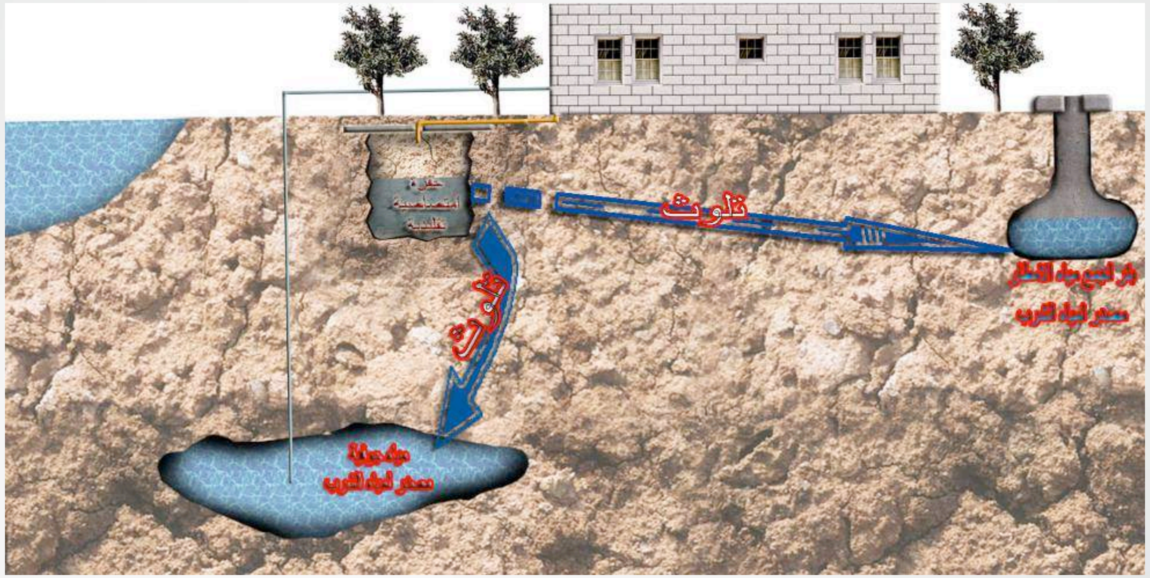
- No major epidemics have occurred in and around ITSs.
- Black water does not present an immediate problem in the ITSs. Desludging is a major financial burden and the wastewater ends up untreated in the environment.
- Hardly any WWTP in Lebanon is operational.
- Grey water and storm water are seen as a bigger issues in the ITS's. Often in combination with solid waste.
- The free aid approach of INGOs has create a dependent attitude among residents.
- Two years of savings (8 million dollars) by reducing the desludging can cover the investment of the entire program.
- The suggested technologies will produce a wastewater that meets the Lebanese effluent standards
- Lebanese communities dealing with similar WW challenge as the ITSs, can benefit from the this program for the ITSs

# Where **not** to work

**1. ITSs that are in a good condition** and need only small improvements. These camps include mainly those that are connected to a sewer network, and very isolated ITSs where the environmental capacity to absorb and treat the relatively small volume of wastewater is sufficient.

**2. ITSs that are in unsuitable locations** (such as flood prone, too close to military installations and military transport corridors), where conditions are unfit for living, improvement will be extremely difficult and expensive, and will not result in real changes.

# 'Technical' criteria prioritization




1. ***Reduce pollution:***

   Avoid open systems such open channels / open (cess)pits and leaking (septic) tanks

2. ***Reduce high operational costs:***

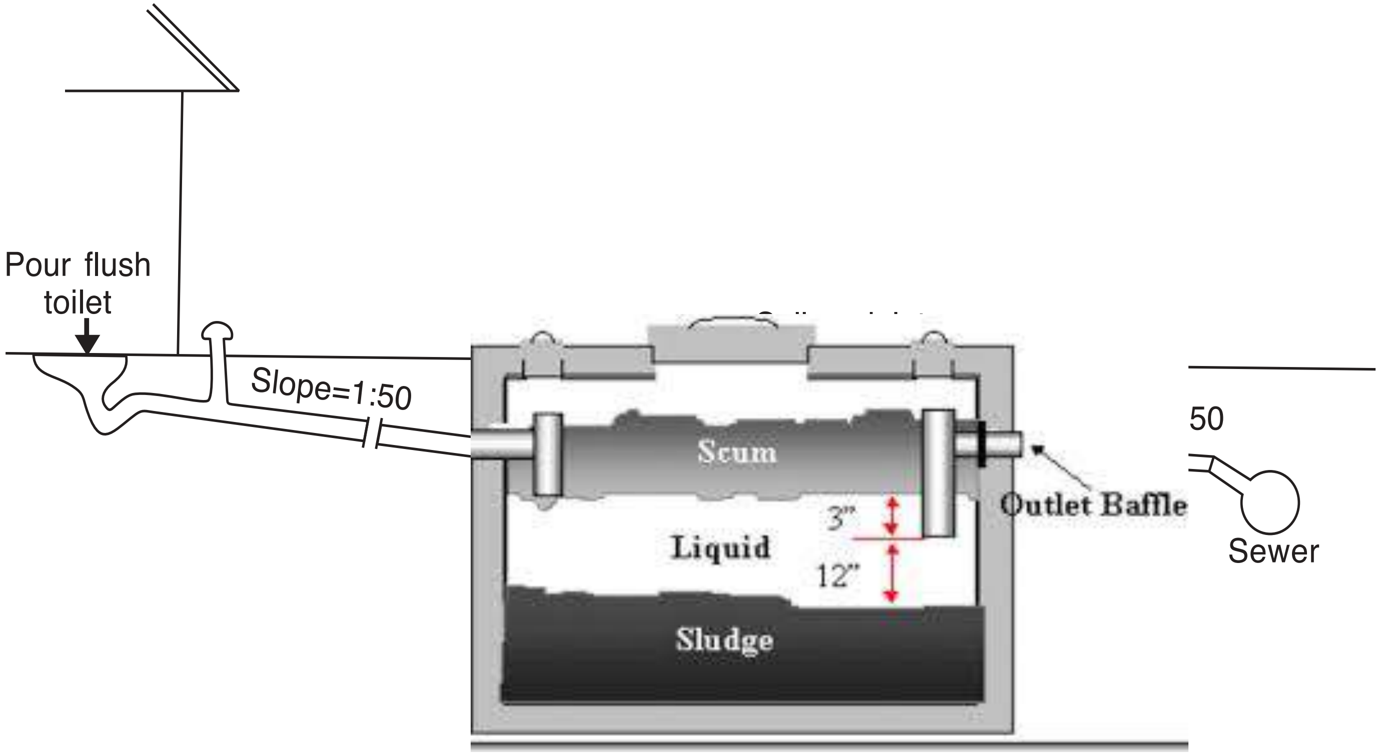
   Minimize emptying of tanks

# Basics of the Technical Strategy

- Collect, treat and dispose settled wastewater in the ITS → No transport of wastewater anymore
- In situ wastewater treatment → Reduce sludge to be transported to 25 liters per person per year

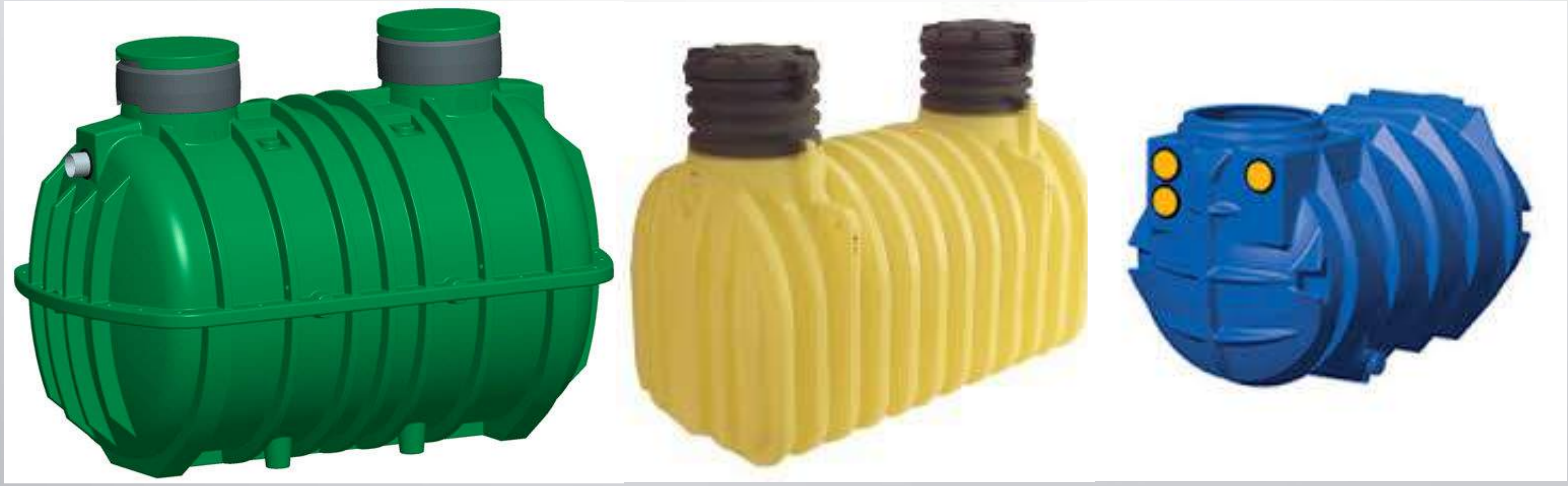
# minimal adjustments, low cost, no-low energy demand, natural systems and eventually prefab

# Solids Free Plastic Sewers

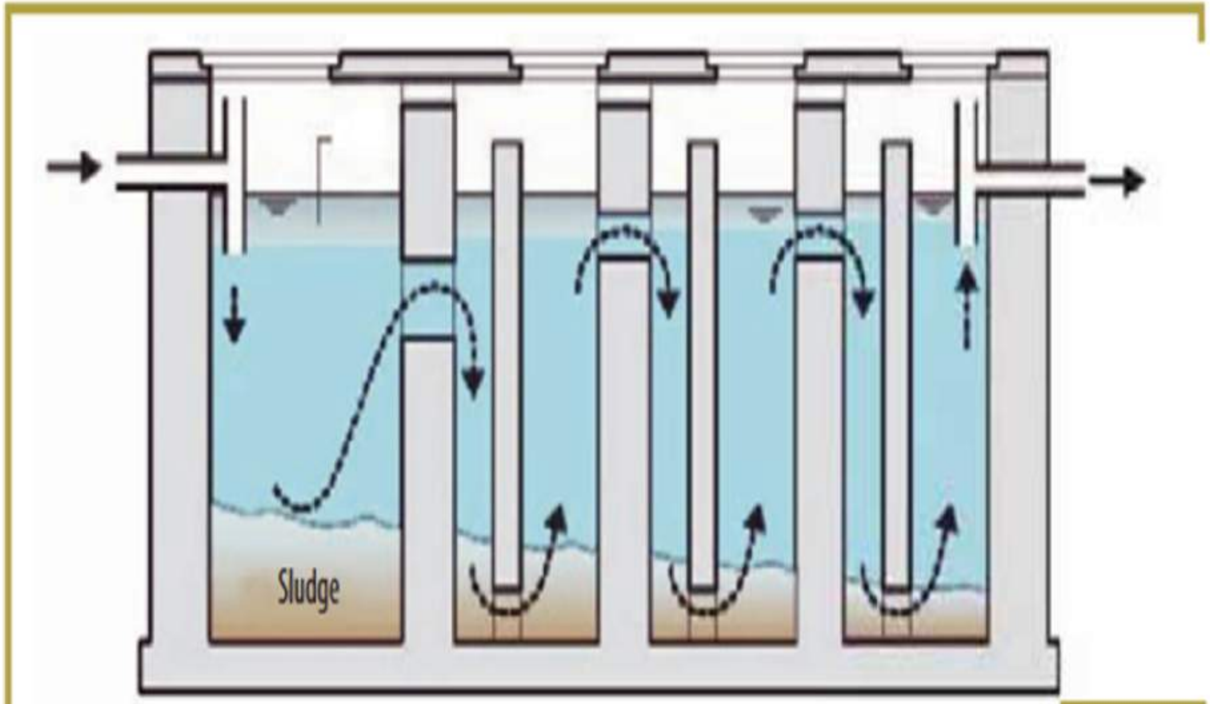

*Source:* After Kalbermatten et al. 1982.

# Prefab septic tanks



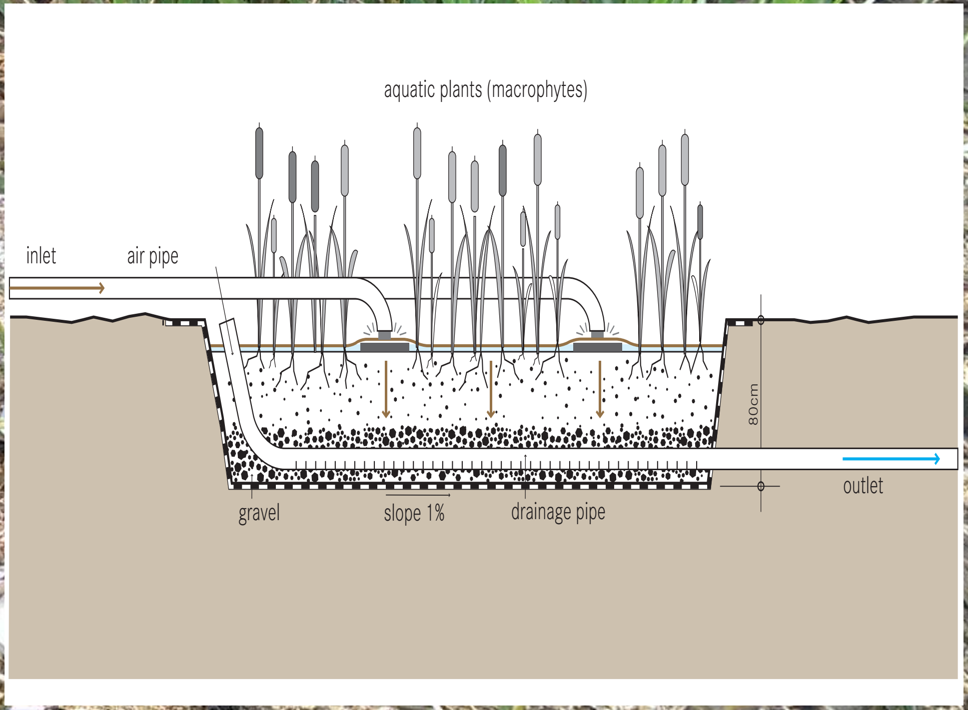
# HDPE pipes

# Anaerobic Baffled Reactor




Schematic cross- section of an up flow anaerobic baffle reactor (Morel and Diener, 2006) FIGURE 9

# Vertical Flow (Constructed) Wetland



# Sludge drying beds (1/year)

# Costs & Environmental impact

- 17,000 wastewater units to improve
- Per capita cost improvements: US$ 45 (payback period: 2-3 years)
- Total net cost: US$ 8 million (gross: US$ 11.5 million)
- Effluent quality : from 625 mg BOD/litre → 25 mg BOD/litre
- Faecal Coliforms: from 1,000,000 FC/100 ml → 1,000 FC/100 ml.

## Status

- **UNICEF-Lebanon** is implementing an adjusted pilot version of the strategy at this moment.
- An INGO is considering to endorse a pilot by **WASTE** for 450 people in Lebanon.
- A similar project is implemented by **Daily Business a.o.** in Tamale-Ghana for a settlement of 6000 residents and two schools

## Way forward

- Preparedness of sanitation services of;
- Prefab modular systems that;
- Present prospects of adaptation by local communities

# Thank you for your attention…

# Wastewater treatment plant efficiency

*Missions realized by Judy FAY FERRON and Isabella PORQUEDDU*

*Presented by Rym ARBAOUI*

*April 2018*

# Objectives of the project

- To measure the impact of MSF activities on public health and on environment
- To investigate the quality of MSF effluents released into surface water

  ⇨ Big hospitals in urban areas implies very often no space for infiltration which underline the effluent quality issue

- To develop a laboratory kit for effluents/wastewater quality testing

# Project presentation

- 1st PHASE:

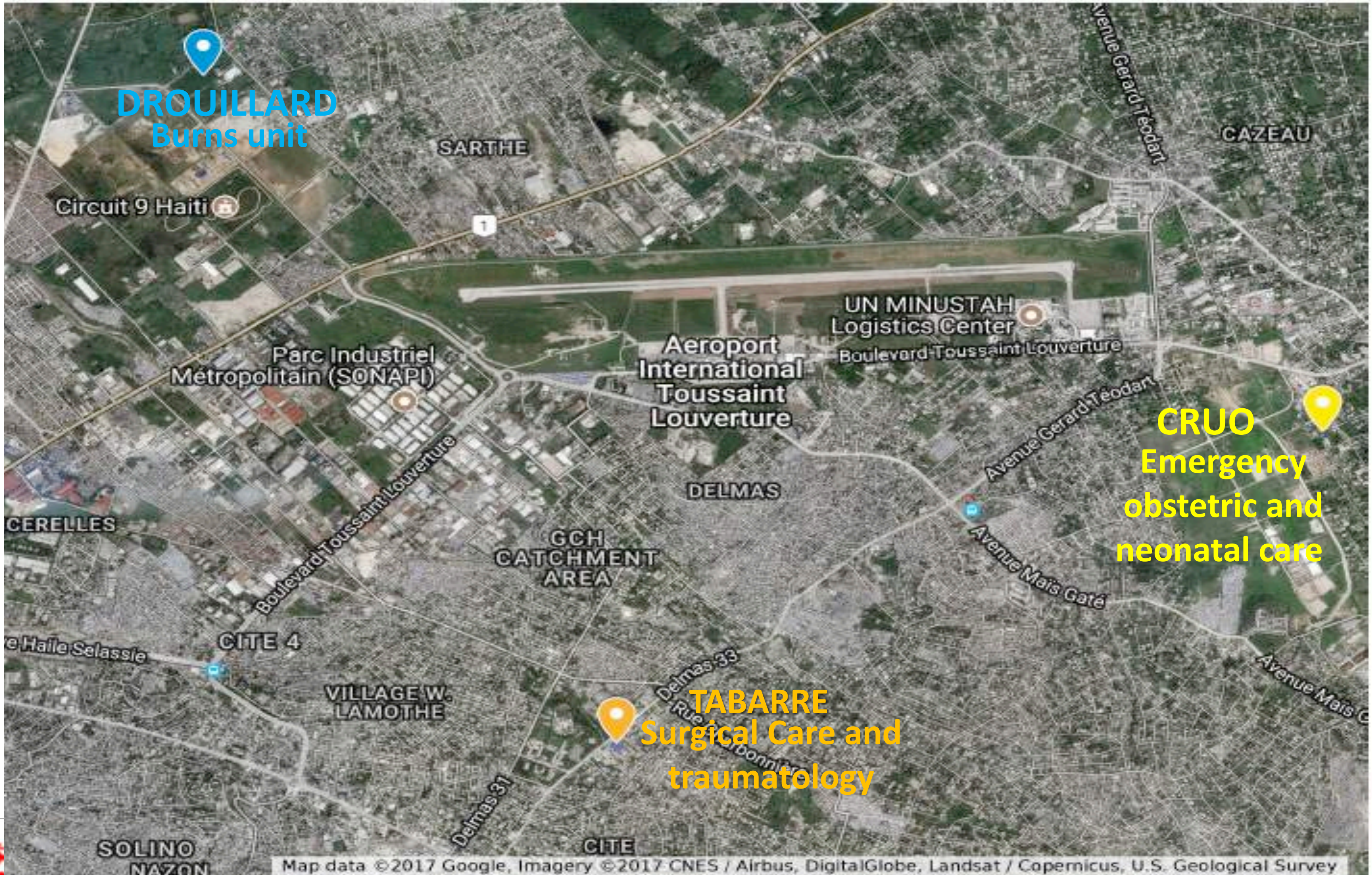
Upstream choice of methods usable on the field
+ logistical preparation of the analysis campain

- 2$^{nd}$ PHASE:

Tests run on effluents from 3 MSF hospitals in Haïti

MEDECINS SANS FRONTIERES

# Testing in Haïti



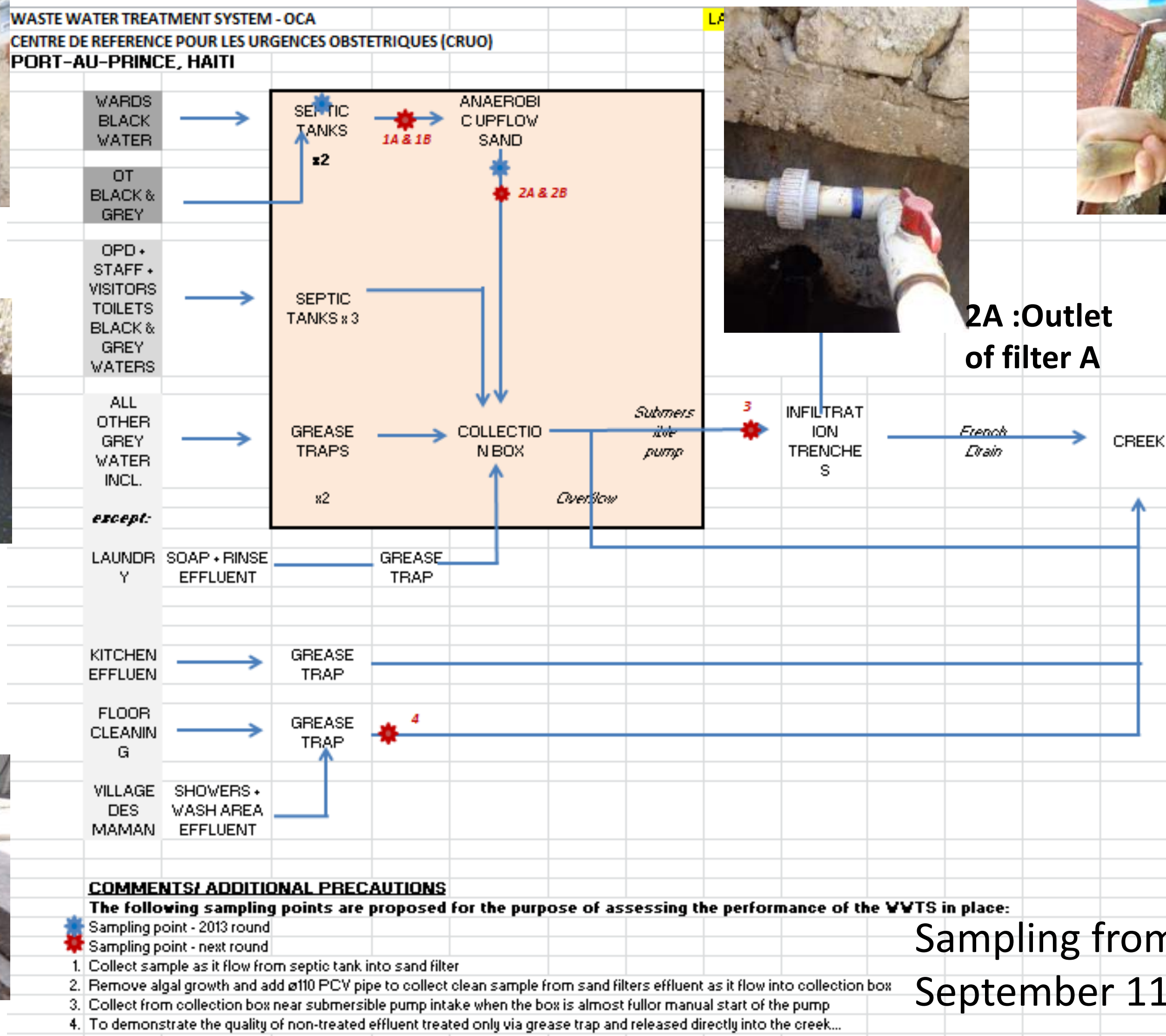
# Testing in Haïti

# CRUO- Sampling

1A : Exit FS A

1B : Exit FS B

4 : Exit GT Village mamans + vidoir eau de lavage hôpital.




2A :Outlet of filter A

2B :Outlet of filter B

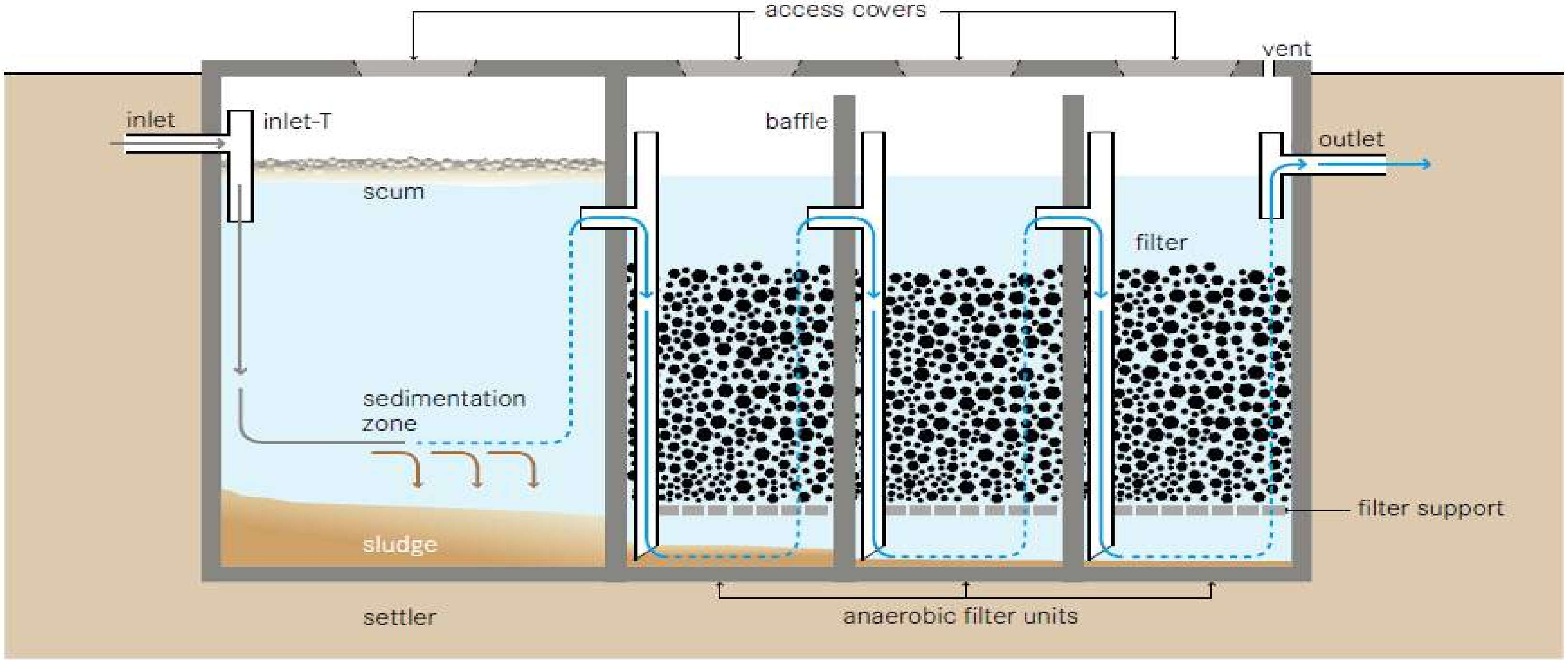
3: Outlet of the collect submersible pump

Sampling from August 29th to September 11th of 2017

MEDECINS SANS FRONTIERES

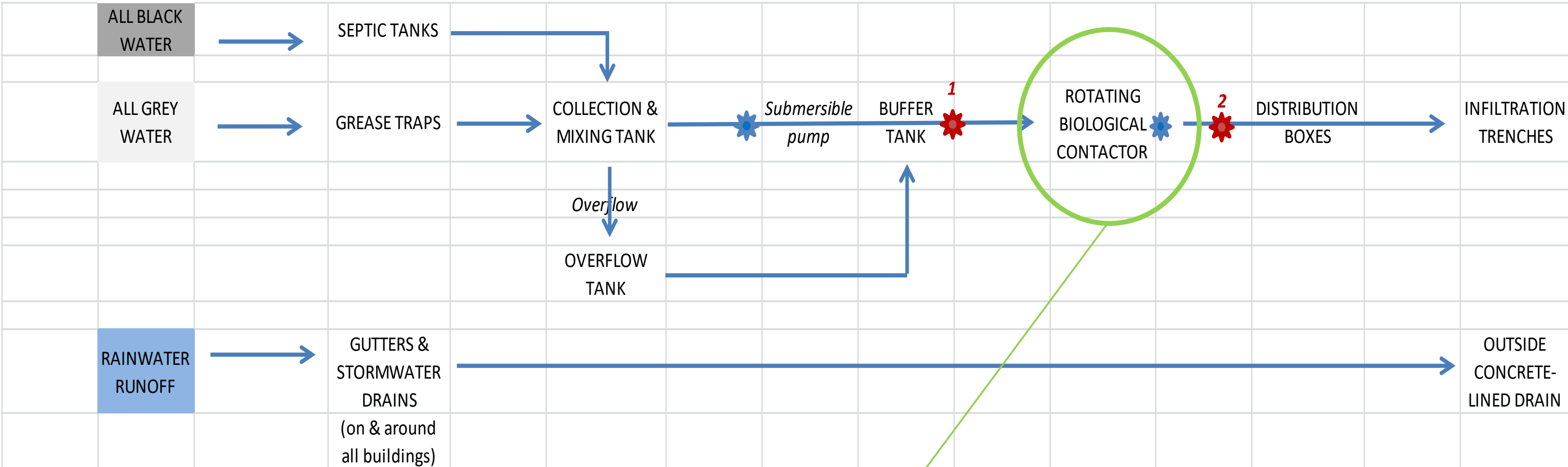
# UPFLOW FILTER

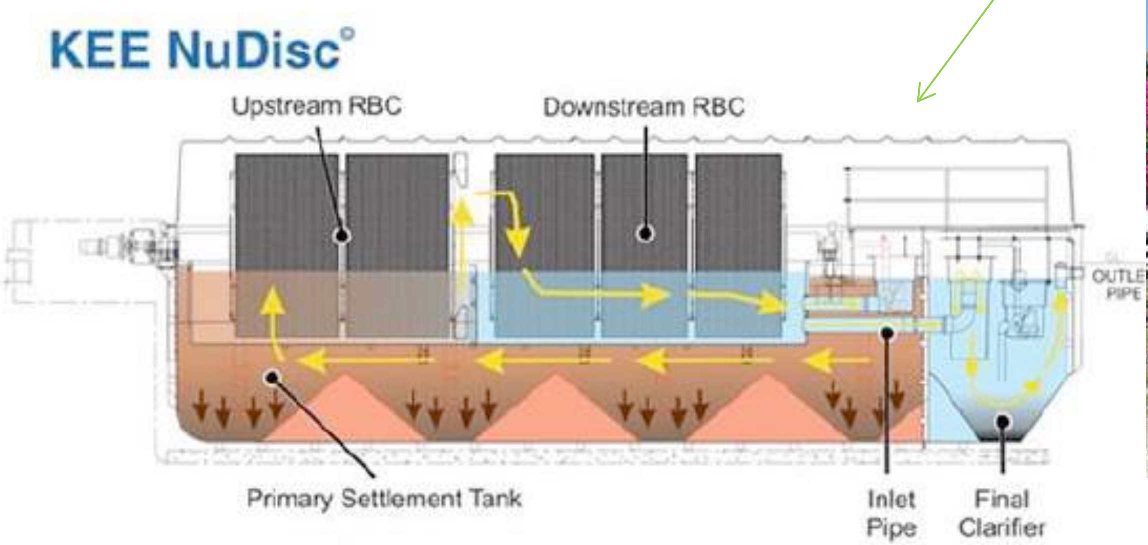
= anaerobic biological wastewater treatment unit




| Advantages | Disadvantages |
|---|---|
| **Reduce suspended matters** | Weak reduction of nitrogen and phosphorus |
| **No electricity needed** | Clogging risk of the filtration media |
| **Low operational costs** | Renewal of the filtration media is heavy, difficult and can be dangerous (emanation of dangerous gas) |

# TABARRE- Sampling




Sampling from July 22$^{nd}$ to September 14$^{th}$ of 2017

# Rotating biological contactors (RBC)

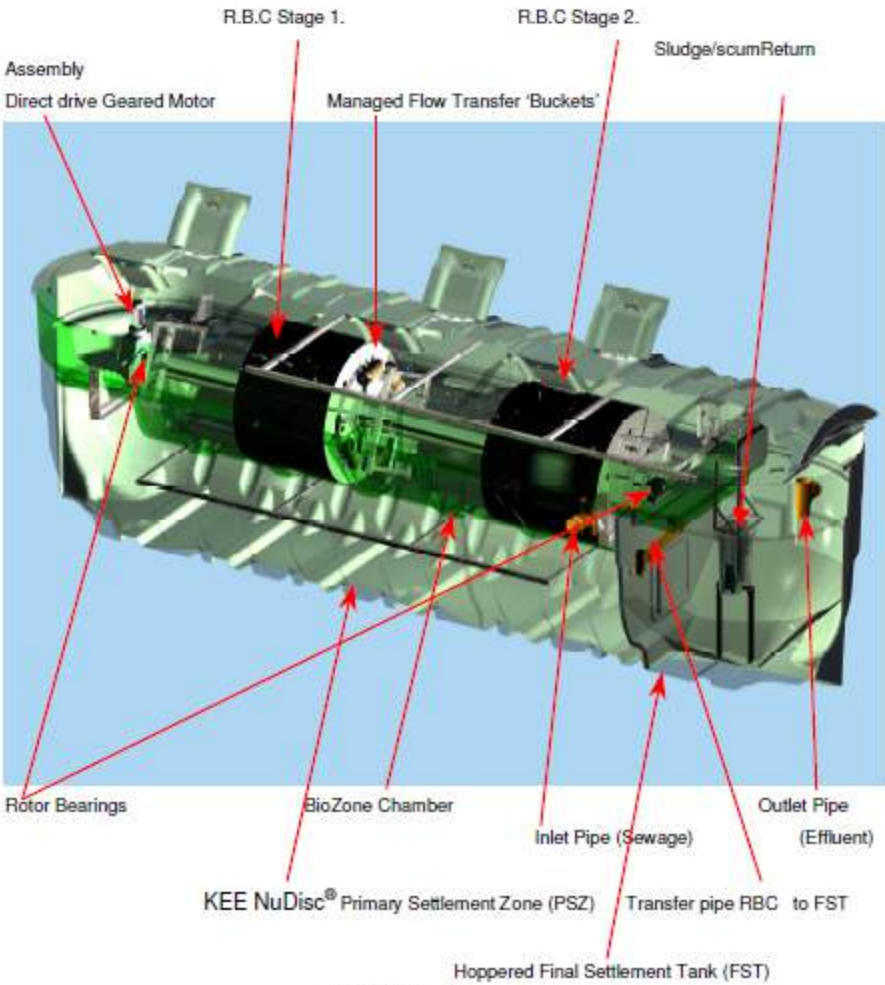
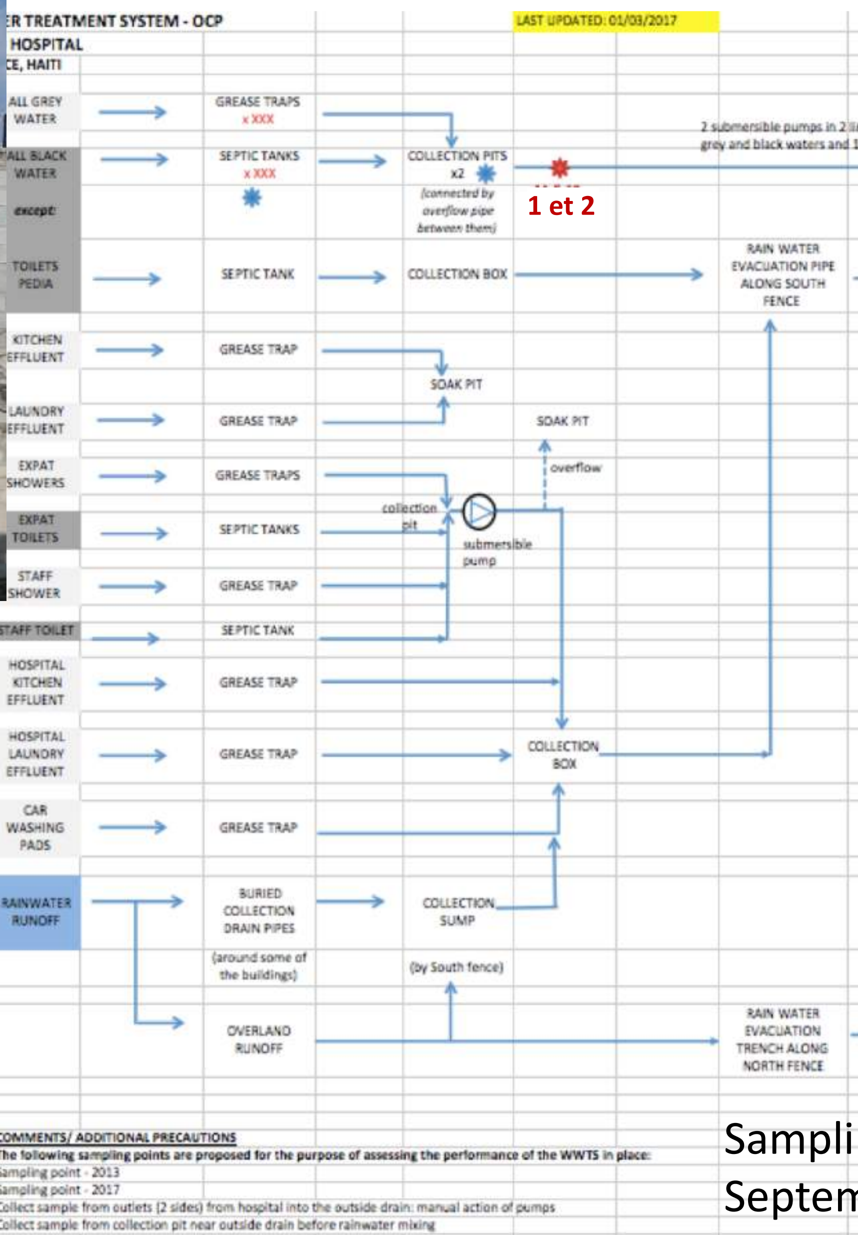



FIG 1: Cut through of KEE1600 KEE NuDisc® with some media packs removed for clarity.

- aerobic biological wastewater treatment unit
- activated sludge systems and fixed film

| Advantages | Disadvantages |
|---|---|
| ➢ Compact<br>➢ reduce organic matter and Nitrogen | - high-tech<br>- require skilled staff |

# DROUILLARD- Sampling



Sampling from August 21st to September 21st of 2017

# Results

| Parameters | Unity | D1 | D2 | D3 | C3 | C4 | T2 |
|---|---|---|---|---|---|---|---|
| **pH** | - | 8,0 | 7,8 | 8,0 | 7,9 | 8,0 | 8,0 |
| **DBO** | *mgO$_2$/L* | **87** | **64** | **92** | **286** | **335** | 28 |
| **DCO** | *mg O$_2$/L* | 181 | 174 | 195 | **314** | **696** | 67 |
| **Chlore libre** | *mgCl/L* | 0,1 | 0,0 | 0,8 | 0,1 | 0,1 | 0,1 |
| **Phosphore tot** | *mgP/L* | **15** | **21** | **14** | **29** | **60** | **10** |
| **Azote ammoniacale** | *mg NH$_4$/L* | **42,4** | **38,6** | **18,0** | **79,5** | **26,5** | 6,0 |
| **Escherichia coli** | *UFC / 100mL* | $\approx 10^5$ | $\approx 10^5$ | $\approx 10^5$ | $\approx 10^5$ | $\approx 10^5$ | $\approx 10^4$ |

# Results

| | DBO | Turbidité | DCO | $PO_4^{-3}$ | NT | $NH_4^+$ | *E.Coli et Coliformes fécaux* |
|---|---|---|---|---|---|---|---|
| Performance Filter 1 CRUO (en%) | 3 | 70 | 20 | -35 | 22 | 7 | - |
| Performance Filter 2 CRUO (en%) | 13 | 28 | 41 | 21 | 4 | 1 | - |
| Performance RBC Tabarre (en%) | 86 | 98 | 91 | 74 | 58 | 93 | ~99 |

- Biodisc has the best performance on all the parameters
- Best performance on DBO5, DCO, NH4+ and E. coli 1 Coliforms

# Conclusion

- Septic tank = pre-treatment
  - Reduction of solid maters only!
  - Needs to have a treatment
- Upflow filter = treatment
  - Poor reduction of turbidity and COD
  - BUT needs competence, hard to maintain, can be dangerous during renewal→ to avoid
- Biodisc = treatment
  - Best reduction of  Turbidity, COD, $BOD_5$, *E. coli* and Coliform

# Methods of analysis

| *Parameter* | | *Unit* | *2016-2017 Field Testing Method* |
|---|---|---|---|
| **BOD (Biochemical Oxygen Demand)** | Probable BOD | mg/L | Palin Sewage Effluent Testing Kit (via Permanganate Value) |
| | Calculated $BOD_5$ | mg/L | Tube test Colilert |
| **COD (Chemical Oxygen Demand)** | COD | mg/L | Wagtech Digital Tubetest Heater & Potalab Photometer 7100 Wag |
| **BOD/COD** | BOD/COD | ratio | N/A |
| **TOC (Total Organic Content)** | Probable TOC | mg/L | N/A |
| **COD/TOC** | COD/TOC | ratio | N/A |
| **PV (Permanganate Value)** | PV | mg/L | Palin Sewage Effluent Testing Kit |
| **Turbidity** | Turbidity (NTU) | NTU | DelAgua kit Turbimeter |
| | Turbidity (JTU) | JTU | Palin Sewage Effluent Testing Kit |
| **Nitrate** | Nitrate | mg/L | N/A |
| **Nitrite** | Nitrite | mg/L | |
| **Total Nitrogen** | Total Nitrogen | mg/L | N/A |
| **Total Nitrogen** | TN | mg/L | HACH TN LCK338 |
| **Ammonia** | Ammonia | mg/L | Potalab Photometer 7100 Wag-WE10441 Digital Readout Colorimeter |
| **Phosphate** | Phosphate | mg/L | |
| **FRC (Free Residual Chlorine)** | FRC | mg/L | |
| **Total Chlorine** | | | |
| **FRC in presence of chloramine** | | mg/L | Method Hach 102141 with DR 1900 photometre |
| **Temperature** | Operating temperature | $^{o}C$ | Hanna Instruments pH- EC meter |
| **E-coli** | E-coli | MPN | Tubes Colilert (MPN) |
| **Total Coliforms** | Total Coliforms | MPN | |
| **Faecal Coliforms** | | | DelAgua kit |
| **pH** | pH | pH unit | Hanna Instruments pH- EC meter |
| **Odour** | Odour | - | Observation |
| **Colour** | Colour | - | |
| **General aspect** | General aspect | - | |

# Methods of analysis Discussion

- BOD5:
  - Method hard to understand
  - Parameter very imprecise
- Palin sewage testing kit: *COD and BOD5 probable*
  - Very easy to use BUT
  - Permanganate value hard to differentiate from a sample to another → COD and BOD5 always the same.
- E. coli and coliforms: MPN method on 3 tubes→ the 3 dilutions are chosen by the operator. Need pre-testing to get close to the « good dilutions » + precision questionned

# Wastewater analysis kit

- European law imposes minimum treatment performance for the following parameters only: BOD5, COD and MES + nitrogen and phosphorus if water released in eutrophication sensitive zone.
- Treatment used in MSF doesn’t treat Nitrogen nor Phosphorus
- Proposition for the wastewater analysis kit :
  - $BOD_5$ → rework the protocole to make it clearer + refine the comparaison between the 2 methods
  - COD
  - MES → find a method of analysis easy to use on the field
  - pH, temperature

  - Phosphore and nitrogen only for information?

# What is next?

- Continue the analysis of the effluents released by other treatment systems
- Lobying for a multidisciplinary discussion around the quality of effluents we want to reach in MSF

Questions?

# Thanks for your attention

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