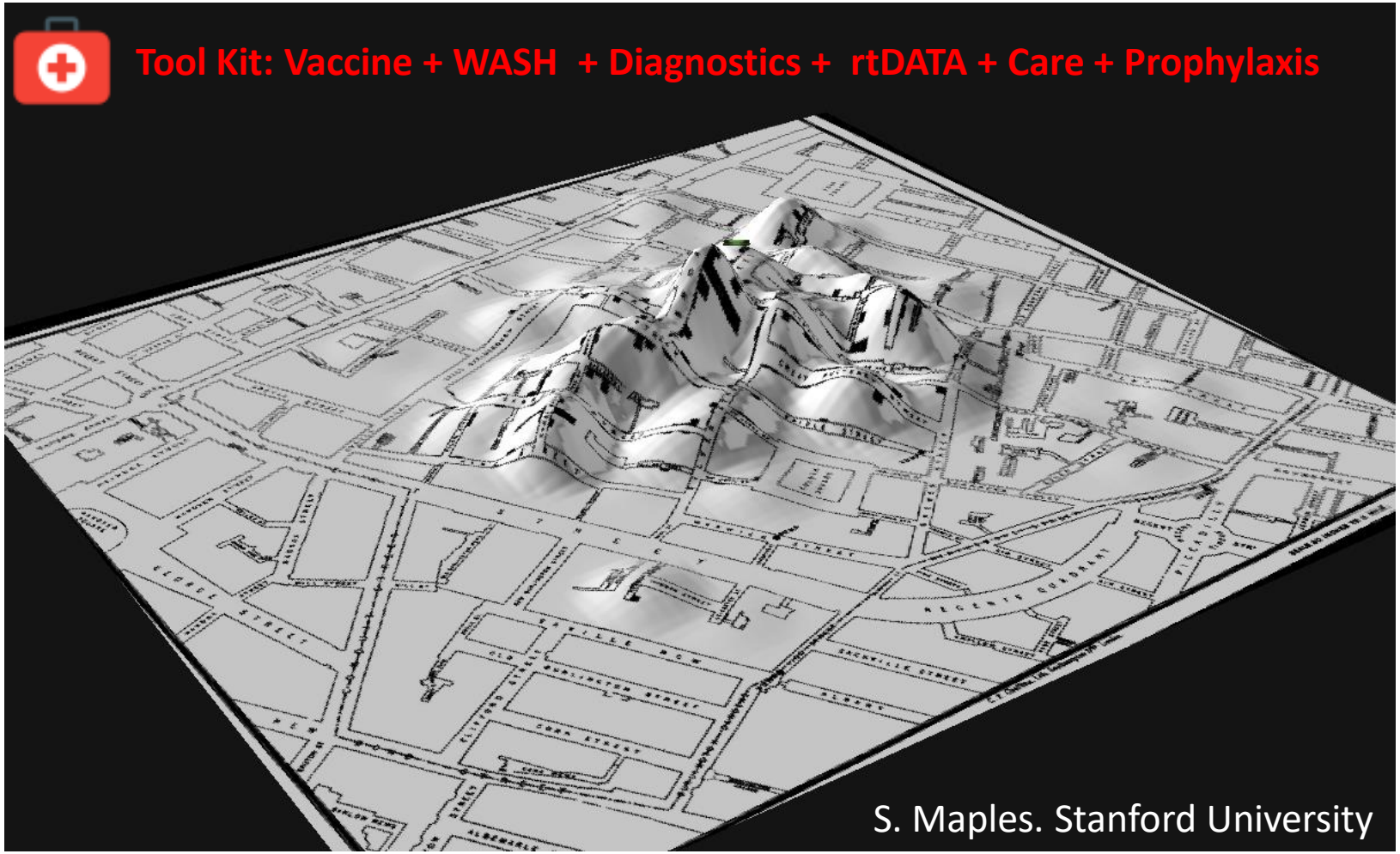
What tools are needed for cholera elimination campaigns?



UF: Eric Jorge Nelson, MD PhD . IEDCR Drs. Flora, Salimuzzaman, Sujon, et al.
icddr,b: Drs. Khan, Qadri, Zion, Sarker, Chisti et al. Email= eric.nelson@ufl.edu

Tool Kit: Vaccine + WASH + Diagnostics + rtDATA + Care + Prophylaxis

Our journey to contribute to an end-to-end pipeline for outbreak response

A. Science: How might we enable actionable real-time data collection?

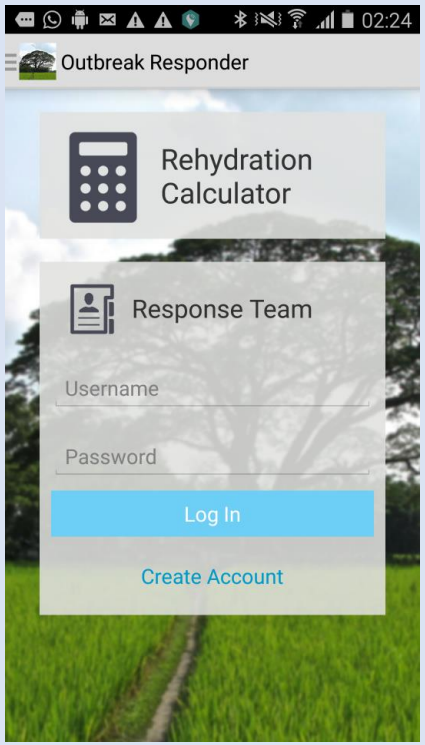
B. Medicine: How might we assure high-quality care at hospitals?

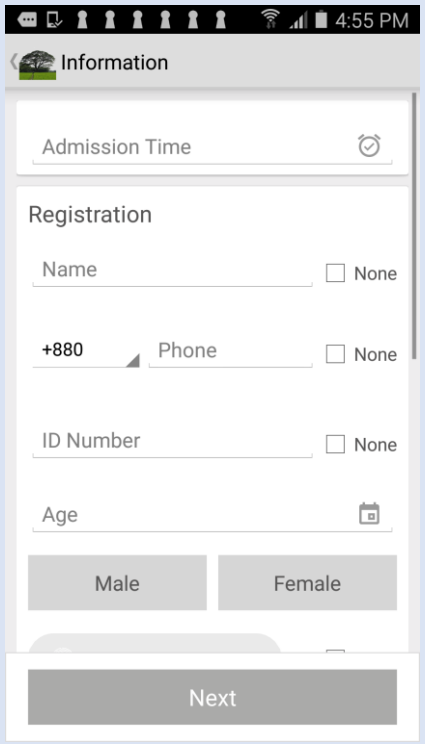
A. Science: Real-time data collection (rtData)

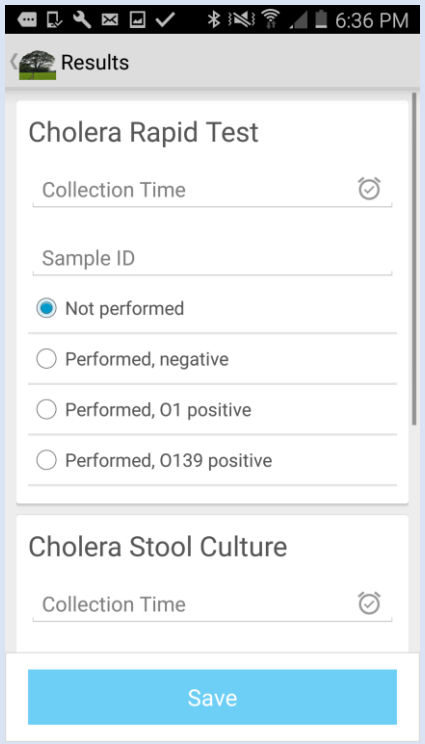
rtData collection with diagnostic integration

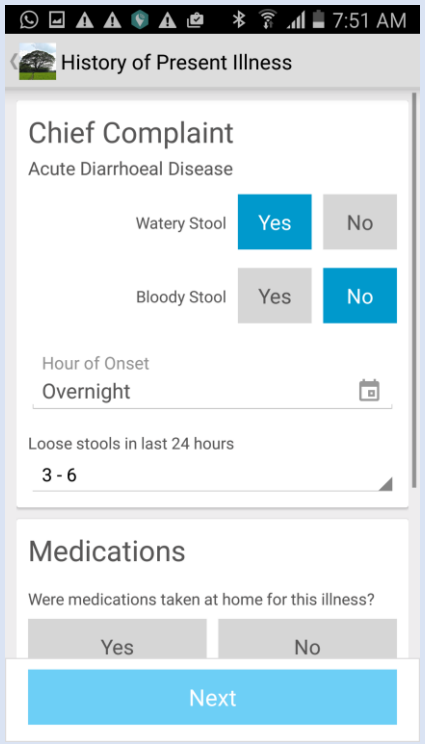
Google Playstore: “Outbreak Responder” , App Key= “gtfcc”
User= “gtfcc01” OR “gtfcc02” …, Password= “Test123”

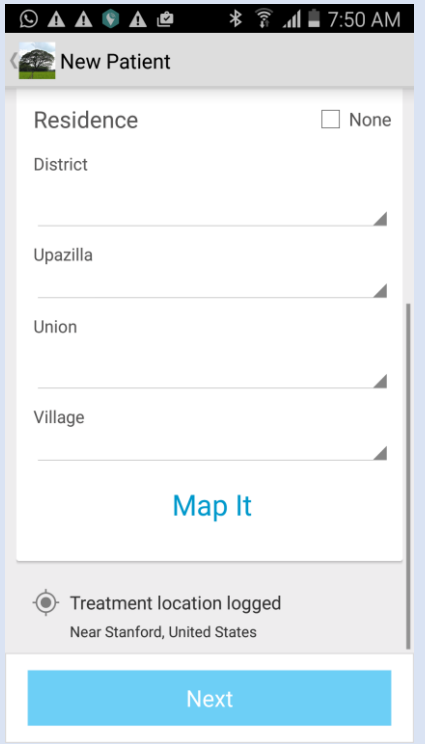
Outbreak responder: rtData collection and diagnostic integration





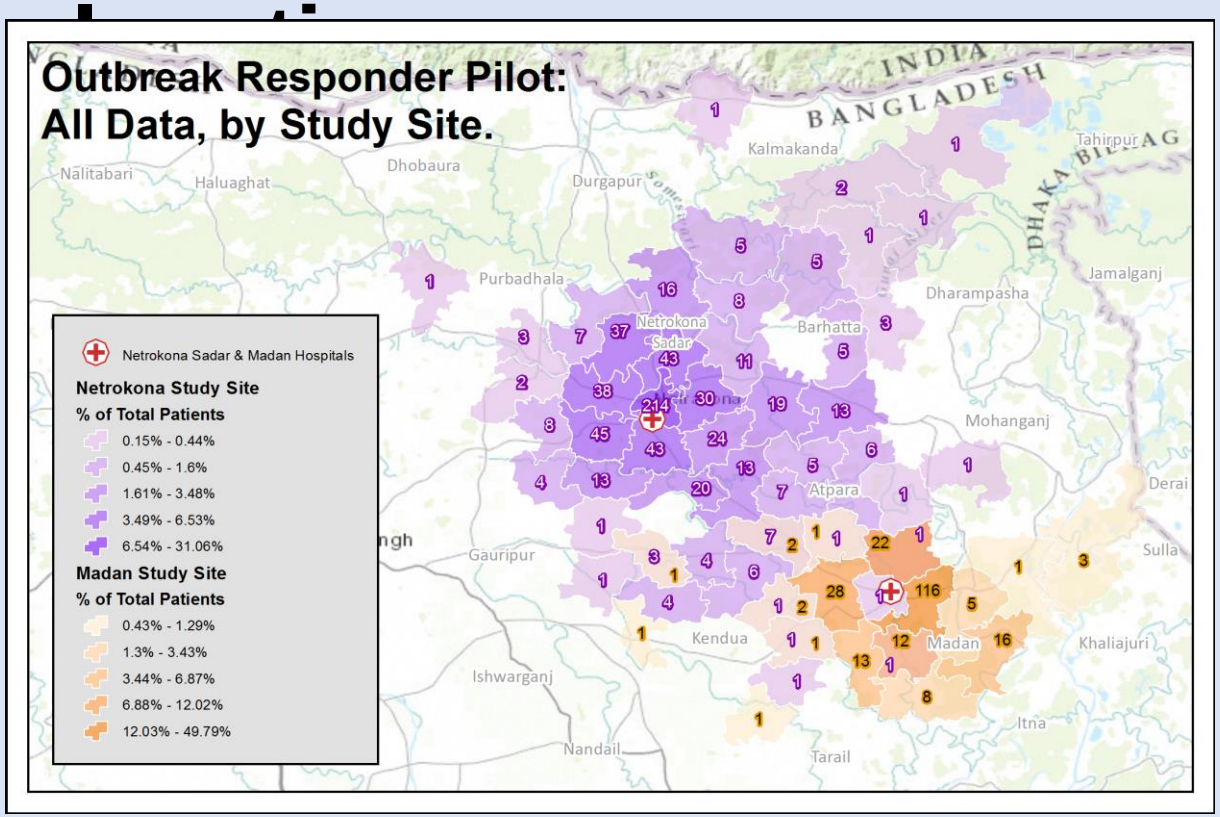






Who **What** When **Where**

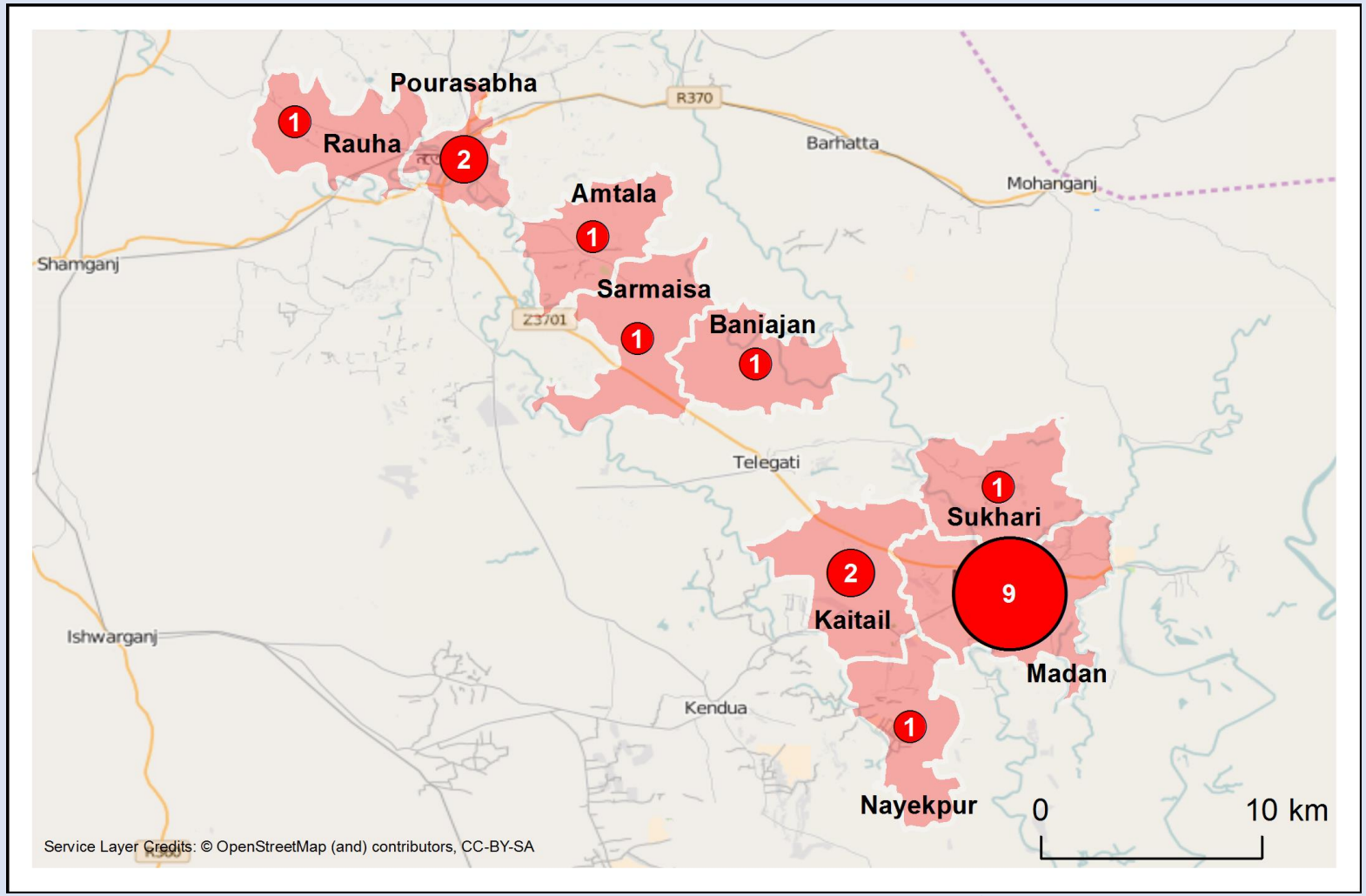
Where: mapping residence in un-mapped



S. Maples, Stanford University Geospatial Center

Waliur Rahman and Stace Maples: Gazeteer credit

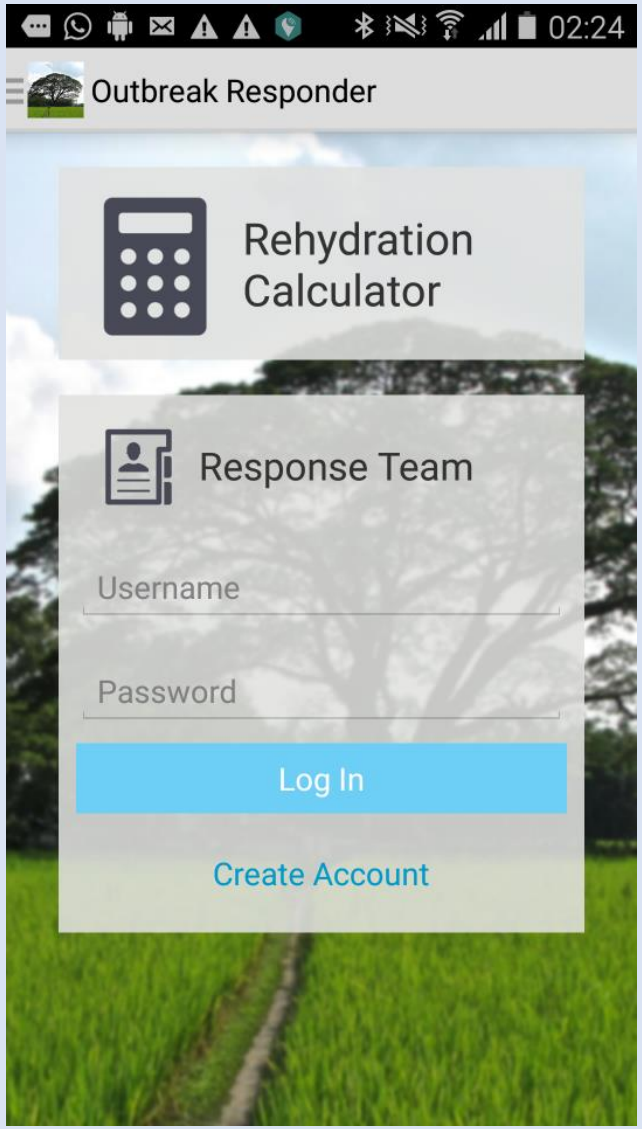
What: residence by positive rapid diagnostic test (RDT)

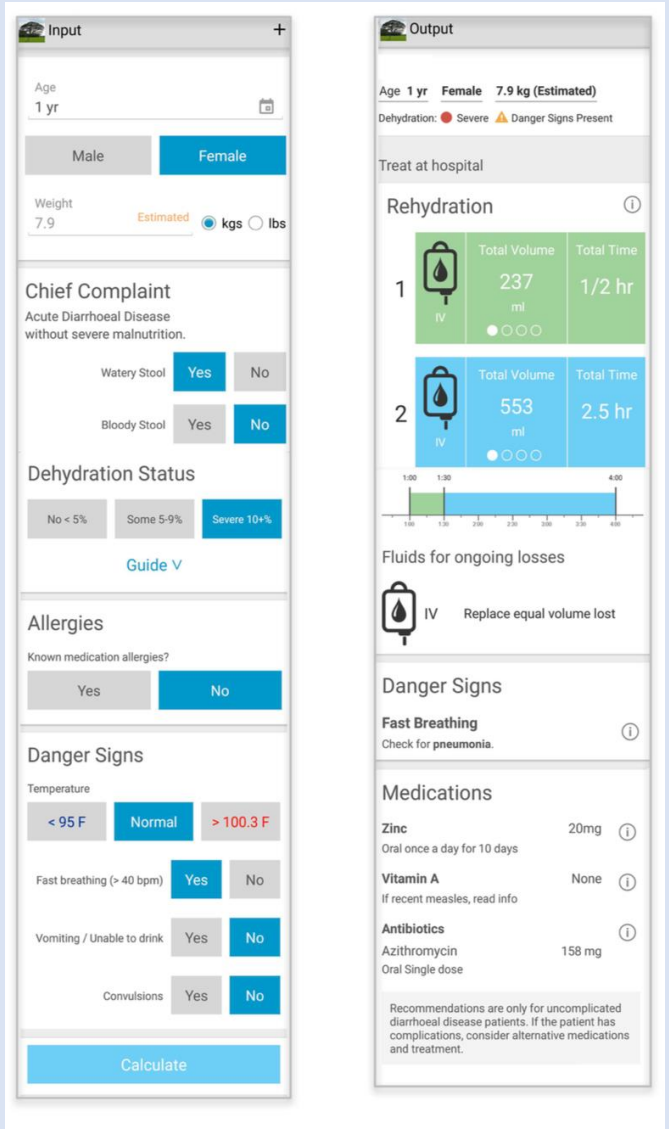


S. Maples, Stanford Geospatial Center

B. Medicine: Improving hospital CARE

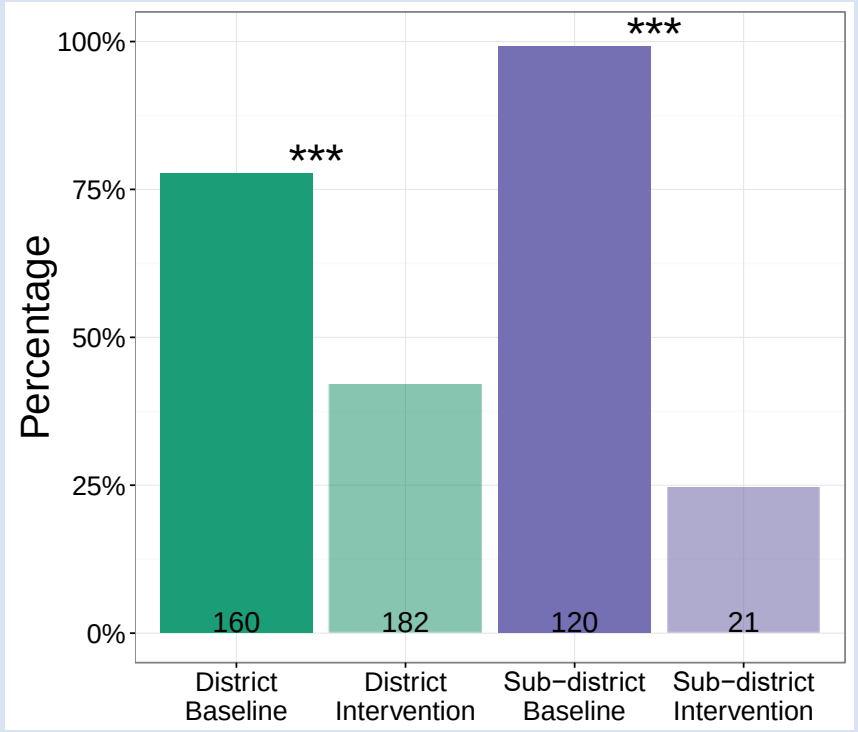
and bending antibiotic behavior


02:24
Outbreak Responder
Rehydration Calculator
Response Team
Username
Password
Log In
Create Account

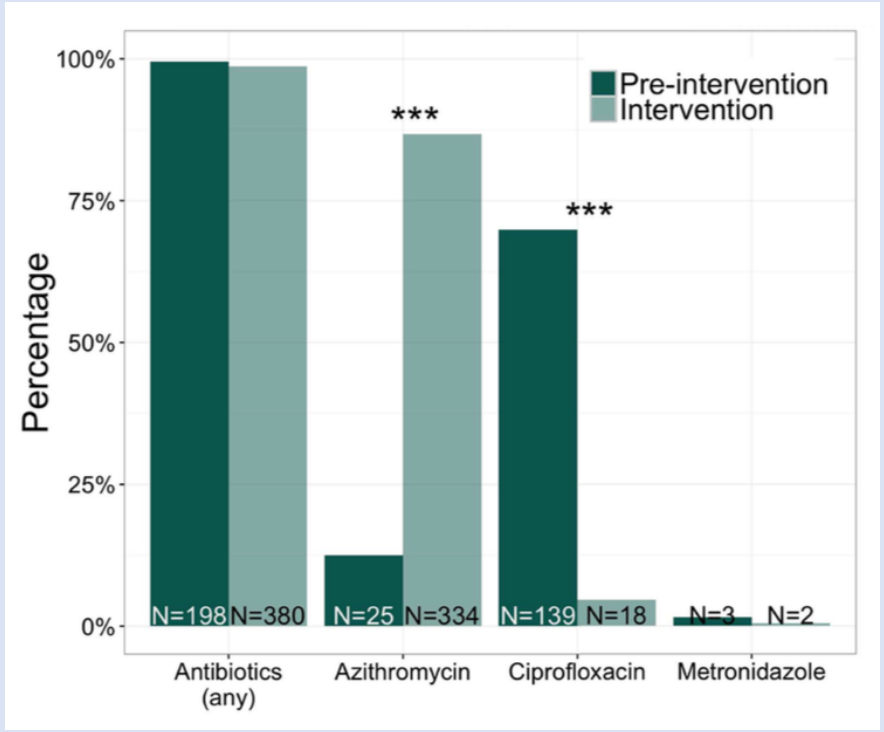

Input
Age
1 yr
Male
Female
Weight
7.9
Estimated
kgs
lbs
Chief Complaint
Acute Diarrhoeal Disease without severe malnutrition.
Watery Stool
Yes
No
Bloody Stool
Yes
No
Dehydration Status
No < 5%
Some 5-9%
Severe 10+%
Guide
Allergies
Known medication allergies?
Yes
No
Danger Signs
Temperature
< 95 F
Normal
> 100.3 F
Fast breathing (> 40 bpm)
Yes
No
Vomiting / Unable to drink
Yes
No
Convulsions
Yes
No
Calculate
Output
Age 1 yr
Female
7.9 kg (Estimated)
Dehydration: Severe
Danger Signs Present
Treat at hospital
Rehydration
1
IV
Total Volume
237
ml
Total Time
1/2 hr
2
IV
Total Volume
553
ml
Total Time
2.5 hr
1:00
1:30
4:00
Fluids for ongoing losses
IV
Replace equal volume lost
Danger Signs
Fast Breathing
Check for pneumonia.
Medications
Zinc
20mg
Oral once a day for 10 days
Vitamin A
None
If recent measles, read info
Antibiotics
Azithromycin
158 mg
Oral Single dose
Recommendations are only for uncomplicated diarrhoeal disease patients. If the patient has complications, consider alternative medications and treatment.

Netrokona, Bangladesh. F. Haque, M. Rahman et al.

Decreased IV fluid use and antibiotic class switching



Patient's Receiving IV Fluids



District: Antibiotics ordered at admission

* Significant difference ($p<0.05$, <0.01, <0.001); chi-squared test

Haque and Nelson et al, PLoS NTD 2017

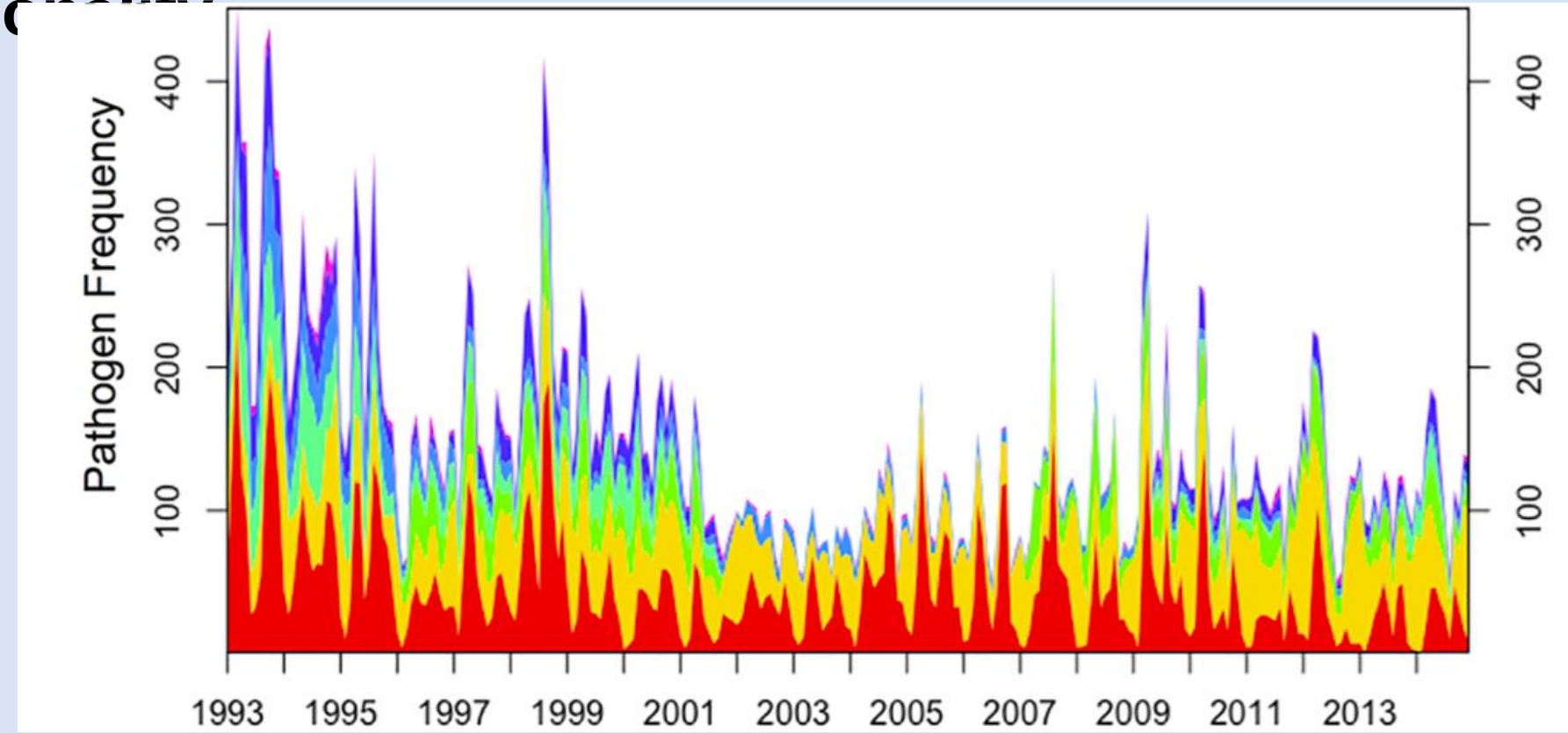
Safety outcomes were equivalent but increased 'discharge on request'

Hospital course	District			Sub-district		
	Pre-intervention N = 204	Intervention N = 430	*p*-value[a]	Pre-intervention N = 121	Intervention N = 86	*p*-value[a]
Duration of admission (h); median (Q1,Q3)[b]	24.1 (17.2,34.4)	25.0 (18.3,41.7)	0.09	27.9 (20.8,39.5)	24.6 (21.9,29.6)	**< 0.001**
Complications[c]	2 (1)	1 (0.2)	0.24	0 (0)	0 (0)	-
Discharge type; N (%)						
with advice	128 (62.7)	210 (48.8)	0.07	1 (0.8)	1 (1.2)	1
on request	32 (15.7)	145 (33.7)	**< 0.001**	113 (93.4)	84 (97.7)	0.84
against medical advice	11 (5.4)	13 (3.0)	0.18	1 (0.8)	0 (0)	1
absconded	31 (15.2)	53 (12.3)	0.39	6 (5.0)	1 (1.2)	0.25
other	2 (1.0)	9 (2.1)	0.52	0 (0)	0 (0)	-
Mortality; N (%)	0 (0)	0 (0)	-	0 (0)	0 (0)	-

Safety outcomes at 10-days follow-up were not significantly different for mortality (n=1) and readmission rates

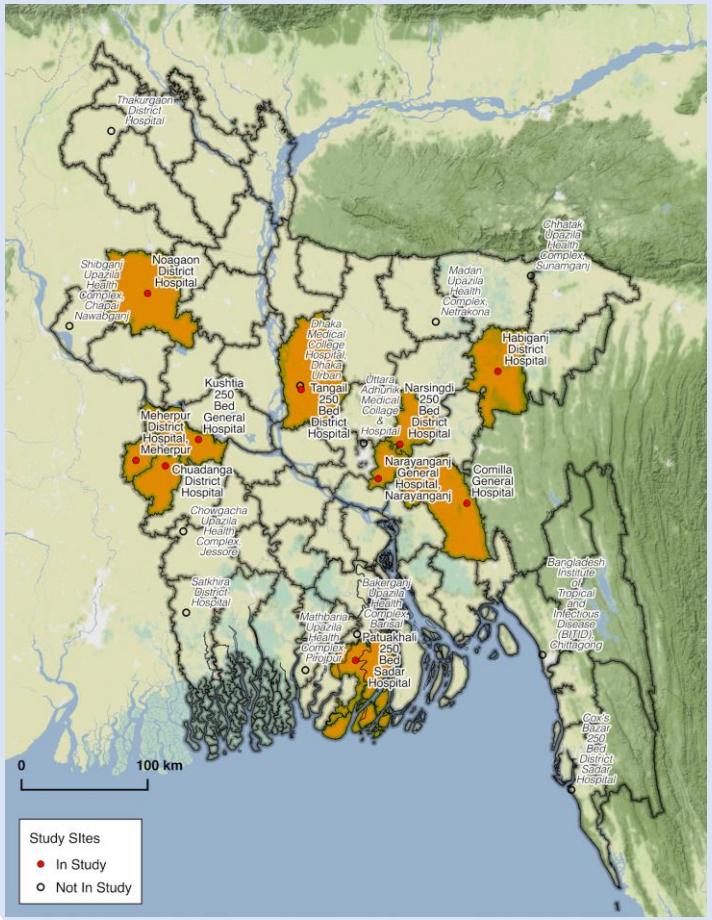
Haque and Nelson et al, PLoS NTD 2017

Challenge: Development of a study that accounts for seasonality



Cholera Rotavirus ETEC Shigella Aeromonas Andrews, Nelson, Faruque PLoS NTD 2017

Pilot Validation: cluster randomized controlled trial



mHealth Diarrhea Management (mHDM) Trial

Cholera Surveillance Hospitals (N=22 total)

→ Hospital exclusions:
- Non-district hospitals
- Sites previously used
- Extremely remote sites

Study Hospitals (N=10)
Patients = 4,924

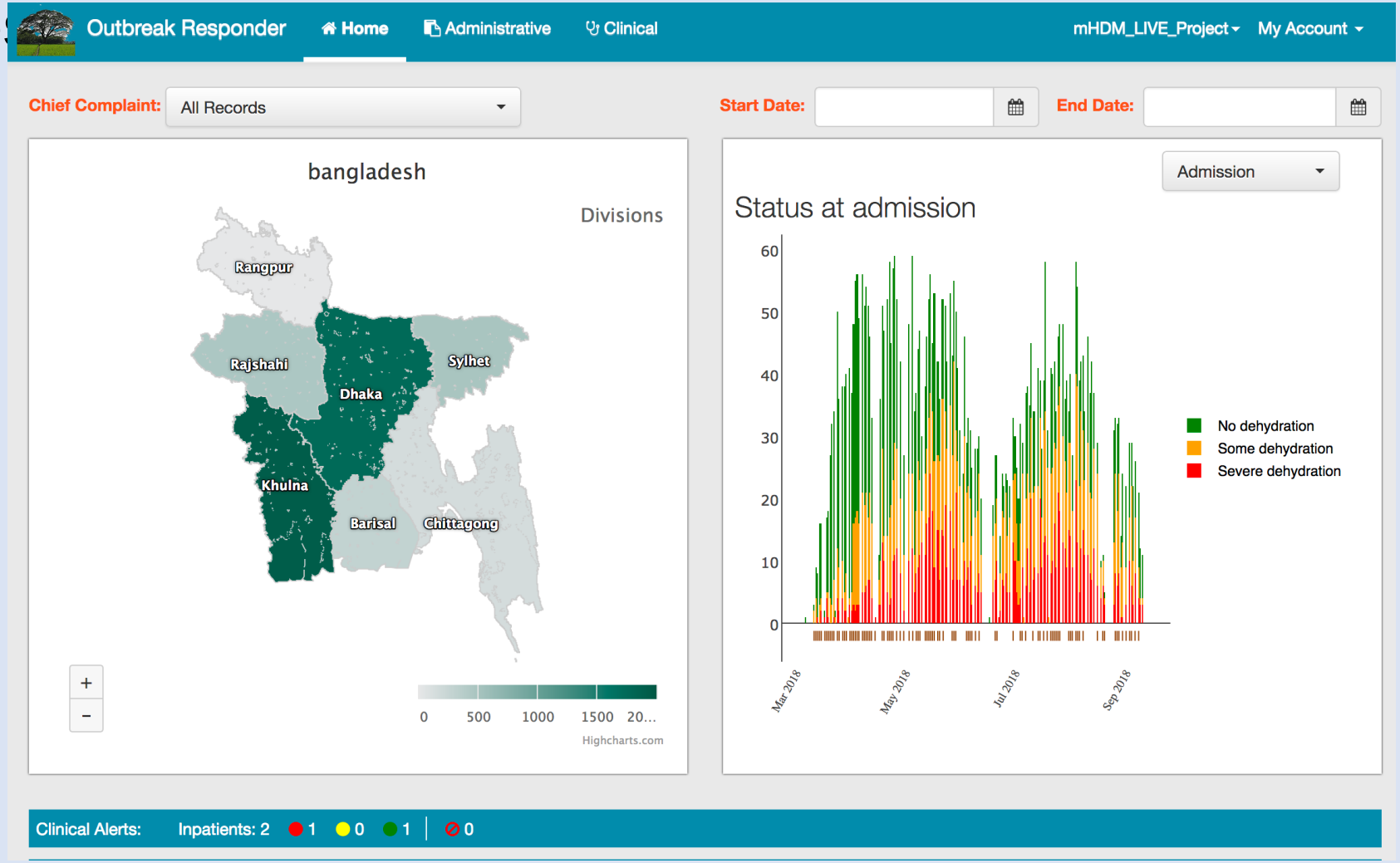
→ Patient Exclusions (1.8% total):
- No consent (<1%)
- No diarrhea (1.2%)
- Complicated disease (<1%)
- Chronic symptoms (<1%)
- Severe malnutrition of children < 5 years (<1%)

Hospitals paired based on similar profiles and then randomized

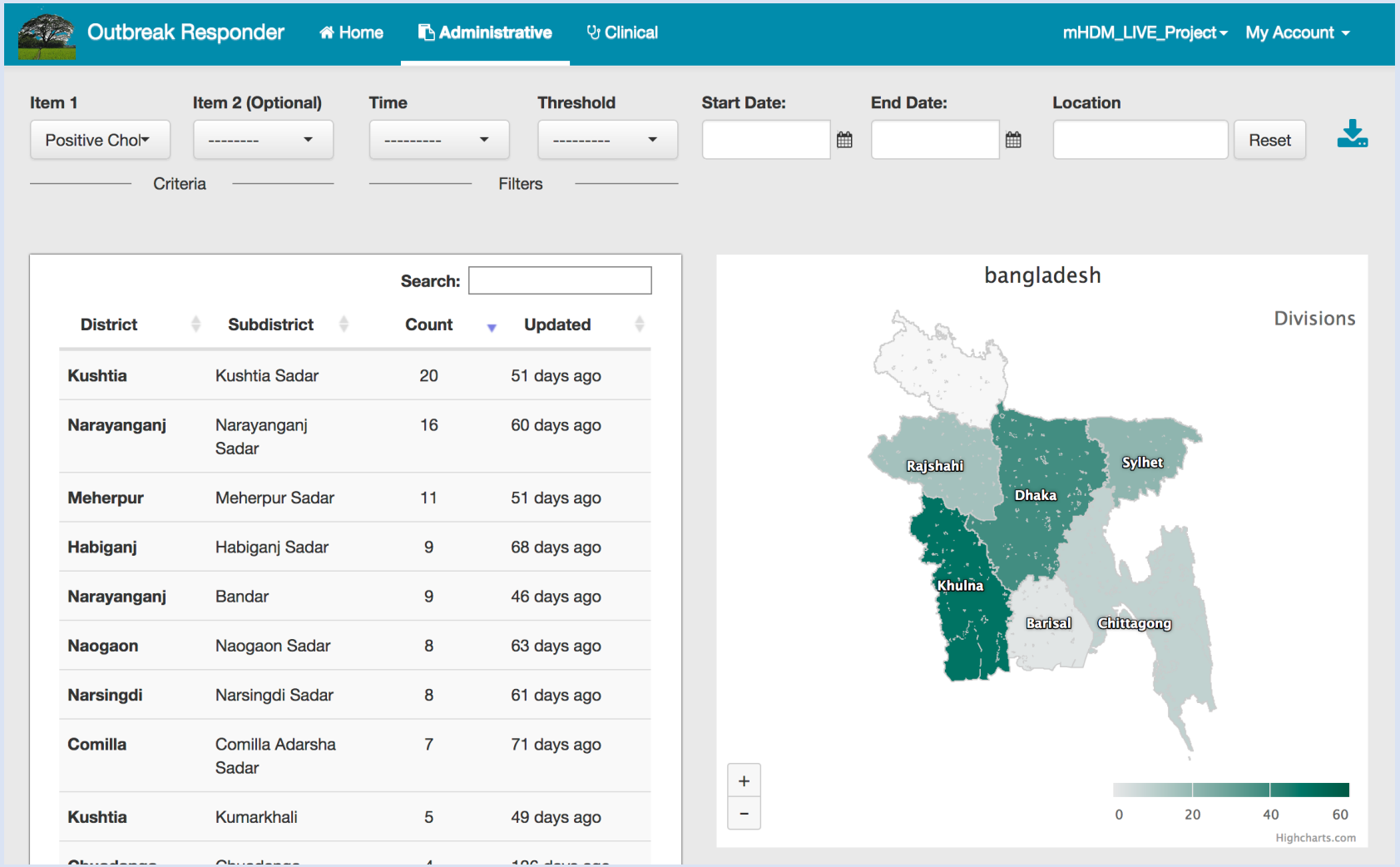
Patients = 4,837

Pre-Intervention	Intervention	
Observation period to establish baseline	Standard of Care + Paper-based decision-support	Standard of Care + Android-based Decision-support
Hospitals = 10 Patients = 1,571	Hospitals = 5 Patients = 2,046	Hospitals = 5 Patients = 1,220
Adult patients = 696 (44.3%) Children (<18 years) = 875 (55.7%) Ordered IV fluids >= 1,493 (95.0%)	Adult patients = 1,214 (59.3%) Children (<18 years) = 832 (40.7%) Ordered IV fluids >= 1,981 (96.8%)	Adult patients = 698 (57.2%) Children (<18 years) = 522 (42.8%) Ordered IV fluids = 995 (81.6%)

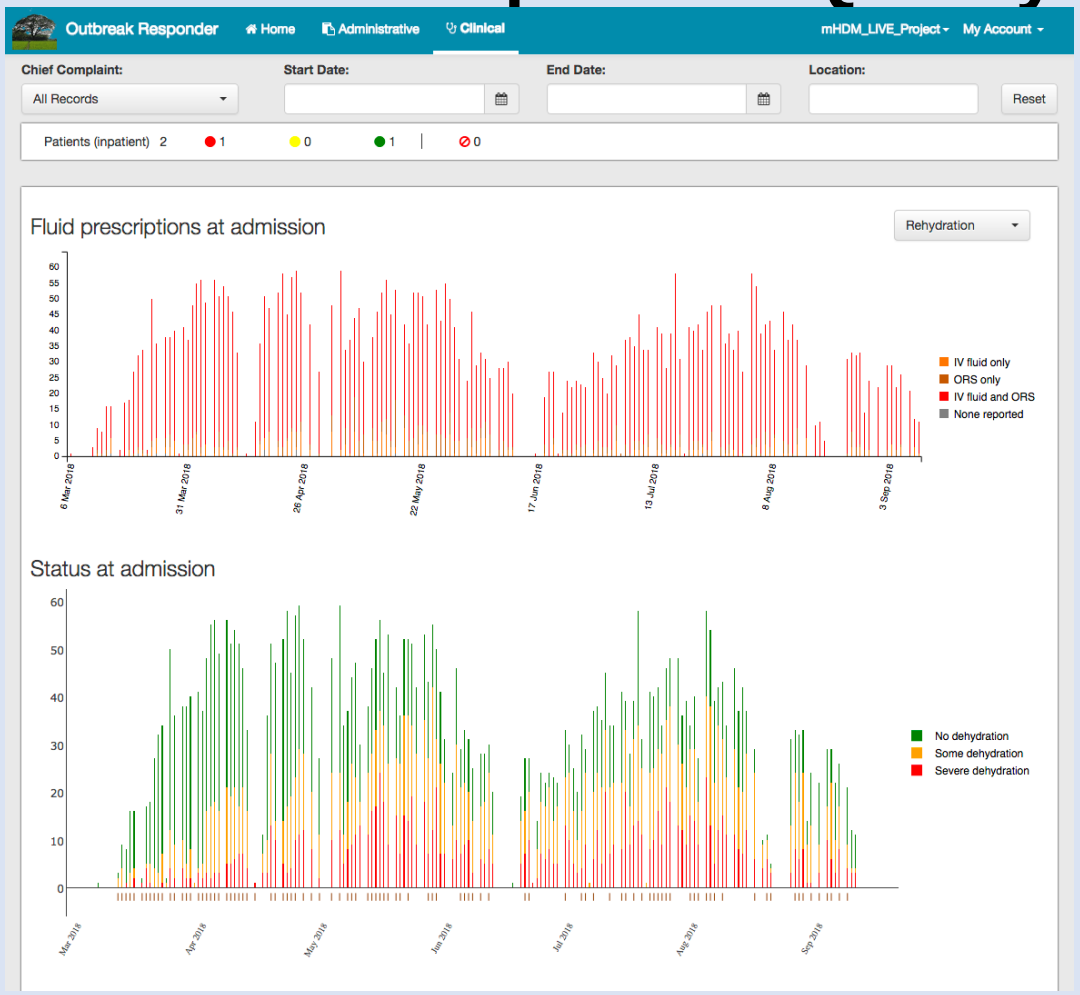
Outbreak Responder: Common landing page for all user type

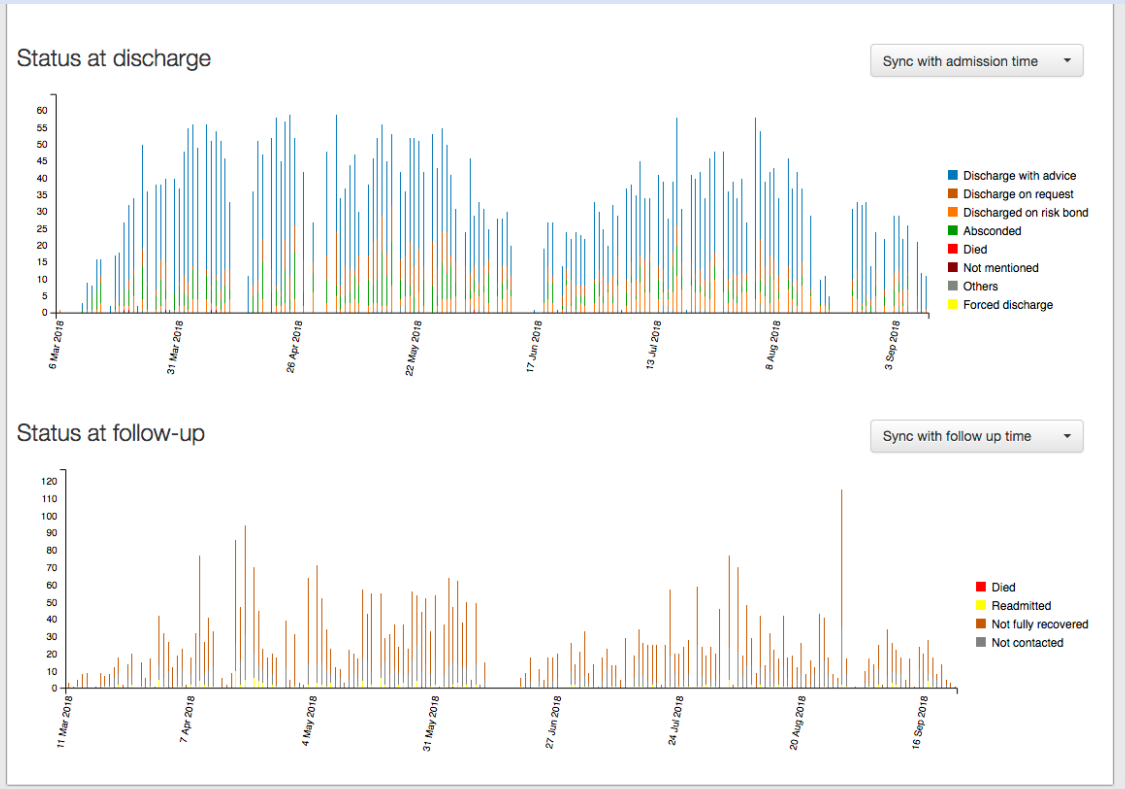


Outbreak Responder: Administrative decision-support



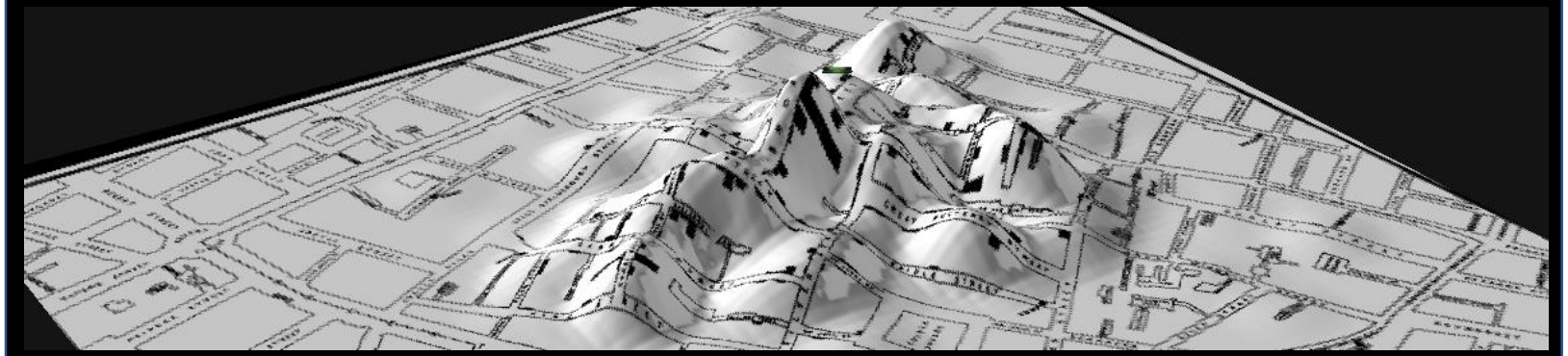
Outbreak Responder: Quality metrics for clinical decision-





Please help us to collaboratively development and deploy these tools

Tool Kit: Vaccine + WASH + Diagnostics + rtDATA + Care + Prophylaxis



Timeline

2018-19: Publish cRCT and release software (iOS/Android/French/English)

2019-20: Outbreak Responder hand-off to interested partners

2019-24: Gates and NIH funded to make responsive decision-support (AI)

Educational Technique Training Hub: Representatives are welcome to attend the Cholera Outbreak Training and Shigellosis Course at the State University of Haiti, PAP

Email: eric.nelson@ufl.edu

Google Playstore:
“Outbreak Responder” ,
App Key= “gtfcc”
User= “gtfcc01”
Password= “Test123”

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- USA: University of Florida, CHRI; Bangladesh: icddr,b, IEDCR (MOHFW)
- Collaborators: Johns Hopkins, Stanford University, Brown Univ.
- Tech: Beehyv Inc. ; NIH: DP5 OD019893; FICS R21 TW010182, UF and Stanford internal awards