

Mobile Wellness Toolkit Project

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Problem statement

How do we make low cost consumer technologies available to organizations who implement health and wellness programs?

- Many opportunities to use consumer technologies for health and wellness services
 - SmartPhones, Tablets, Cloud computing, SMS, . . .
- Organizations innovating in the deployment of health services generally don't have expertise in computing

Mobile Wellness Toolkit Project

- National Science Foundation project
- Partnership between University of Washington and PATH
- University of Washington
 - Richard Anderson, CSE
 - Gaetano Borriello, CSE
 - Beth Kolko, Human Centered Design and Engineering
- PATH
 - David Lubinski
 - Kiersten Israel-Ballard
 - Noah Perin



Mobile Wellness Toolkit

- Project goal:
 - Produce tools and platforms that allow organizations to develop and deploy low cost health and wellness solutions based on consumer technology
- Methodology
 - Work in partnership with health and field based partners
 - Iterative approach
 - Develop innovative technology
 - Deploy with partner in specific instance
 - Refine technology
 - Generalize to a re-usable component



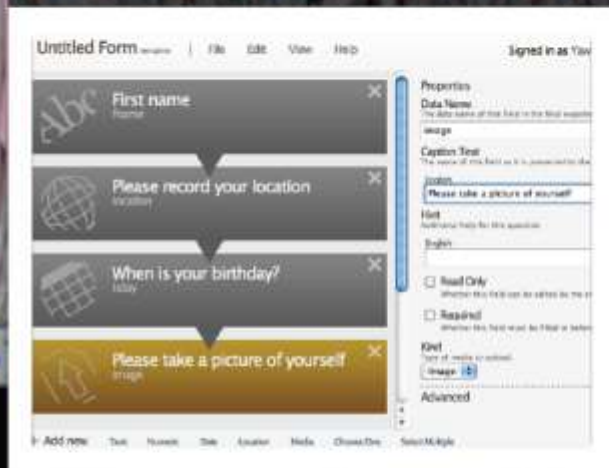
Projects

- Data collection on mobile devices
- Task support
- Decision support: use of data
- Behaviour change communication

Integrated data collection

Open Data Kit

1. Build form



2. Collect data

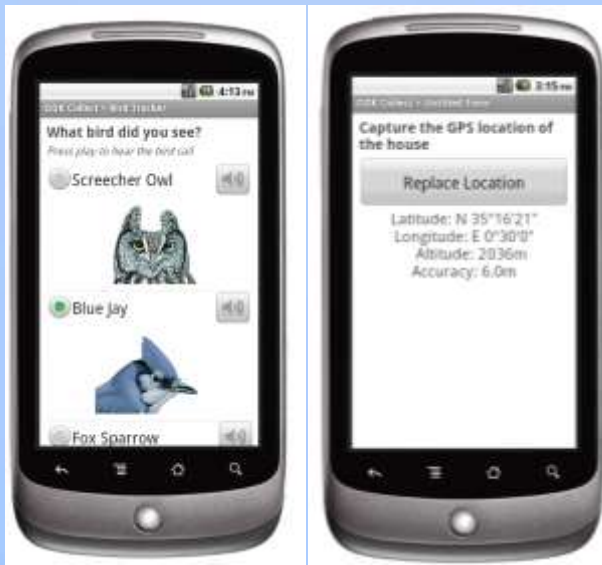


3. Aggregate results



Expand ODK Capabilities

- Support simple databases on the mobile phone
 - ODK Tables
- Data from sensors, not just entered by humans
- Already exploit built-in sensors
 - Camera for photos, video, digitizing paper forms
 - GPS, barcode scanner
- Make it easy to add *external* sensors
 - Motivated by many apps we work on in our group



ODK Tables

- Visualization of underlying database
 - Support interaction with a database instead of just submission to a database
 - Sqlite database
- Data transfer
 - Synchronized with server tables
 - Shared tables between phones
 - SMS communication
- UI features
 - Join to other tables
 - Multiple views of data (maps, graphs)
 - ODK collect to edit row contents



Joined tables

ODK Tables

Facilities

ft_facility_code	ft_facility_type	ft_facility_name	ft_target_births	ft_tot_pop
1004-0000	4	SALIMA HOSPI	2527	56153
1004-0001	1	SALIMA DISTR	16737	371938
1004-0002	11	CHITALA HEAL	454	10098
1004-0003	11	KAPHATENGA	973	21624
1004-0004	10	CHINGULUWE	600	13344
1004-0005	12	KATAWA HEAL	363	8068
1004-0006	10	KHOMBEZA HI	2319	51535
1004-0007	10	MAKIYONI HEA	1031	22911
1004-0008	10	THAVITE HEAL	1030	22890
1004-0009	16	SALIMA ADMA	1115	24772
1004-0010	12	BLM CLINIC	85	1880
1004-0011	11	BAPTIST MEDI	643	14280
1004-0012	10	LIFUWU HEAL	652	14494
22				760055

ODK Tables

Fridges

ft_equipment_i	ft_facility_code	ft_library_id	ft_model_name	ft_manu_na
R-000061	1004-0000	E003011	MK 204	Vestfrost
R-000062	1004-0001	E388M	RCW 50 EG	Dometic
R-000063	1004-0001	E3111M	TCW 2000 AC	Dometic
R-000064	1004-0001	E003004	TFW 800	Dometic
R-000065	1004-0001	F1100	Non-PQS Uprig	Unknown
R-000066	1004-0002	E391M	RCW 50 EK	Dometic
R-000067	1004-0003	E003004	TFW 800	Dometic
R-000068	1004-0003	E003011	MK 204	Vestfrost
R-000069	1004-0004	E397M	ME 214	Vestfrost

ODK Tables

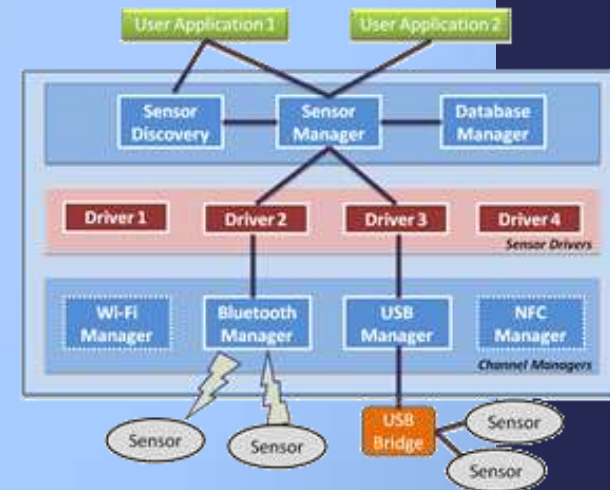
ft_facility_code:1004-0001

Fridges

ft_equipment_i	ft_facility_code	ft_library_id	ft_model_name	ft_manu_na
R-000062	1004-0001	E388M	RCW 50 EG	Dometic
R-000063	1004-0001	E3111M	TCW 2000 AC	Dometic
R-000064	1004-0001	E003004	TFW 800	Dometic
R-000065	1004-0001	F1100	Non-PQS Uprig	Unknown
R-000085	1004-0011	E385M	V 170 EK	Sibir
R-000081	1004-0012	E385M	V 170 EK	Sibir
R-000082	1004-0012	E3111M	TCW 2000 AC	Dometic

ODK Sensors

- **Build a user-level sensing framework with sensor drivers**
 - No operating system modifications
 - Allows convenient reuse between applications
- **Create a single sensor interface**
 - Access wired, wireless, and built-in sensors
 - Support multiple sensors over multiple channels
- **Focus on ease of deployment and development**
 - Distribution through existing app store model
 - Reduce complexity
 - Without adverse effects on performance



FoneAstra

- Sensor bridge for mobile phones
- Initial version for low cost phone, current efforts directed to Android phones



Practical, affordable breast milk pasteurization



- Temperature probe monitors milk temperatures
- Android mobile app:
 - Collects donor information
 - Guides user through pasteurization process based on milk-temperature
 - Prints pasteurization report and labels for processed milk-bottles
 - Uploads temperature data to server for review by supervisors

Breast milk pasteurization

- Recognized health benefits of breast milk
- Milk banking an option when breast feeding not possible
- Providing safe breast milk in low-income regions is a challenge
 - Commercial pasteurizers are expensive
 - Low-tech methods lack quality control



Pasteurization process



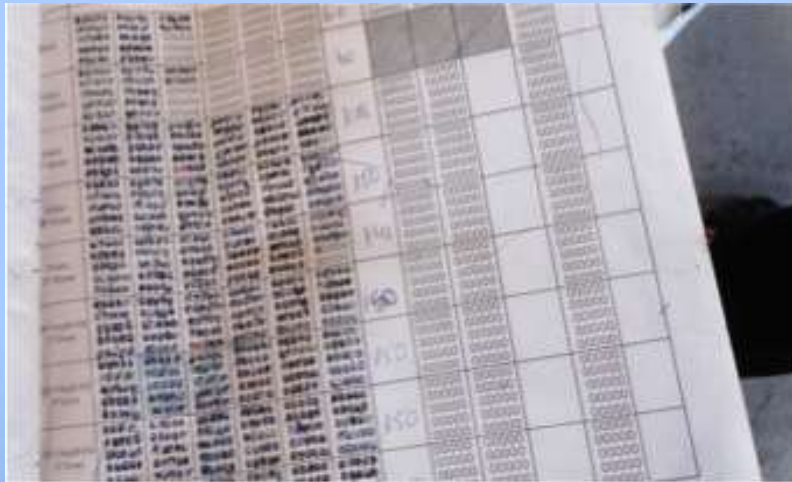
Development of FoneAstra

- Initial interface board developed for basic phone in collaboration with MSRI
- Deployment in Albania for vaccine monitoring
- Identification of HMB application
- Prototype developed and tested
 - Process design work from HCDE students
- Interface board for Android developed
- Deployment in South Africa
 - Introduction of Bluetooth printer
- Development of new interface board to support battery powered use



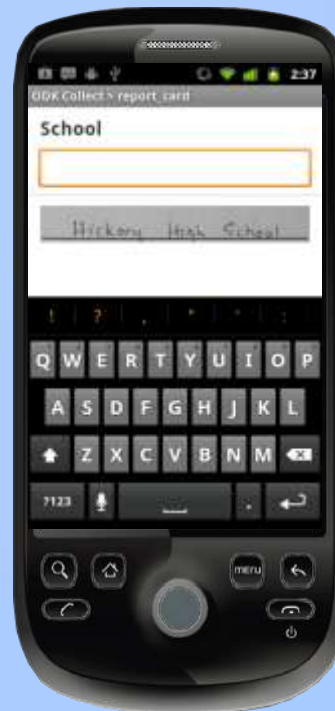
ODK Scan

- Many organizations in developing countries rely on paper forms to collect data.
- However, paper-based data is difficult to transport, analyze and aggregate.



Form input with mobile phone camera

- Users take a picture of the form using a phone camera
- Data automatically extracted from the image
- Multiple choice “bubbles” and checkboxes digitized with 99% accuracy.
- Image snippets displayed on the screen to make it easier to enter text.
- Integrated with ODK Collect



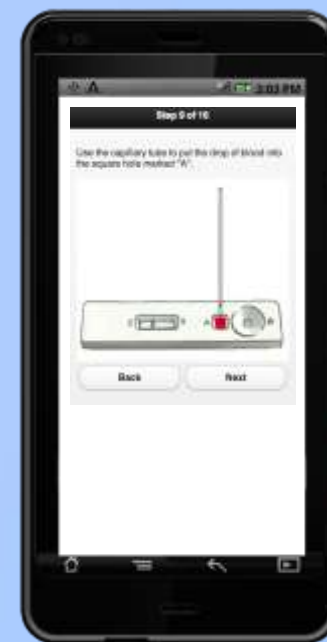
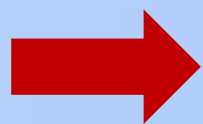
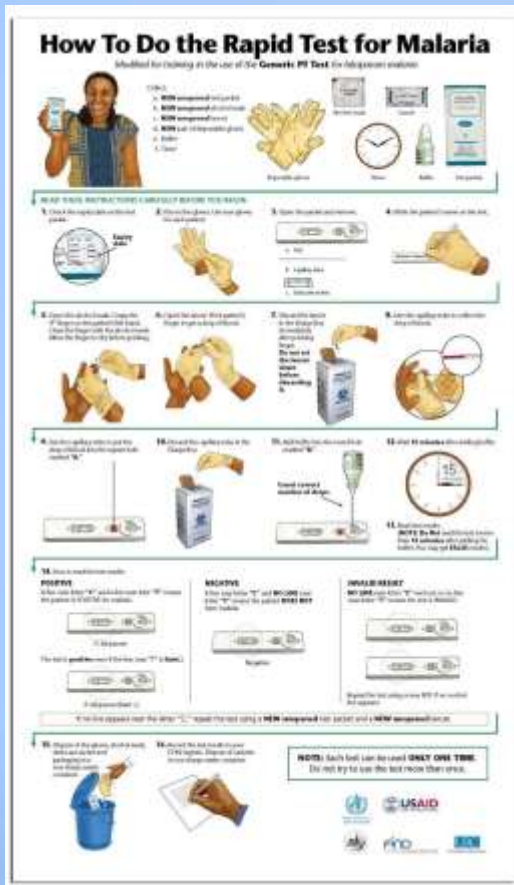
Deployments

- Technical implementation and initial evaluation completed
- Ongoing deployment with health workers in Mozambique
- User study quantifying the benefits of digitizing data



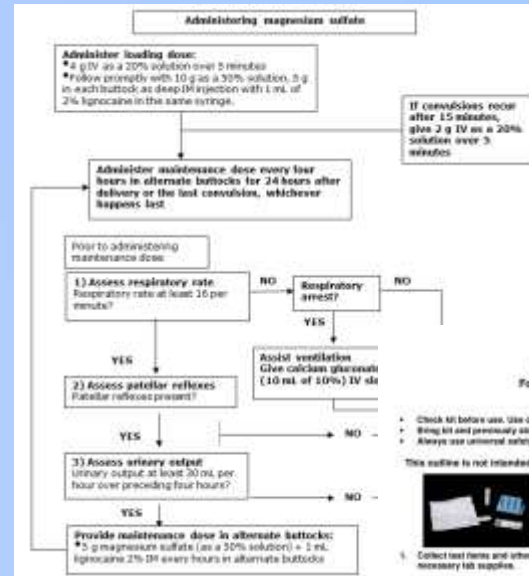
Task support

Job Aids: Smartphone Apps for health workers



Job Aid framework

- Functionality for job aids
 - Clear wayfinding
 - Decision trees
 - Calculators
 - Timers
 - Animated images
- Environment to support creation of electronic job aids by non-programmer
- Usability considerations critical
- Is 'hands free' operation possible?



OraQuick HIV Rapid Test

For use with whole blood, serum or plasma
Store kits: 2 - 30° C

- Check kit before use. Use only kits that have not expired or been damaged.
- Bring kit and preciously stored specimens to room temperature prior to use.
- Always use universal safety precautions when handling specimens. Keep work areas clean and organized.

This sulfate is not intended to replace the product insert or your standard operating procedure (SOP).

1. Collect test items and other necessary lab supplies.
2. Set reusable stand on a flat, level surface. Partially remove device from package and label device and the developer stat with client identification number.
3. Carefully uncap the developer vial and pour vial into the stand.
4. Collect approximately 3 µl of specimen using a new disposable loop.
5. Transfer the collected specimen to the vial.
6. Stir the specimen in the vial with the loop.
7. Insert the device peel completely into the vial with the result window facing forward.
8. Wait 20 minutes (no longer than 30 min.) before reading the results.
9. Read and record the results and affix pertinent info on the worksheet.

OraQuick HIV Rapid Test Results

Reactive	Non-reactive	Invalid
3 lines appear in both the control and test areas.	1 line appears in the control area and no line in the test area.	No line appears in the control area. Do not report invalid results. Repeat test with a new test device even if a line appears in the test area.

Use of trade names and commercial sources is for identification only and does not imply endorsement by WHO, the Public Health Service, or by the U.S. Department of Health and Human Services (DHHS).

Point of care diagnostics

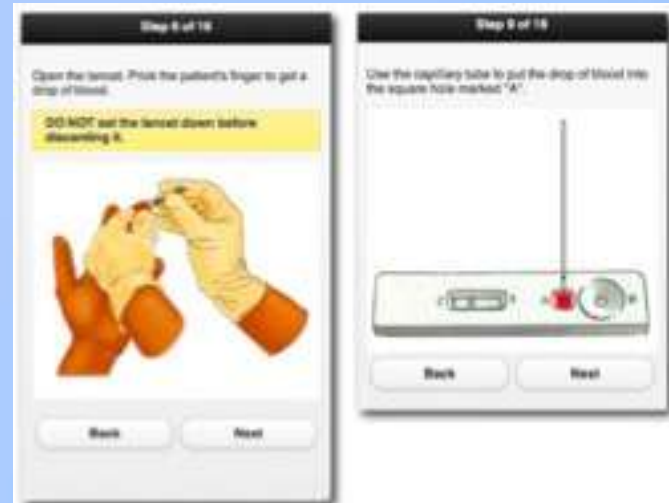
- Rapid diagnostic tests (RDTs) quickly test for conditions based on blood/urine sample
- Supportive tools to aid health workers with the administration and interpretation of these tests.



Android based point-of-care diagnostic system

Diagnostics aids health workers in 3 ways:

1. As a platform for creating digital job aids for RDTs.
2. By automatically interpreting the test results using computer vision algorithms running locally on the phone.
3. By automatically collecting data about the type and outcome of the RDT.



Project status

- Technical implementation and initial evaluation completed
- Initial results suggest that the system is ready to be field tested with health workers.
- Study based on optical samples from organization deploying wide range of RDTs.



Pulse Oximetry for detection of childhood pneumonia

- Include blood oxygen readings into Integrated Management of Neonatal & Childhood Illness
- Protocol implemented on Android tablet
- Connection with bluetooth and USB pulse oximeters



Decision making: Use of data

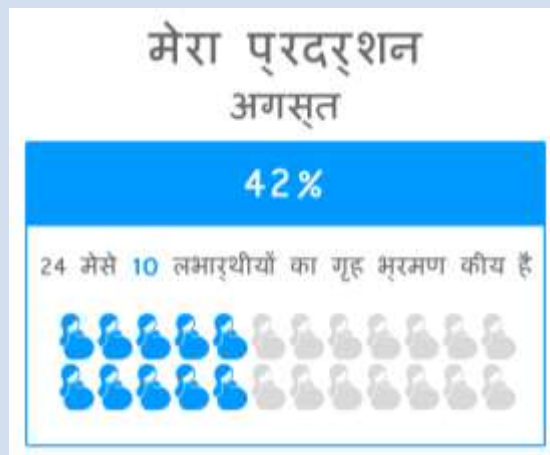
Supervision Support for Community Health Workers

- CHWs responsible for household visits
- Supervisors track performance and deliver feedback
- Mobile phones used by CHWs for data collection
 - Commcare, application developed by Dimagi
- Augmented to send CHWs images showing performance



Sending performance feedback

Individual feedback



Peer comparison



Health system visualization

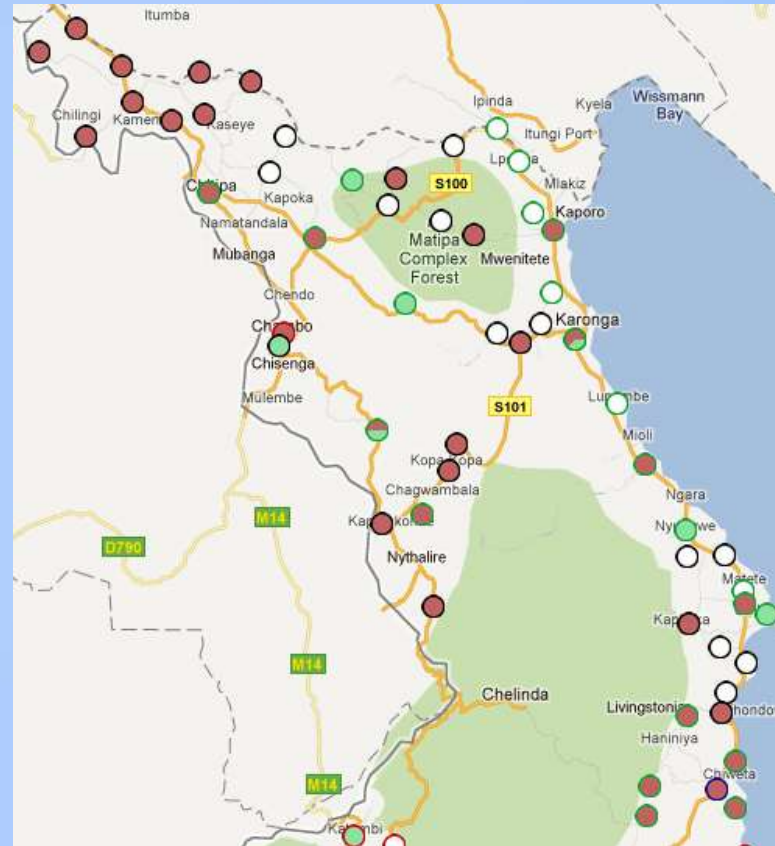


Health system inventories

- National database of health facilities, assets, and indicators
- Example, Kenya cold chain inventory, 4,000 facilities
 - Facility information
 - Demographics
 - Infrastructure
 - Cold chain equipment
 - Refrigerators with status
 - Cold boxes
 - Other equipment
- Challenge
 - Make this information available for management
 - Support simple modeling
 - Add a new vaccine to the routine immunization - how does that impact required cold chain capacity?

Vaccine cold chain

- Refrigerators for storing vaccines
- Important component of immunization system
- PATH developed Cold Chain Equipment Manager
 - Inventories of multiple countries in Africa
 - Support for India cold chain assessment



Health System Visualization Tool

- Support national and regional managers in decision making
 - Geographic visualization
 - Simple modeling
- Usability and meeting stakeholder needs central to project
- Technical challenges
 - Allowing customization for multiple data sets
 - Easy to use mechanism to support modeling
 - Visualization of multiple indicators at same site
 - E. g., energy sources, population, refrigerator types, capacity shortages
- Browser based implementation supporting online and offline use
 - Likely to use D3 for visualization

Behaviour Change Communication

Reminder and Encouragement Systems

- Messaging systems to clients
 - Assume basic mobile phones (SMS + Voice)
- Escalating reminders (SMS followed by voice) more effective than just SMS
- Two way messaging – soliciting response by SMS
- Evaluate impact of different approaches to messaging
- Develop backend to support complex messaging

Testing SMS messages

Control Group

No intervention.

One-way SMS

Pregnant woman receives twice-weekly SMS with health information relevant to her health and her stage of pregnancy.

Two-way SMS

Pregnant woman receives twice-weekly SMS requesting a reply.

Hypothesis that woman's reply can be a proxy for engagement and uptake of health services.

Web-based system for managing messages

ENCOURAGEMENT SYSTEM LOGOUT

Abuya Abasi

Patient List Sort by Priority

- Abuya Abasi**
No reply for 4 days
- Mukami Adoyo**
4 incoming messages
1 message was not sent successfully
- Hamisi Omondi**
2 incoming messages
- Murugi Onyango**
1 incoming message
- Elinah Atieno**
1 incoming message
- Adila Michieka
- Eucabeth Owiti
- Adla Otieno
- Eucabeth Adovo

TO: ABUYA

Enter Message...

9 / 160 characters, 1 message **SEND**

Patient Information

- CLIENT NUMBER: #08372923
- NAME: Abuya Abasi
- PHONE NUMBER: +254 722 002100
- PROBLEM LIST: Anemia
- BIRTHDAY: 10-30-1988
23 years 4 months old
- STATUS: Pregnant
- EDD: 8-20-2012
10 weeks
- EDUCATION COMPLETED: 8 years
- LANGUAGE: English
- MESSAGE FREQUENCY: 5 days
- TIME: 8-10 p.m.

Communication History Dialogue View

YOU: 12 mins ago
Stop eating fish first and visit the clinic as soon as possible. ✓

Abuya: 30 mins ago
I don't know if I should eat fish or not. It makes me itchy.

Abuya: 36 mins ago
Is fish good for pregnant woman?

YOU CALLED 02-07-2012
Patient is okay. She didn't response

Digital Public Health

- Health education based on community created video
- Build on model developed by Digital Green
- Projects in Seattle and Uttar Pradesh



Community Video Education

- Video based education where content is both created and presented by the community
 - Localization of content and messaging
 - Community engagement and empowerment
- Enabled by low cost consumer digital video technology



Piloting Digital Public Health

Pilot objectives

- Develop a strategy for implementation
- Assess and evaluate feasibility of integrating mobile videos into routine community-based support

Digital Green, PATH, Sure Start Partnership

- Community based partner, Gram Vikas Sansthan
- Bachhrawan Block, Raebareli District, Uttar Pradesh, India

Focus on maternal health messaging using SureStart materials

Develop methodology in 20 villages



Thanks!

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