

Monitoring and Improving Rural Tuberculosis Treatment

Bill Thies

Microsoft Research India

In collaboration with Manish Bhardwaj^{1,2},
Sara Cinnamon^{2,3}, Goutam Reddy^{2,3}, Emma Brunskill^{1,2},
Somani Patnaik^{1,2}, Seema Kacker^{1,2}, Sourav Dey^{1,2} and Ajit Dash^{1,2}

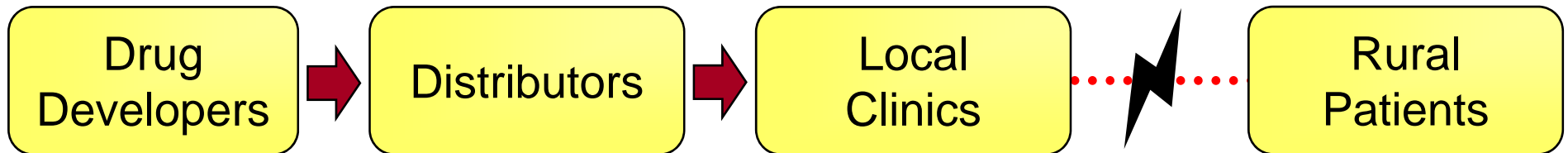
¹Massachusetts Institute of Technology

²Innovators In Health

³Abiogenix, Inc.

April 28, 2009

Drug Delivery: Last-Mile is Broken



- TB treatment: 4 drugs, 6-8 months
 - Worker supervises ingestion 3 times/week (DOT)



Courtesy PIH



Courtesy PIH

- Rural programs operate in the dark
 - Interaction: Are workers reaching patients?
 - Adherence: Are patients taking medication?
 - Health: Are patients getting better?

Our Mission: Track Interaction, Adherence, Health



The uBox: A Smart Pillbox

Developed by Abiogenix, MIT, and Innovators In Health

■ The uBox monitors

- Delivery, by logging patient/worker visits
- Adherence, by logging pills dispensed

■ uBox impact

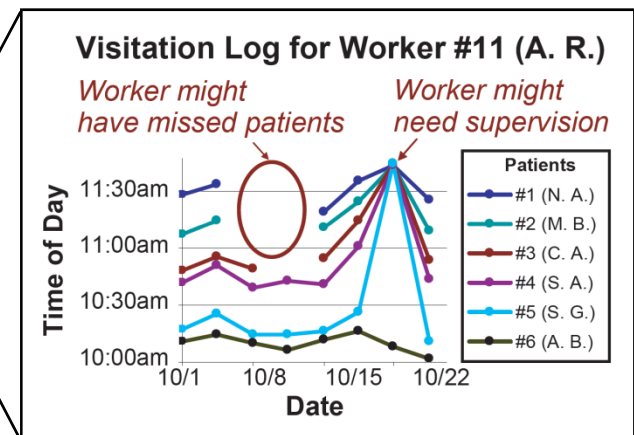
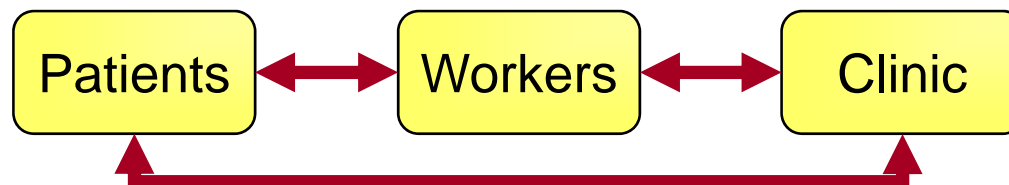
- Worker supervision and incentives
- Timely and targeted intervention
- Lowers adherence burden



uBox
(one per patient)



uKey
(one per patient,
one per worker)



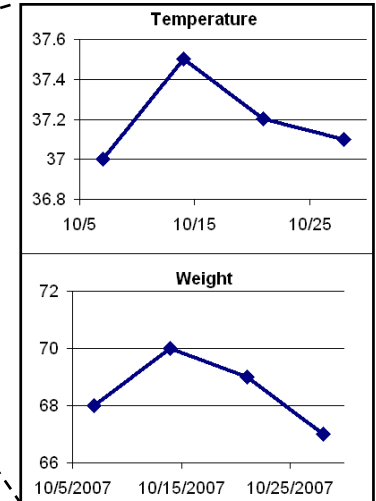
The uPhone: Monitoring Patient Health



Worker
relays vital patient health indicators using cell phone



Nurse
analyzes data, identifies problems



Patient
lives in a remote area



Physician
sends advice to patients, schedules field visits



Is Technology Really the Answer?

- Often ignores systemic and societal issues
- But, delivery is overwhelmingly about diligence
 - Today: 2.4M doses/day, 187 countries, 77% reliability
 - Need: 7M doses/day, 100% reliability
 - FedEx: 7.5M shipments/day, 220 countries, 97.7% reliability
- Our goal is to reduce the burden of diligence
 - Change the culture: 85% is not enough
 - Need to respond to every failed transaction
 - Identify superstar workers early and replicate techniques



Iterative Design: UBox

Bihar, Jan. 2008



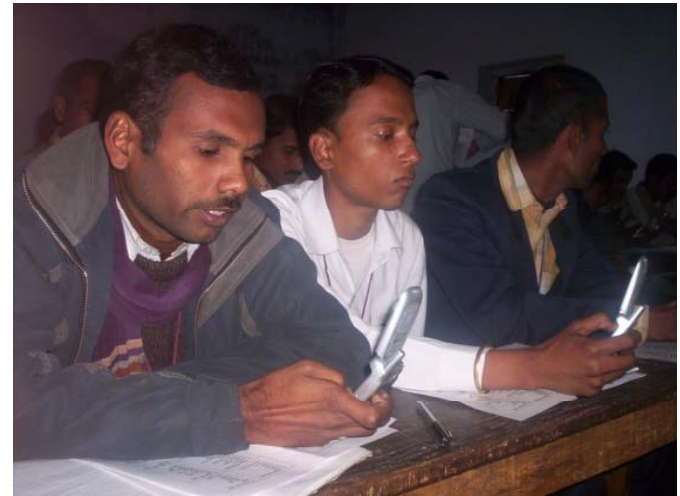
- Class proficient in less than 3 hours
- Incorporated feedback into 9th design revision



Iterative Design: UPhone

Bihar, Jan. 2008

- uPhone more challenging
- Despite intensive training, many errors on menu-based interface



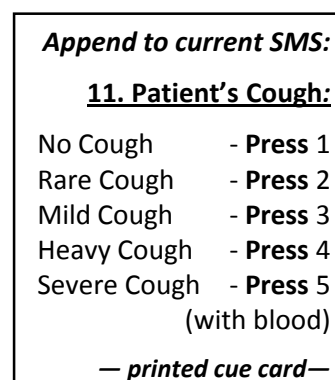
Controlled Study

Gujarat, July 2008

Patnaik, Brunskill, & Thies [ICTD'09]

- Compared three interfaces for health data collection

13 literate health workers & hospital staff, Gujarat, India



	Electronic Forms	SMS	Live Operator
Error rate (errors / entries)	4.2% (12/286)	4.5% (13/286)	0.45% (1/ 220)

Result caused partners to switch from forms to operator



The Case for Live Operators

- Operators are good solution for mobile data collection
- Benefits:
 - Lowest error rate
 - Less education and training needed
 - Most flexible interface
 - Cost effective



Establishing a Treatment Program

Bihar, Oct. 2008



- Found few established DOT providers in rural Bihar
- With Innovators In Health and the Prajnopaya Foundation, training local health workers and staff
- Next step: controlled trial, measure impact on health outcomes



Open Problem

- How to prove that a health worker visited a patient?

- Criteria:

- Low cost
- Instant notification
- Fool-proof



- Possibilities:

- ID tags? *Not fool proof.*
- Finger-print reading? *Not low-cost?*
- Speaker identification? *TBD.*

