Monitoring and Improving Rural Tuberculosis Treatment

Bill Thies
Microsoft Research India

In collaboration with Manish Bhardwaj¹,², Sara Cinnamon²,³, Goutam Reddy²,³, Emma Brunskill¹,², Somani Patnaik¹,², Seema Kacker¹,², Sourav Dey¹,² and Ajit Dash¹,²

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)

- 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

![Diagram showing patients, workers, and clinic with uBox and uKey](image)
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

<table>
<thead>
<tr>
<th>Electronic Forms</th>
<th>SMS</th>
<th>Live Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Error rate</td>
<td>4.2%</td>
<td>4.5%</td>
</tr>
<tr>
<td>(errors / entries)</td>
<td>(12/286)</td>
<td>(13/286)</td>
</tr>
</tbody>
</table>

Append to current SMS:
11. Patient’s Cough:
- No Cough
- Rare Cough
- Mild Cough
- Heavy Cough
- Severe Cough
(with blood)

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.