Mobile Phones for Global Health

Rowena Luk
Mission

“Dimagi’s mission is to integrate innovative technology into global public and private services in order to improve human health and wellbeing.”
ABOUT DIMAGI

▪ Founded in 2002 at Harvard and MIT Media Lab
▪ Successful track record of developing diverse & innovative technology solutions for healthcare
▪ Core team of Dimagi experts collaborates with >50 institutional and individual partners
▪ Experience with US and Global healthcare delivery best practices spanning 25+ countries
▪ Leadership in healthcare Open-Source development
▪ Highly qualified team with physicians, scientists, public health experts, engineers and management consultants
▪ Offices in Boston, USA and New Delhi, India. Opening in Cape Town, SA in first part of 2012.
Dimagi’s Impact Through Technology

CHW in Uganda doing antenatal survey

SmartCare touchscreen for data entry

Cervical imaging for tele-consultation

A Zambian mother receiving a smart card
Mobile Based Data Exchange Platforms

- SMS
- "Feature" Phone Apps
- Smart Phone Apps (Android)*
DIMAGI’S OPEN SOURCE PRODUCTS

- **CommCare**: tools for use by extension workers
  - Since 2008, over 20 deployments in 12 countries with wide range of partners
  - Preliminary evidence to show improves access, quality, experience, and accountability of care.
  - Incorporated into many large projects, including Gates/MOTECH in Bihar India

- **CommConnect**:
  - SMS-based outreach
  - Integrated with CommCare
  - Incorporates ARemind technologies

- **CommTrack**:
  - SMS-based support for logistics/supply chain management
SMS for Adherence
SMS STUDIES WE’VE WORKED WITH

- **Real-Time Adherence Monitoring for HIV Antiretroviral Therapy.** Haberer, Bangsberg et al. AIDS AND BEHAVIOR. Volume 14, Number 6, 1340-1346, DOI: 10.1007/s10461-010-9799-4

- **Effects of a mobile phone short message service on antiretroviral treatment adherence in Kenya (WelTel Kenya1): a randomised trial.** Lester et al. The Lancet - 27 November 2010 (Vol. 376, Issue 9755, Pages 1838-1845)

- **Randomized Controlled Trial of a Personalized Cellular Phone Reminder System To Enhance Adherence to Antiretroviral Therapy.** Hardy, Skolnik et al. AIDS Patient Care & STDs. 2011 March; 25(3): 153-161. DOI: 10.1089/apc.2010.0006
ARemind : SMS for Reminders & Adherence

- ARemind is an SMS based personalized reminder system which incorporates latest electronic messaging technologies and dynamically integrates patients’ interests to improve adherence

- Implemented in the field and being validated through NIH-funded clinical studies at Boston Medical Center

  ➢ In Phase I, a pilot study 75% of subjects supported feasibility & usefulness of cell technology (N=23). ARemind Phase I study, Aremind users had higher adherence rates to ART over a 6 wk period versus beeper users

  ➢ In Phase II, 4 studies with total of 100 subjects are being undertaken at Boston Medical Center

1: J Wise, et al. AIDS Pt Care 2008; 22(6);
**ARemind: Personalized SMS Reminders**

- User Prefs
- RSS Feeds
- Patient History
- Medical Record

- Personalized SMS Reminders
- Entertainment
- News
- Etc.
- Smart clustering based on past behavior
- Other medical conditions
- Appointment schedule

### Registered Patients

<table>
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<tr>
<th>Patient ID</th>
<th>Site</th>
<th>Days Post-Op</th>
<th>Registered on</th>
<th>Phone</th>
<th>Notifications (day)</th>
<th>Followup Visit</th>
<th>Final Interview</th>
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</table>

- not signed up for notifications

**export to CSV • get message log**
ARemind NIH Study: Pilot

- Prospective, 2-arm randomized pilot cohort study (Beeper vs ARemind)
- Inclusion Criteria: HIV, > 18 year old, on ART x 3 mo, \( \leq 85\% \) adherence (Self Recall, past 3 days)
- 6 wk follow-up, In person interview @ baseline, wk 3, wk 6
- 820 screened, 23 randomized in 2 arms, 4 dropped out

• Adherence Measures used were
  - MEMS (wk 3, wk 6)
  - Pill count (PC, baseline, wk 3, wk 6)
  - Self-report (SR, baseline, wk3, wk 6)
  - Composite adherence score: MEMS / PC / SR (Calibration to MEMS values or pill count)
ARemind NIH Study: Pilot Results

- In Week 3
  - Mean of 24 ± 10 reminders sent per wk & per person
  - 73% overall response rate per person and per wk
  - Wk 3 - Composite Adherence Score / Time to Response (-0.58, p=0.07)
  - Wk3 - PC/TR(-0.6, p=0.05)

Questions Raised

- Fatigue: Lower responsiveness by Week 6
- Content: Despite initial excitement, content didn’t matter (...???)
- Frequency: Daily might not be the right frequency
ARemind: Workflow

ADHERENCE MEASUREMENT

- We explored:
  - Fatigue
  - Content
  - Frequency

ARemind

SMS (text messaging) 4-Day Recall

Missed Doses?

How many doses did you miss yesterday?

IVR (automated voice) 4-Day Recall

Count the number of pills in each bottle.

Counselor-Initiated Unannounced Pill Counts

Wireless Pillboxes

ADHERENCE SUPPORT

Appointment and drug intake schedules

Appointment Reminders

EMR / Patient Health Record

RSS Feeds
- Entertainment
- News etc

Patient’s Interests Preferences

SMS Reminders

ARemind

CommCare
ARemind: Workflow

**ADHERENCE MEASUREMENT**

We explored:
- Fatigue
- Content
- Frequency

**SMS (text messaging)**
- 4-Day Recall

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**ADHERENCE SUPPORT**

- Appointment and drug intake schedules
- EMR / Patient Health Record
- Appointment Reminders
- Adherence-Based Encouragement
- SMS Reminders
- RSS Feeds - Entertainment - News etc

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**Patient’s Interests & Preferences**

**Counselor-Initiated Unannounced Pill Counts**

**Wireless Pillboxes**

**ARemind**
ARemind NIH Study: Phase II RCT

• In 2010, the NIH funded a 2 year Phase II grant for the commercialization of ARemind.

  - Three small clinical studies with a total of 115 patients at Boston Medical Center to evaluate unannounced phone based pill count, SMS & IVR based reminders for adherence
  - Clinic appointment adherence module
  - Web based adherence report
  - Personalized SMS reminders with interest based content from over different RSS feeds
  - Can integrate with MEMS caps
  - Integration with Social media applications possible
  - Expected completion: July 2012. NIH fund matching Phase III investments possible.
CommCare
SPECIFIC CHALLENGES

**Access to Care**
- Many eligible clients not enrolled
- Missed visits
- Staff/CHW attrition

**Quality of Care**
- Short visits
- Key steps skipped
- Sensitive issues avoided
- Insufficient training

**Accountability**
- Monitoring reports delayed
- Data quality low
- Only aggregate data delivered
SUMMARY OF BENEFITS

Access to Care
Reminders increase timeliness of visit
Encouragement to increase enrollment
Increased retention

Quality of Care
Checklists
Decision support
Video & audio convey sensitive topics
Audio prompts help low-literacy users

Accountability
CommCareHQ provides real-time monitoring of daily activity of each CHW
Dimagi’s Active Data Management improves workforce performance
COMMERCARE
(VIDEO)
COMMERCARE: A GENERIC, PRODUCT-CENTRIC APPROACH

CommCareHQ (cloud-based server)

Global Client List, Visit Schedules, Authoring tools, Reports, Data Export, Secure backup.

Data Sent to HQ:
Registrations,
Client data
Visits: who, when, duration

Data Sent From HQ:
Reminders,
Encouragement
Form updates

Data Collection:
Registration forms, Follow-up Forms

Client Records

Checklists and Protocols,
Decision Support

Multimedia

CommCare Mobile Clients (CHWs phones)
Countries
- Afghanistan
- Bangladesh
- India (12)
- Malawi (D-tree)
- Mexico
- Mozambique (2)
- Nicaragua
- South Africa
- Tanzania (D-tree)
- USA, Zambia, more...
- 22 countries (that we know of)

Core Funding
- Bill and Melinda Gates Foundation
- IDRC
- UN Foundation
- Norwegian Government
- Rockefeller Foundation
- USAID
- Vodaphone Foundation
- Wellcome Trust
ACCESS TO CARE (WORK BY BRIAN DERENZI ET. AL ‘2012)

- 85% More timely Visits
- Randomized Controlled Trial

QUALITY OF CARE

- Intrahealth Preliminary Result in India:
  - ASHAs had increased their knowledge retention of at least 3-5 key danger signs from 48% at baseline to 70%
- Improvement in IMCI protocol adherence

<table>
<thead>
<tr>
<th>Investigation</th>
<th>Current practice adherence</th>
<th>e-IMCI adherence</th>
<th>p-value</th>
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<tbody>
<tr>
<td>Vomiting</td>
<td>66.7% (n=24)</td>
<td>86% (n=28)</td>
<td>-</td>
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<tr>
<td>Chest indrawing</td>
<td>75% (n=20)</td>
<td>94% (n=18)</td>
<td>-</td>
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<tr>
<td>Blood in stool</td>
<td>71% (n=7)</td>
<td>100% (n=3)</td>
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<tr>
<td>Measles in the last 3 months</td>
<td>56% (n=9)</td>
<td>95% (n=21)</td>
<td>&lt; 0.05</td>
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<tr>
<td>Tender ear</td>
<td>0% (n=1)</td>
<td>100% (n=5)</td>
<td>-</td>
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<tr>
<td>All</td>
<td>61% (n=299)</td>
<td>85% (n=359)</td>
<td>&lt; 0.01</td>
</tr>
</tbody>
</table>

(Work by Brian DeRenzi et. al CHI 2008)
ACCOUNTABILITY
(WORK BY BEN BIRNBAUM ET. AL. DEV 2012*)

- Detecting Surprising Answers
- Analyze distributions of answers by a CHW.
- Example
  Question: Did you give any referral in this household?
  Overall: 93% No, 7% Yes
  CHW #3: 62% No, 38% Yes
- Detects systematic errors
- Supports quality control

*Best Paper Award
TWO LARGE EVALUATIONS PLANNED FOR 2012

1. Randomized controlled study in Bihar
   - Partnering with CARE and Mathematica Policy Research
   - 12-18 month study starting in April 2012
   - Will study 600 CHWs using CommCare compared to control group not using CommCare
   - Will study impact of CommCare on knowledge, uptake of services, and health outcomes

2. Factorial randomized controlled study
   - Will study 130-250 CHWs using CommCare
   - Will test different motivation and supervision techniques, for impact on CHW behavior and health outcomes
THANK YOU

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Additional Resources:
http://www.commcarehq.org
http://www.dimagi.com