Computing and Global Health
Lecture 6
Patient Support

Winter 2015
Richard Anderson
Today’s topics

- Trevor Perrier, SMS
- Phone messaging
- Messaging technologies
- Example Projects
- Messaging studies
- Adherence
- Health information systems
Readings and Assignments

- SMS For Life
- WelTel Study
- Iron Tablet Adherence Study

- Homework 6
  - Design an SMS syntax for cold chain reporting

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
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<tbody>
<tr>
<td>Jan 7, 2015</td>
<td>Overview</td>
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<td>Jan 14, 2015</td>
<td>Surveillance</td>
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<td>Jan 21, 2015</td>
<td>Tracking</td>
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<td>Jan 28, 2015</td>
<td>Medical records</td>
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<td>Feb 4, 2015</td>
<td>Logistics</td>
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<td>Feb 11, 2015</td>
<td>Patient support</td>
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<td>Feb 18, 2015</td>
<td>Treatment support</td>
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<tr>
<td>Feb 25, 2015</td>
<td>Health worker support</td>
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<tr>
<td>Mar 4, 2015</td>
<td>Behavior change</td>
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<tr>
<td>Mar 11, 2015</td>
<td>Finance</td>
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Organization

- Patient support
- Treatment support
- Worker support
- Behavior Change Communication
Patient Support

• Messaging
  – Spam
  – Reminders
  – Interaction
  – Adherence messaging

• Adherence (other than messaging)

• Information services
Phone Messaging

• Different types of messaging
  – What is the intended behavior to be influenced
  – What is the theory of behavior change

• Health knowledge

• Promotion of a specific activity

• Reminder of action

• Interaction with health system
Adherence

• Medication
  – HIV ART
  – Tuberculosis
  – Diabetes
  – Iron Pills

• Lifestyle
  – Diet
  – (Not) smoking
Obstacles to Adherence

• Why do people stop taking medication?
Reminders

- Appointment reminders
  - ANC visits
  - TB Testing
- Immunization reminders
- Long term birth control
Technology

• SMS, Voice, Smartphone Apps, Social Media
Personal mobile phones

• Mobile phones have tremendous reach, but
  – Vast variety in different situations
  – Rapid change
Mobile Phone Issues

• Handsets
  – Generally available, prestige good

• Airtime
  – Prepaid. Costs vary dramatically

• Signal
  – Widely available, spotty coverage, no coverage

• Electrical power
  – Depends on the electrical grid

• Simcards

• Monopolies
Mobile Phones and Gender

• Phone ownership models
  – Shared across household (less common)
  – Household phone
  – Individual phones

• Common practices
  – Men have better phones than women
  – Children have access to mother’s phone
SMS

• Available on almost all mobile phones
• Restricted message length
• Highly variable cost
  – Although essentially no cost for carrier
• Highly variable usage
  – Different populations and countries
• Gateway Issues
• SPAM!
Voice

• Universal on phones
• IVR – Interactive Voice Response
• Automated calls with recorded messages
• Callbacks triggered by missed call
Smartphone Apps and Social Media

• Applicability depends on demographics
• Rapid change
• For global health, often an emphasis in reaching late adopters
Example projects
Walter Curioso

• Early work in SMS reminders in Latin America
  – Voxiva

• Messages aimed at high risk populations to influence behavior

• Many issues around confidentiality and privacy
Free t4b msg: Morning sickness may be caused by a change in your hormones. Try eating crackers or dry cereal. Eat small meals often. Don’t go without eating.
Mobile Technology for Community Health (MOTECH)

• Platform developed by Grameen Foundation with support from BMGF
  – Motechsuite.org

• Evolving platform

• Significant deployment through BMGF grantees in Bihar

• Initial work in Ghana
MOTECCH Architecture

Communication Systems
- Nuntium, Telcos, etc.
- Verboice, Telcos, etc.

Modules
- SMS
- IVR
- Pill Reminder
- Comm Care
- Open MRS
- ...

Core Platform
- Tasks
- Metrics
- Event System
- Scheduler
- Data Services
- Admin
- OSGi Container

External Health Systems
- CommCare HQ
- OpenMRS

Event Queue

SQL
Motech Ghana

- Initial deployment in Northern Ghana
- Early version of Motech developed to support deployment
- Maternal messaging and phones for nurses
Lessons learned

• Phones for nurses
  – Phone management and logistics
  – Nurses did not feel the phones helped them in reporting

• Messaging
  – Voice, not SMS
  – Tremendous challenges in localization
    • Expense for translation
  – Cost and sustainability challenges
  – Significant formative work in identifying needs
Evaluation Studies

• Very different approaches to evaluation based on discipline
• Medical evaluation
  – Define intervention
  – Construct study design
  – Enroll study subjects in different arms
  – Conduct study without further intervention
• Computer Science
  – Develop technology with initial field tests
  – Deploy technology in field with iterative adjustments
  – Analysis of multiple sources of ad hoc data from deployment
  – Promote large scale deployment or use
WelTel Study

- HIV Patients on ART
- Simple intervention
  - Send patients a weekly SMS: Mambo
  - Patients respond: Sawa / Shida
- Measured outcomes
  - Self reported adherence
  - Viral suppression
WelTel Study

![Diagram showing study design and outcomes]

**Table 2: Primary and secondary outcomes**

<table>
<thead>
<tr>
<th></th>
<th>SMS group (number [%])</th>
<th>Control group (number [%])</th>
<th>RR (95% CI) *</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary outcome</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intention-to-treat analysis?</td>
<td>168 (62%)</td>
<td>132 (50%)</td>
<td>0.81 (0.69-0.94)</td>
<td>0.006</td>
</tr>
<tr>
<td>Self-reported adherence (+95%)</td>
<td>156 (57%)</td>
<td>128 (48%)</td>
<td>0.85 (0.72-0.99)</td>
<td>0.04</td>
</tr>
<tr>
<td>Viral suppression (+400 copies per mL)</td>
<td>168 (91%)</td>
<td>132 (91%)</td>
<td>1.00 (0.94-1.07)</td>
<td>0.94</td>
</tr>
<tr>
<td>Complete-case analysis†</td>
<td>156 (75%)</td>
<td>128 (66%)</td>
<td>0.88 (0.77-1.00)</td>
<td>0.047</td>
</tr>
<tr>
<td>Self-reported adherence ‡</td>
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<tr>
<td>Secondary outcomes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total attrition (missing)</td>
<td>53 (19%)</td>
<td>61 (23%)</td>
<td>1.24 (0.82-1.89)</td>
<td>0.31</td>
</tr>
<tr>
<td>Loss to follow-up</td>
<td>17 (6%)</td>
<td>27 (10%)</td>
<td>1.69 (0.91-3.23)</td>
<td>0.094</td>
</tr>
<tr>
<td>Mortality</td>
<td>25 (9%)</td>
<td>30 (11%)</td>
<td>1.27 (0.72-2.22)</td>
<td>0.42</td>
</tr>
<tr>
<td>Withdrawal</td>
<td>7 (3%)</td>
<td>3 (1%)</td>
<td>2.26 (0.59-8.67)</td>
<td>0.341</td>
</tr>
<tr>
<td>Transfer out</td>
<td>4 (1%)</td>
<td>1 (0%)</td>
<td>0.25 (0.19-2.17)</td>
<td>0.38</td>
</tr>
</tbody>
</table>

Percentages do not add up to 100% in some cases because of rounding. *For non-adherence or virologic failure. †273 patients in the SMS group and 265 in the control group. ‡Because the intention-to-treat analysis classified all patients with missing data as non-adherent or having viral failure, the number of adherent patients and number of patients with viral suppression are the same here as in the intention-to-treat analysis. $185 patients in the SMS group and 145 patients in the control group. ||Fisher’s exact test.

**Figure 3: SMS intervention response rates**

The graph is truncated at 12 months’ follow-up. A line is drawn at 3 months indicating the usual transition to HIV disease stability and reduction in toxicities after initiation of antiretroviral therapy.
Adherence to Iron Pills

• Evaluate if voice messaging improves adherence to taking pills

• Study goal – evaluate mHealth intervention with measurable health outcome
  – Anemia is highly prevalent for low income women in India
  – Simple treatment – iron pills
  – Measurable results – Hemoglobin test
Sian Hospital Study

• High anemia rates, low utilization of iron pills
  – Pills available for free, but 70% of women fail to take them
    • Forgetfulness, dislike of pills
  • Intervention
    – Recorded voice calls from doctor
    – Three messages per week in local language
    – Positive, affective messages

Hello, this is Dr. Niranjan Pai. We met in Sion Hospital. Your backache may increase. Don’t worry, take rest. Take the prescribed pills regularly as they are important for you and your child’s health. I will call you again in a couple of days. Thank you
Results

• Slight positive results, treatment superior to control, but not statistically significant

• What went wrong
  – Study failed to enroll sufficient number of subjects who completed study
  – Difficulty in following up to get final Hb
  – Early subjects had to be de-enrolled due to poor quality Hb measurements
How to do a literature review

- Determine if there has been prior work on assessment of voice based adherence support in developing countries.

On PubMed and IEEE Xplore, we included all studies that contained both an adherence keyword and a phone keyword in the title or abstract, with at least one of the keywords appearing in the title. For adherence keywords, we used “adherence”, “adhere”, “adhered”, “compliance”, “comply”, and “complied”. For phone keywords, we used “phone”, “phones”, “telephone”, “telephones”, “interactive voice”, “voice response”, “automated calls”, and “automated voice”. 

Figure 1: Overview of the literature review.
Adherence

• Direct Observation Therapy
TB Drug Distribution

• Fingerprint scanning in drug distribution
SMS Reporting

- Send confirmation code associated with each pill
Pill box notifications
Health Information
Awaaz De

[Diagram showing the interaction between a Caller, Awaaz.De, and a Responder, with intermediate involvement of a Community Manager.]

2/11/2015

University of Washington, Winter 2015
Health Line, Pakistan

- Voice based health information system
- Target low-literate users

Fig. 3. Block diagram of HealthLine system components.

- Speech recognition research challenges
Next week

• Treatment Support