Computing and Global Health

Richard Anderson
Undergraduate Research Seminar
January 20, 2012
Computing and Global Health

- Broad interest in introducing computing based solutions to health challenges
- Rapidly changing technological landscape
Research Domains

- ICTD / CHANGE
- Mobile Wellness Toolkit: NSF Project
  - Anderson/Borriello/Kolko
- Educational Technology
- Computing for Low Resource Environments Capstone (CSE 490D / CSE 481K)
- PATH
Extended Sabbatical at PATH (2009–2011)

- Seattle based NGO working in health technologies
- Program for Appropriate Technology in Health
- Focus areas:
  - Maternal and Child Health
  - Reproductive Health
  - Immunization
  - Infectious diseases
  - Safe Water
NSF Mobile Wellness Toolkit Project

- 3 year NSF funded project
- UW co-PI’s:
  - Richard Anderson, Gaetano Borriello, Beth Kolko
- Partner: PATH
- Mobile technology for health and wellness
Immunization systems

- One of the worlds most effective health interventions
  - Wide coverage of basic vaccines
    - Diphtheria, Pertussis, Tetanus: 77% in poorest countries
    - Tremendous reduction in deaths
    - Some diseases close to elimination

- Large scale global programs
  - Decade of Vaccines

- Introduction of new vaccines
  - Pneumococcal and Rotavirus vaccines
Immunization: National Health Information Systems

- Manage health information on national scale
- Reporting from facility level
  - Web based submission to central database
- Integrate tools into existing systems
Immunization: Health System Modeling

- Analyze health system based on data
  - PATH CCEM: Vaccine Cold Chain Analysis

Estimated costs to address cold chain equipment deficiencies in four countries\(^1\) (USD in 000’s)

<table>
<thead>
<tr>
<th>Country</th>
<th>Base Schedule with Pneumo</th>
<th>Base Schedule with Pneumo and Rota</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ILR units</td>
<td>Gas/Ker units</td>
</tr>
<tr>
<td>Country A(^2)</td>
<td>219</td>
<td>258</td>
</tr>
<tr>
<td>Country B(^3)</td>
<td>47</td>
<td>56</td>
</tr>
<tr>
<td>Country C(^4)</td>
<td>94</td>
<td>413</td>
</tr>
<tr>
<td>Country D(^5)</td>
<td>55</td>
<td>35</td>
</tr>
</tbody>
</table>
Immunization: Facility Monitoring

- Data collection to understand status of health facilities
- Link with multiple sources of data
Immunization: Health Worker and Manager Support

- Develop (mobile) tools to support management of the health system
  - Manage and track assets
  - Record information during facility visits
Communication and Education

- Promote behavior change and adoption of practices
- Maternal and child health focuses on small number of interventions
  - Taking iron pills
  - Exclusive breast feeding
  - Keeping babies warm
  - Promoting institutional delivery
  - Birth preparedness
- Mobile Interventions
  - Multimedia playback
  - Reminders
  - Community building
  - Spam
Digital Public Health
Mobile Job Aids

- Job aids
  - Process walk through
  - Calculator
  - Care protocol
- Support with mobile applications
  - Tool for use during care
    - Often these tasks are rare
  - Training
  - Standardization

### Magnesium Sulfate Dilution Chart

<table>
<thead>
<tr>
<th>Presentation</th>
<th>Required Solution</th>
<th>Dilution Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 g in 10 mL (50% solution) OR 10 g in 20 mL (50% solution)</td>
<td>4 g in 20 mL (20% solution) OR 20 mL of a 20% solution</td>
<td>Extract 8 mL from a vial. This will contain 4 g of MgSO₄. Add to 12 mL of normal saline.</td>
</tr>
<tr>
<td>5 g as 50% solution</td>
<td>2 g as a 50% solution</td>
<td>Extract 4 mL from a vial. Use without dilution.</td>
</tr>
<tr>
<td>10 mL of a 20% solution (2 g) OR 2 g of a 20% solution (10 mL)</td>
<td>5 g in 1000 mL</td>
<td>Extract 4 mL from a vial. This will contain 2 g of MgSO₄. Add this to 6 mL of normal saline.</td>
</tr>
<tr>
<td>1 g in 2 mL (50% solution)</td>
<td>4 g in 20 mL (20% solution) OR 20 mL of a 20% solution</td>
<td>Add the contents of 4 vials (4 g total, 8 mL) to 12 mL of normal saline.</td>
</tr>
<tr>
<td>5 g as 50% solution</td>
<td>Combine the contents of 5 vials (5 g total, 10 mL). Use without dilution.</td>
<td></td>
</tr>
<tr>
<td>2 g as a 50% solution</td>
<td>Combine the contents from 2 vials (2 g, 4 mL). Use without dilution.</td>
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Community Health Worker Supervision

- Health workers not permitted to treat patients
  - CHW, ASHA, VHV, . . .
- Tracking pregnancies, promoting health practices, identifying disease suspects, collecting information
- Mobile applications
  - Job aids, data collection, supportive supervision
- Technology issues
  - Usability, low cost phones
C4D Capstone

- CSE Capstone course
  - Winter: Design seminar
  - Spring: Implementation
- Offered since 2008
Encouragement System for CHWs

- Develop system to for automatic reminders
- Allow different levels of escalation and triggers
- Key technical challenge: develop a finite state machine implementation
Smart Phone Vaccine Register

- Register to track children and immunizations
- Link to existing PC systems
Interactive Health Videos

- Digital Green Model
  - Community created content
  - Facilitated showings
- Work with Global2Local
Small mobile phone applications to support medical tasks
  - Calculators
  - Decision trees
  - Protocols

Allow public health professions to create mobile application through a wizard
Game based interface for public health modeling

- Geographic modeling
- User interface challenge
  - Setting scenarios
  - Manipulating facility information
- Idea: interface from games
Mobile phone integration with a health information system

- Health Information System
  - Internet based system for national reporting of health information

- Interface with smart phone for facility operations
  - Internet access by cellular network
  - Many advantages of mobile phone over desktop system
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