Today’s topics

- Aditya Vashistha
  - Voice based messaging
- Treatment Support
  - Adherence
  - Protocol Support
  - Diagnostics
- Gadgets
  - Hijack
  - ODK Sensors
  - FoneAstra
  - Partopen
  - CellScope
  - ColdTrace

Readings and Assignments

- Readings
  - eIMCI
  - CellScope
  - Hijack
- Homework 6
  - Design an SMS syntax for cold chain reporting
- Homework 7
  - Paper prototype of medical protocol
    - Details TBD
- Homework 8
  - Open Data Kit

Homework 7: SMS Reporting

Homework 7: Solutions

Medication Adherence

- TB and HIV
  - Concerns about drug resistant strains
- Adherence obstacles
  - Side effects, inconvenience, perceived cure, stigma
Adherence

• Direct Observation Therapy
  – Health worker observes daily medication
    • Home or clinic
    • Considered burdensome
  – Variations
    • Family member observes
    • Pick up medication every few days

WHO TB Strategy
Pursue high-quality DOTS expansion and enhancement
1. Secure political commitment, with adequate and sustained financing
2. Ensure early case detection, and diagnosis through quality-assured bacteriology
3. Provide standardized treatment with supervision, and patient support
4. Ensure effective drug supply and management
5. Monitor and evaluate performance and impact

TB Drug Distribution

• Fingerprint scanning in drug distribution
  – Reduce record keeping and increase accuracy
  – Verification of drug pick up
  – Allow follow up of non-compliant

SMS Reporting

• Send confirmation code associated with each pill to a given number

Pill box notifications

• Pill box records openings
• Dispense a fixed amount each day
• SimPill – built in SMS modem and simcard
  – Automatic notifications
  – Initial development for low resource settings but commercialized for developed world

Delivery of health services

• Routine care delivered by Nurses or CHWs

• Problems to solve
  – Consistent delivery of services
    • Standards based
    • Competent
  – Availability
  – Appropriate escalation and referral

Vision versus reality
IMCI

- WHO Designed protocol on diagnosing/treating childhood illness
- Step through diseases with flow chart
- Target nurses/health workers
- Standardize care

Tanzania e-IMCI Study

- Implement IMCI on a PDA
- Goal:
  - Demonstrate improved compliance to IMCI protocol
  - No increase in time of visits

Open Data Kit 1.0

- Collect
  - Forms based data collection application running on Android device
- XLSForm
  - Form creation tool reading in Excel spreadsheet
- Aggregate
  - Backend server to receive data

IMCI to ODK

- Convert IMCI Protocol to decision tree
- Encode in forms
- Establish branching logic
- Implement in spreadsheet
  - Compile to ODK
- Challenges
  - Extracting the decision tree
  - Verification of wording and workflow
  - Usability
- Medical review of IMCI
  - Difficulty in adapting protocol
  - Official approval of protocol
  - Determining correspondence of electronic and paper version

IMCI + Pulse Oximetry

- Measure blood oxygen level
- Low oxygen levels can indicate pneumonia
- Add blood oxygen level into pneumonia questions
- Pulse oximeter connected to mobile phone so readings entered automatically
Diagnostics

- Issues
  - Cost of test
  - Precision of test
  - Accuracy of test
    - Error profile
  - Action on positive test
  - Action on negative test
- Goals
  - Individual treatment
  - Public health goals

Lab Diagnostics

- Highly accurate tests
  - E.g., Enzyme-linked immunosorbent assay (ELISA)
  - Microscopy
- Requires infrastructure, trained staff, equipment
- Issues
  - Costs
  - Transport of samples
  - Delays in processing or notification

Lab Information System

- Internal lab management
- Tracking of samples and tests
- Interoperability with medical records
- Notifications
- Probably not much difference between developed and developing world

Rapid Diagnostic Tests

- Point of Care Tests
  - Deliver results without sending test to lab
  - Fast turn around
  - Limited test preparation
- Lateral flow immunochromatographic assays
- Large number of tests available
  - Blood, Urine
  - HIV, Malaria, Syphilis

ODK Diagnostics

- Nicki Dell, Gaetano Borriello
- Image analysis on Smartphone to read RDT
  - Computation done locally
  - Template to adapt to multiple tests
- Use cases
  - Enable lesser trained health workers to conduct tests
  - Support tests which are not frequently used
  - Supervision
  - Quality control
- Field trials
  - Zimbabwe

Gadgets
Hijack

- Sensor interface through audio jack
- EKG Interface
- Soil temperature monitor
- UBC Pulse Oximeter for iPhone
- HIV Diagnostic

Smartphone for point of care diagnosis

- Recent press attention on HIV/Syphilis diagnosis by Columbia University
- Laboratory quality immunoassay
- Ultra low power
- Power from cell phone
  - iPhone = Battery
  - Signal processing on cell phone to generate results

ODK Sensors

- Build a user-level sensing framework with sensor drivers
  - No operating system modifications
  - Allows convenient reuse between applications
- Create a single sensor interface
  - Access wired, wireless, and built-in sensors
  - Support multiple sensors over multiple channels
- Focus on ease of deployment and development
  - Distribution through existing app store model
  - Reduce complexity
  - Without adverse effects on performance

Fone Astra

- Sensor connection to low cost phone
  - Phone for communication and output
- $25 board + $25 phone
- Temperature monitoring

Android Fone Astra

- Version 2 of FoneAstra replaced basic phone with Android phone
- Communication by bluetooth or USB
- Separate power for FoneAstra device
- Programmability and UI on phone

Milk Pasteurization

- Human milk pasteurization
- Replace high price pasteurizer with hotplate
- Temperature monitoring to ensure proper heating and verify quality
PartoPen

- Paper record of birth progress
  - Plot dilation versus time
  - Too slow, issue an alert
- Idea
  - Implement using a LiveScribe digital pen
- Deployment
  - Nurses in Kenya, in both training and practice

Cell Scope

- UC Berkeley project
  - Dan Fletcher, Bioengineering
  - Build a cheaper microscope for diagnostics

Cold Trace

- Remote temperature monitoring
- Connection through audio port to Android phone
- Deployments now rely on a single model of low cost Android phone
- Well engineered product with substantial support
- Need for multi sensor device

Next week

- Supporting the health worker