Computing and Global Health

Richard Anderson
University of Washington
or, what I’m doing with my Reed math degree
or, how computing can help address the problems of the very poor

- Project examples from PATH and University of Washington
- PATH
  - Health Information System Architecture
  - Smart Connect
- University of Washington
  - Digital StudyHall
  - CAM
  - ComCare
  - Open Data Kit
PATH

- Seattle based NGO working in health technologies
- Founded 1977
  - Now working in 70 countries
- Formerly: Partners for Appropriate Technologies in Health
Path Mission Statement

Our mission is to improve the health of people around the world by:

- Advancing technologies
- Strengthening systems
- Encouraging healthy behaviors
PATH focus

- Solutions for emerging and epidemic diseases, like AIDS, tuberculosis, and malaria.
- Health technologies designed for low-resource settings, by the people who will use them.
- Safer childbirth and healthy children.
- Health equity for women, among the world’s most vulnerable—and influential—populations.
- The basic protection of vaccines for women and children around the world.
Path Projects: Cold Chain
Path Projects: Safe Injection
Path Projects: Reproductive Health
Path Projects: Diagnostics
How is PATH organized? *Global Health projects managed either by global programs or by field programs.*
Health Information

Complex, crowded field; many donors; disease-focused M & E; fragmentation; epidemic indicators. Lack of comparability, need for certification and application of common standards. Weak analytical capacities; health poorly connected to statistics; translation of health data into information for policy action; evidence-based decision making.

Paris Declaration on Aid Effectiveness; harmonization and alignment.
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<thead>
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# Health System Domain Reference Model

<table>
<thead>
<tr>
<th>Health System Domain</th>
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<tbody>
<tr>
<td>1. Community Based Services</td>
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<td>2. Facility Based Services</td>
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<td>3. Diagnostic Services</td>
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<td>4. Commodities Supply Chain</td>
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<td>5. Human Resources in Health</td>
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<td>6. Environmental Services</td>
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<td>7. Stewardship &amp; Management</td>
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<td>8. Finance Resources for Health</td>
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<td>9. Knowledge and Information Resources</td>
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<tr>
<td>10. Infrastructure Resources</td>
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</table>
What do we mean by “architecture”?: There are distinct phases of ICT development that our process will follow.

• Architecture is grounded in user analysis, requirements and systems design grounded in the situational context.
• Solutions (by design) will need to be scalable past discrete pilot projects and integrate with country HMIS.
Held in Tanzania with Health Care workers
Determine workflow around TB diagnosis and treatment
Two days, ½ day in Swahili, 1 ½ days in English
Participants working with paper artifacts proved very useful
Successfully generated activity diagrams of workflow
Developers observed workshop
Smart Connect

- Last mile connection (digital dial tone)
- Device targeting occasional, low bandwidth communication
- Sample applications
  - Vaccine Refrigerator temperature monitoring
    - Status reports and alerts
  - Updating stock information
- Determine feasibility for scaled deployment
Augment solar power refrigerator with smart connect
Cell phone connectivity
Smart Connect Design

- Cell phone radio
- Microprocessor
- Display and input device
- Attach to external power supply (refrigerator)
- Secure location (rural clinic)
- Communicate by SMS
Digital Study Hall, Rural India
Videoing Live Classes
Mediation Based Pedagogy
Key technologies
CAM, Tapan Parikh

- Record data from Micro Finance Transactions
- Key Ideas
  - Mobile phone for data entry
  - Use bar codes to synchronize with forms
Comcare / Open Data Kit

- Gaetano Borriello + Students
Integrated Management of Childhood Illnesses (IMCI)

GIVE EXTRA FLUID FOR DIARRHOEA AND CONTINUE FEEDING
(See FOOD advice on COUNSEL THE MOTHER chart)

Plan A: Treat Diarrhoea at Home
Counsel the mother on the 3 Rules of Home Treatment:
Give Extra Fluid, Continue Feeding, When to Return

1. GIVE EXTRA FLUID (as much as the child will take)
   - TELL THE MOTHER:
     - Breastfeed frequently and for longer at each feed.
     - If the child is exclusively breastfed, give ORS or clean water in addition to breastmilk.
     - If the child is not exclusively breastfed, give one or more of the following: ORS solution, food-based fluids (such as soup, rice water, and yoghurt drinks), or clean water.

   It is especially important to give ORS at home when:
   - the child has been treated with Plan B or Plan C during this visit.
   - the child cannot return to a clinic if the diarrhoea gets worse.

   TEACH THE MOTHER HOW TO MIX AND GIVE ORS. GIVE THE MOTHER 2 PACKETS OF ORS TO USE AT HOME.

   SHOW THE MOTHER HOW MUCH FLUID TO GIVE IN ADDITION TO THE USUAL FLUID INTAKE:
   - Up to 2 years: 50 to 100 ml after each loose stool
   - 2 years or more: 100 to 200 ml after each loose stool

Tell the mother to:
   - Give frequent small sips from a cup.
   - If the child vomits, wait 10 minutes. Then continue, but more slowly.
   - Continue giving extra fluid until the diarrhoea stops.

2. CONTINUE FEEDING

3. WHEN TO RETURN

Plan B: Treat Some Dehydration with ORS
Give in clinic recommended amount of ORS over 4-hour period

DETERMINE AMOUNT OF ORS TO GIVE DURING FIRST 4 HOURS.

<table>
<thead>
<tr>
<th>AGE</th>
<th>Up to 4 months</th>
<th>4 months up to 12 months</th>
<th>12 months up to 2 years</th>
<th>2 years up to 5 years</th>
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<tbody>
<tr>
<td></td>
<td>&lt; 6 kg</td>
<td>6 - &lt; 10 kg</td>
<td>10 - &lt; 12 kg</td>
<td>12 - 19 kg</td>
</tr>
<tr>
<td>ml</td>
<td>200 - 400</td>
<td>400 - 700</td>
<td>700 - 900</td>
<td>900 - 1400</td>
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</tbody>
</table>

* Use the child's age only when you do not know the weight. The approximate amount of ORS required (in ml) can also be calculated by multiplying the child's weight (in kg) times 75.

- If the child wants more ORS than shown, give more.
- For infants under 6 months who are not breastfed, also give 100-200 ml clean water during this period.

SHOW THE MOTHER HOW TO GIVE ORS SOLUTION.
   - Give frequent small sips from a cup.
   - If the child vomits, wait 10 minutes. Then continue, but more slowly.
   - Continue breastfeeding whenever the child wants.

AFTER 4 HOURS:
   - Reassess the child and classify the child for dehydration.
   - Select the appropriate plan to continue treatment.
   - Begin feeding the child in clinic.

IF THE MOTHER MUST LEAVE BEFORE COMPLETING TREATMENT:
   - Show her how to prepare ORS solution at home.
   - Show her how much ORS to give to finish 4-hour treatment at home.
   - Give her enough ORS packets to complete rehydration. Also give her 2 packets as recommended in Plan A.
   - Explain the 3 Rules of Home Treatment:

1. GIVE EXTRA FLUID
2. CONTINUE FEEDING
3. WHEN TO RETURN

See Plan A for recommended fluids and See COUNSEL THE MOTHER chart
e-IMCI on a PDA

- Removes social barriers
- Collects data electronically
- Context follows course of visit
- Easier navigation with more attention to threshold cases
- Better adherence (60 to 85%)
  - Without extending visit time
Community Health Workers

- Must bring health care to people
- First line of defense
- Routine, regular home visits
- Know their community
- Eyes and ears for local health
- Provide education for best practices
Current methods

- Little, if any, supervision
- Paper-based forms – ad hoc design
- Long time-lag to usable data
- Little or no historical data
Where we want to be

- Standardization of data
- Rapid data aggregation and analysis
- Supervision of CHWs
- Connection to health records

CHW + phone = Flexible, efficient platform for:

- Better home care (checklists, protocols, etc.)
- New outreach programs
- Outbreak detection
- Improved disease surveillance
Open Data Kit (ODK)

- Open-source data collection tool kit
  - Collaboration between Google & UWashington (prof + interns)
  - Forms + GPS + Picture + Barcode + Audio + Video + ...
- Initially targeted at public health applications but also being used for forestation monitoring and other domains
- Current deployments around the world with keystone efforts in Uganda, Kenya, Tanzania, and Brazil (Ghana and Vietnam early next year)
## Open Data Kit Toolset

<table>
<thead>
<tr>
<th>Feature</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collect – Android client for data entry</td>
<td>Available</td>
</tr>
<tr>
<td>Submit – multi-transport layer async data transfer</td>
<td></td>
</tr>
<tr>
<td>Aggregate – App Engine server for data collection</td>
<td></td>
</tr>
<tr>
<td>Manage – remote management tools for config</td>
<td></td>
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<tr>
<td>Visualize – visualization of data on graphs/maps</td>
<td></td>
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<tr>
<td>DB – connect forms to existing DBs for browse/update</td>
<td>In progress</td>
</tr>
<tr>
<td>Voice – make calls with spoken version of simple forms</td>
<td></td>
</tr>
<tr>
<td>Tasks – assignment of tasks to specific workers</td>
<td></td>
</tr>
<tr>
<td>Supervisor – supervisory dashboard</td>
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<tr>
<td>SMS – communication/notification with community</td>
<td>Future</td>
</tr>
</tbody>
</table>
Deployments

Kenya HIV, 300 CHWs

Tanzania e-IMCI, 5 clinicians
Deployments – Forest Service – Brazil
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