Yaw Anokwa, Brian DeRenzi, Benson Limketkai

change

http://change.cs.washington.edu

Hi, I'm Yaw, this is Brian and that's Benson.

Brian and I are advised by Gaetano and Tap, and Benson is a former grad student.

A few months ago, Brian moved to put some of the work that has been happening at UW under one umbrella.

I latched onto that idea and together we came up with Change. Change is a group of faculty and students at the University of Washington are working together on projects to fight inequity and poverty across the globe.

You can find out more about the group at http://change.cs.washington.edu/

Between the three of us, we have lived and worked for over two years in East Africa and since it's rare to catch us all in Seattle during the same time, we figured we'd share a few of our experiences in this talk.
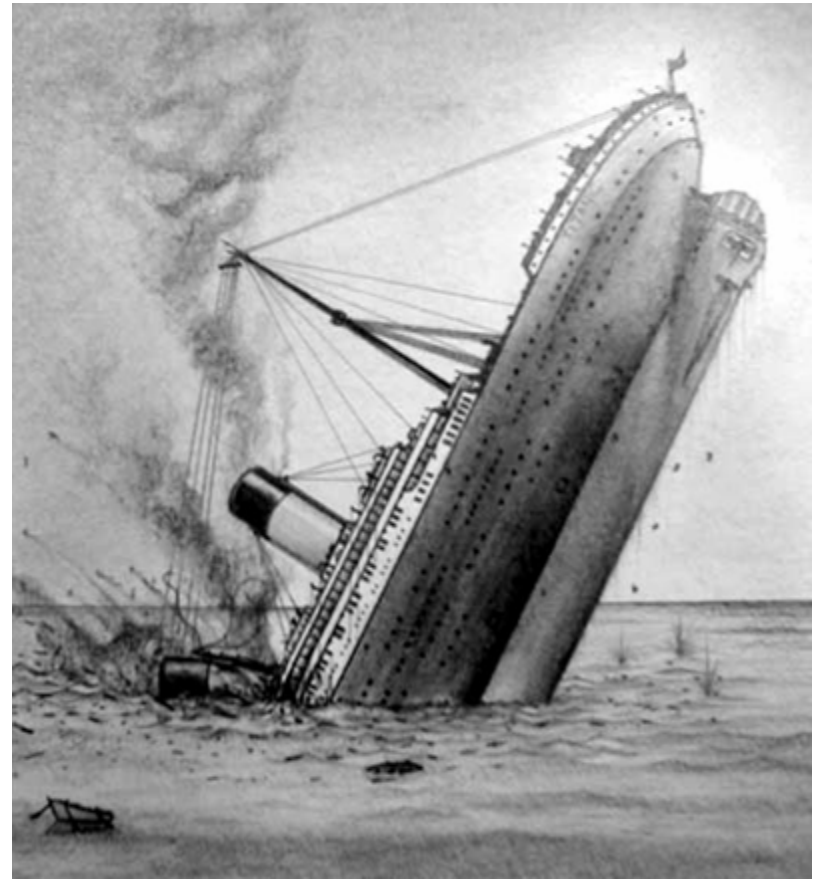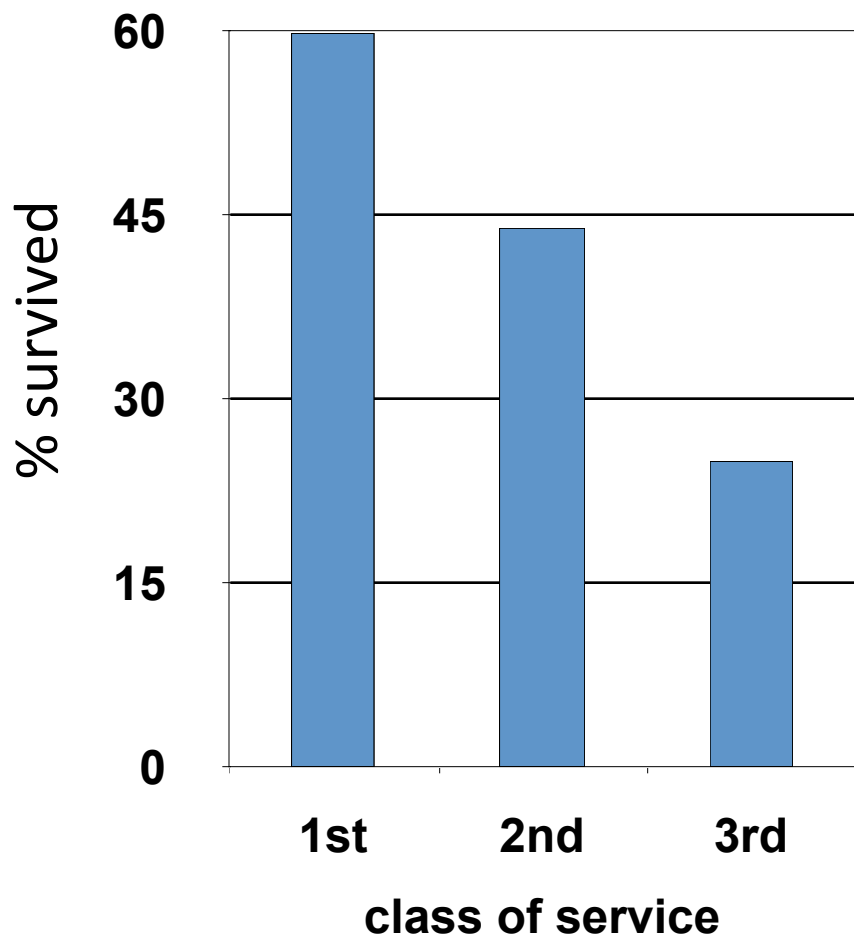
There will be three talks which will flow together. It will be high level because we don't have time for details, but please jump in with questions when you have them, and we'll leave time at the end for more questions.

The slides and video will be made available online.

>> poverty and global health

Poverty as a **Risk Factor**
for surviving the Titanic.

I'm going to start with what somehow seems like a fun example, which is that if you bought a more expensive ticket on the titanic, not only do you get nicer food, but you've got a higher chance of surviving the trip, as shown in this graph. these numbers are real, though it would be a little more fair to show men, women, and children separately ... since this is one of the few cases of where being a woman or child is protective. but moving onto some statistics which I think is the most disturbing of the talk...

Global Health

Okay, so on to the world. And one thing about this talk and public health in general, in that it's pretty focused on people and their basic needs. not so much the animals. not even so much the environment, though that's certainly important for our health. but we can start with how many of us there are. and there's about 6.1 billion people, and counting... and population growth is certainly a factor for public health

Simple Story

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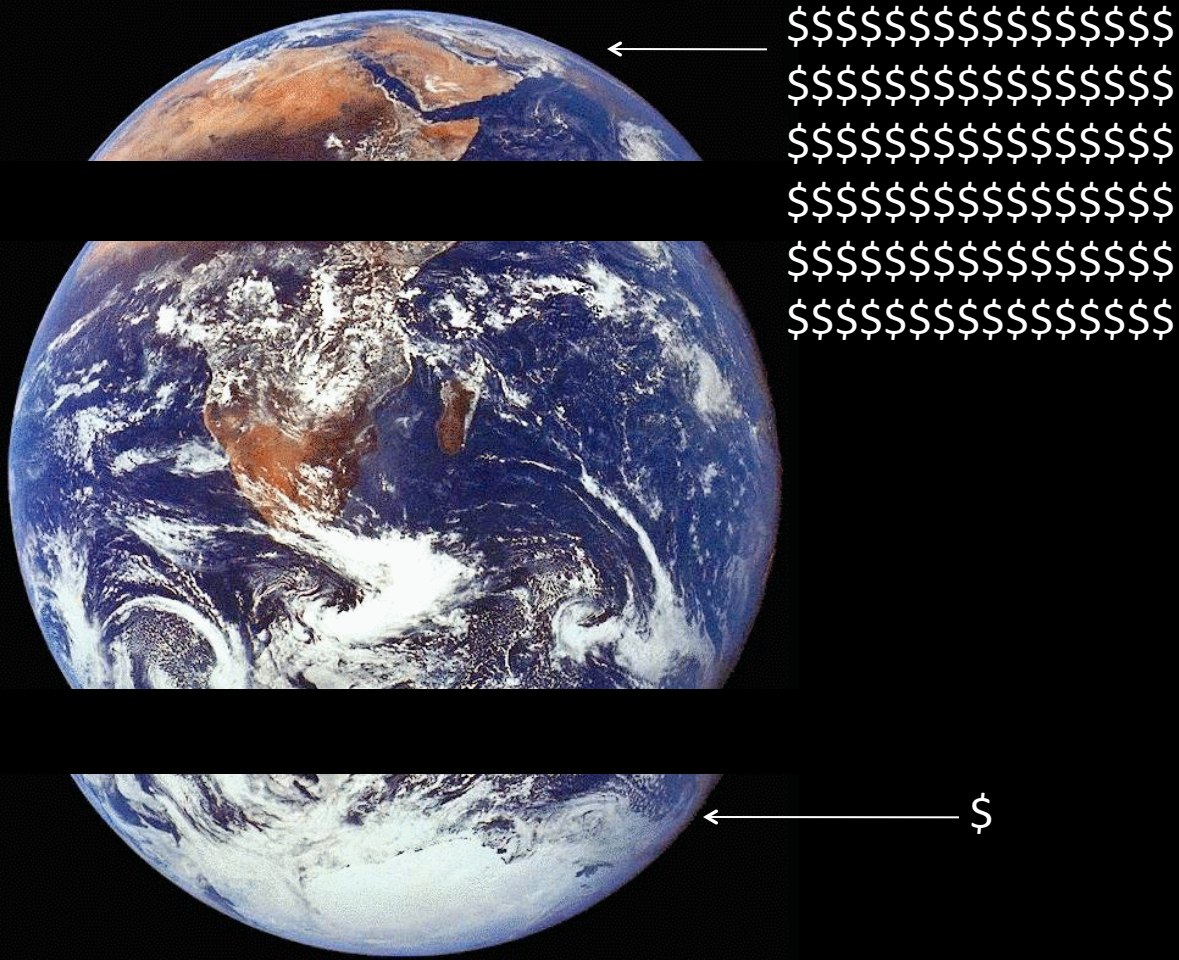$$$$$$$$$$$$$$$$$
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Life expectancy: 78 years

Infant
mortality: 5 per 1,000 births

Maternal
mortality: 8 per 100K births

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Life expectancy: 45 years

Infant
mortality: 95 per 1,000 births

Maternal
mortality: 500-1000 per 100K

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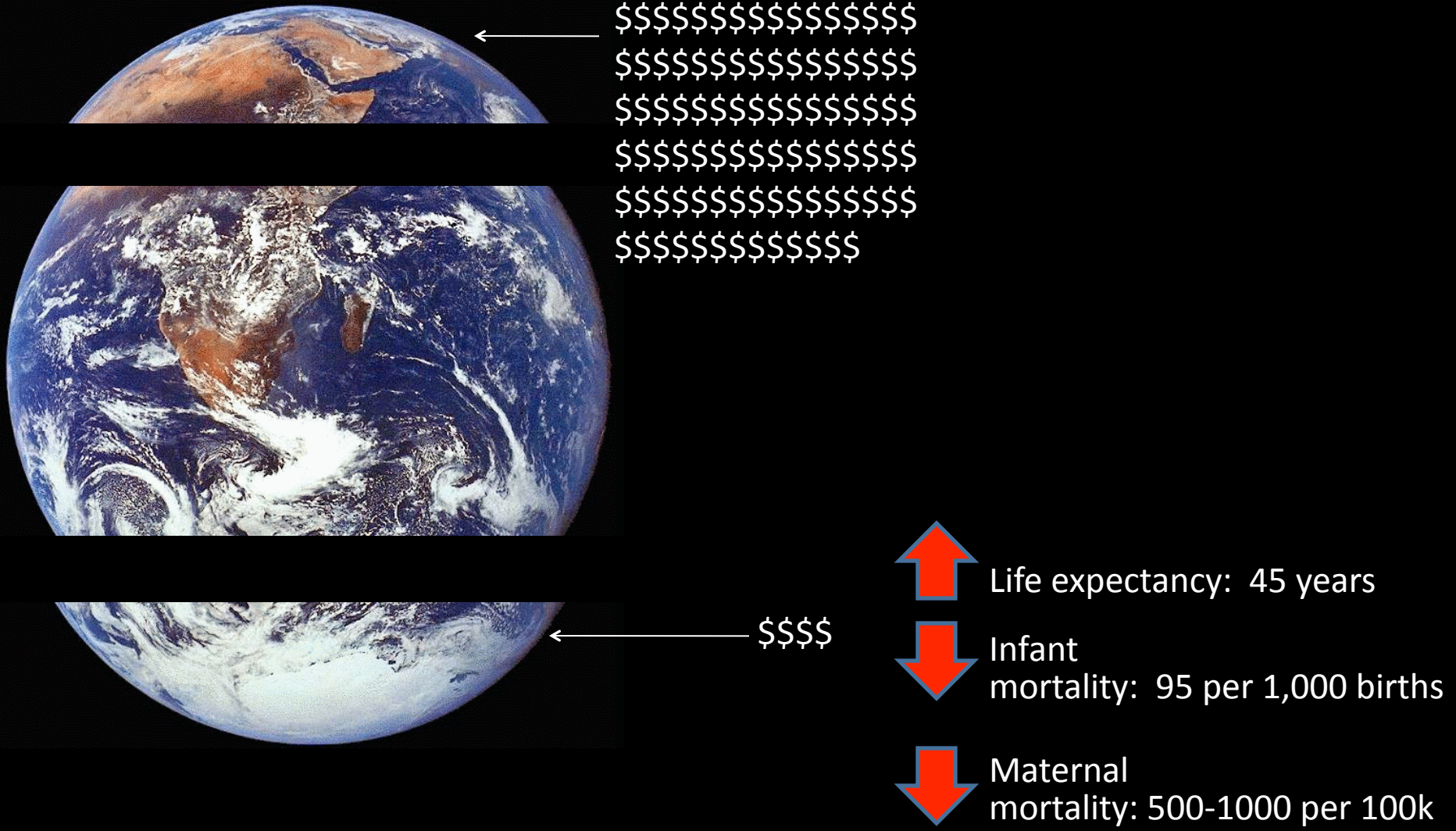
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Simple Story

"*We are the first generation that can end poverty.*"

-Eveline Herfkens, UN Millennium Campaign

Okay, so on to the world. And one thing about this talk and public health in general, in that it's pretty focused on people and their basic needs. not so much the animals. not even so much the environment, though that's certainly important for our health. but we can start with how many of us there are. and there's about 6.1 billion people, and counting... and population growth is certainly a factor for public health

Complexity

- Corruption, careerism, tax write-offs
- 5-star poverty alleviation meetings
- Unintended consequences, e.g., paying volunteers
- Imperialism & foreign experts

"If you want to build a ship, don't drum up people to collect wood and don't assign them tasks and work, but rather teach them to long for the endless immensity of the sea."
  – **Antoine de Saint-Exupery**

Paying volunteers, discussing work-for-food programs over fancy dinner during famine,

Outline

- Health Care System In Tanzania
- How CS can Help with Pediatric Care
- Coalition of Data Collectors
- What Happens Outside Health Care Facilities

>> what does the health system look like in tanzania?

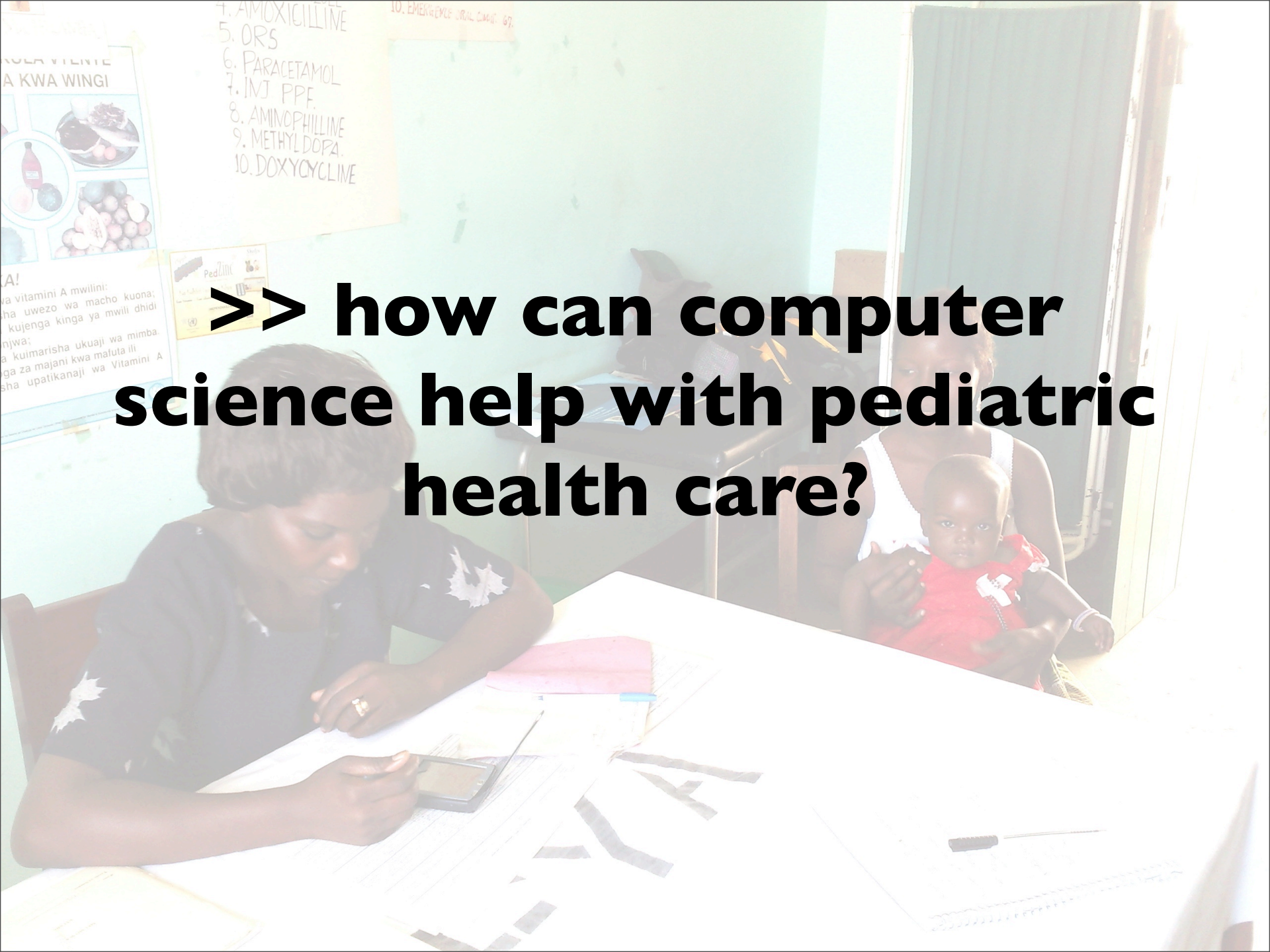# Tanzania

Health Facilities

- IPTi project at IHRDC
- Health facility survey
  - 2004
  - 5 districts of Lindi and Mtwara regions
  - 134 health facilities

Health Facilities

- 15% have electricity for lighting (5 off grid)
- 34% have mobile phone coverage
- 30% had water available
- 11% have functioning equipment for blood slides

>> how can computer science help with pediatric health care?

Motivation

- This year almost **10 million** children will **die** before reaching the age of 5
- Most live in low-income countries
- 10% of infants die during their first year, compared to 0.5% in wealthy countries
- Almost 2/3 could be **saved** by the correct application of affordable interventions

Motivation

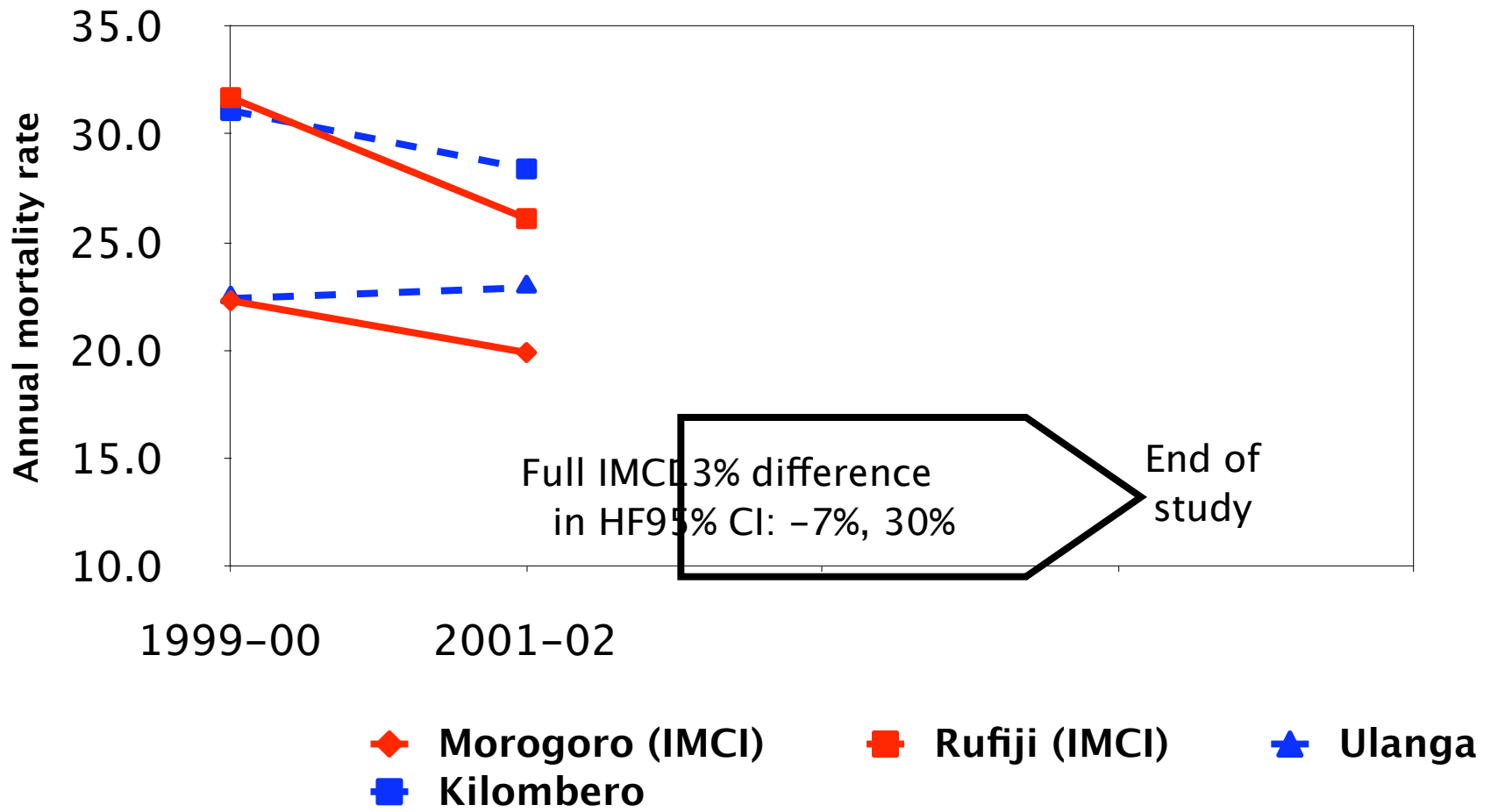- Every **6 seconds** a child dies unnecessarily

IMCI

- UNICEF, WHO and others develop medical protocols
- Integrated Management of Childhood Illness (IMCI)
- Address most common childhood illness
- Easy to use for lowly-trained health workers

IMCI in Tanzania

Annual mortality rate

35.0
30.0
25.0
20.0
15.0
10.0

1999–00   2001–02

Full IMCI 3% difference
in HF 95% CI: −7%, 30%

End of
study

◆ **Morogoro (IMCI)**   ■ **Rufiji (IMCI)**   ▲ **Ulanga**
■ **Kilombero**

In Tanzania: under-5 mortality was 13% lower in the two IMCI districts compared to non-IMCI districts and there was a significant impact on stunting

IMCI Barriers

- Expense of training ($1150 -$1450)
- Not sufficient supervision
- Chart booklet
  - Takes a long time to use
  - Natural tendency to be less rigorous
  - Social pressure

- Result: Not often used in clinic

e-IMCI

- Windows Mobile 5.0
  - PDA/SmartPhone
- Guide health worker step-by-step
- Contains cough, diarrhea, fever and ear pain questions and treatment
- First visit, ages 2 weeks to 5 years
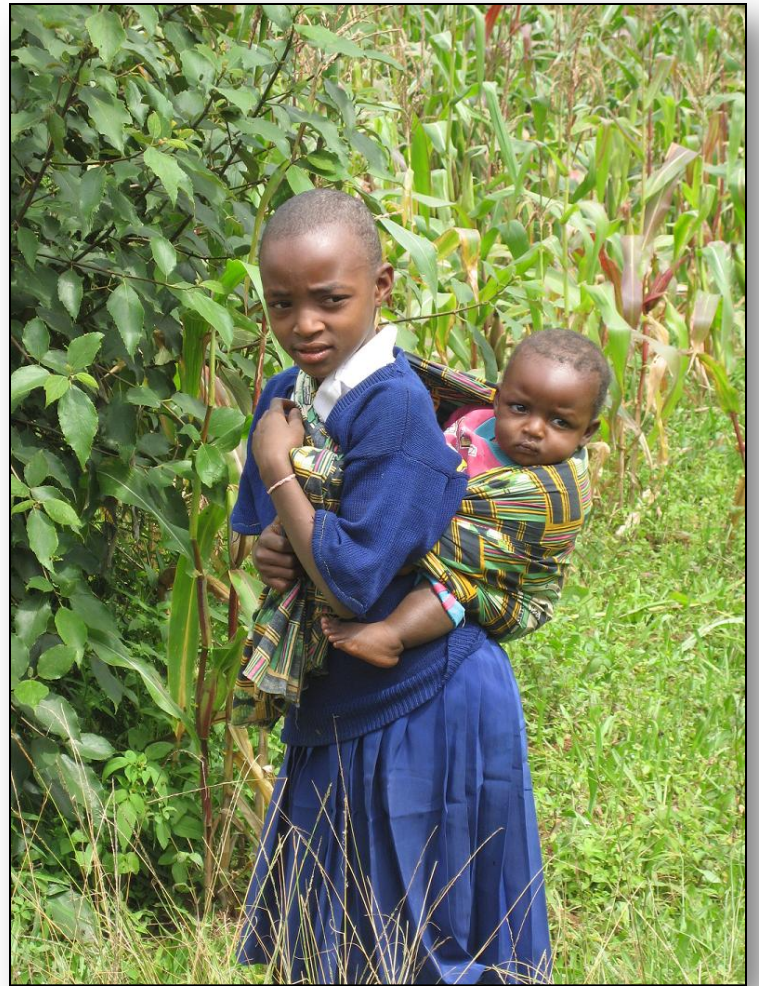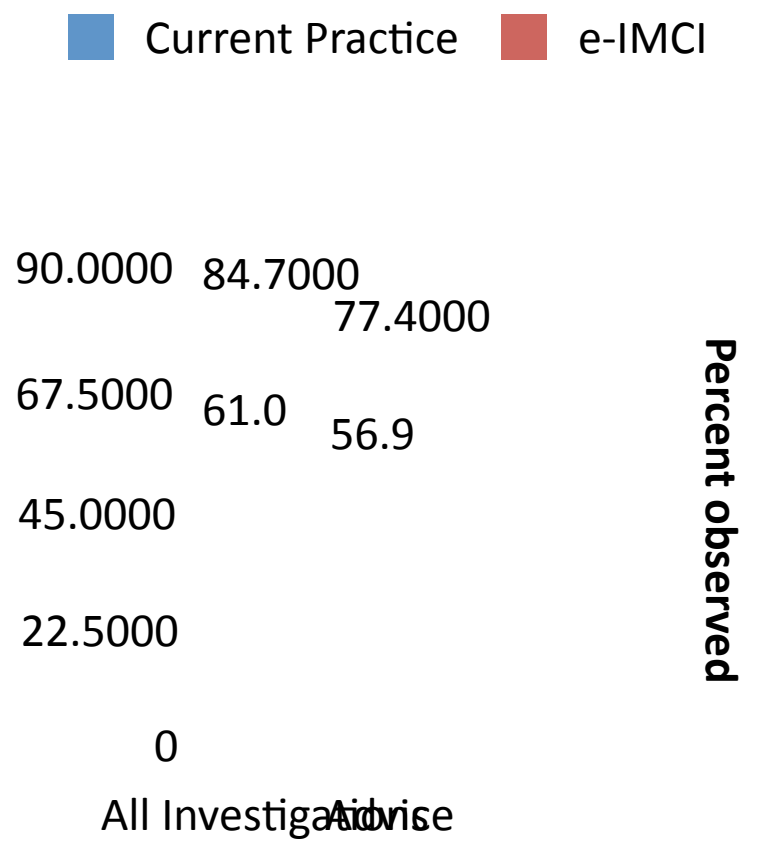
e-IMCI Interface

e-IMCI Study

- Started with some pre-trials to fix major bugs
- Semi-structured interview of all clinicians
- Observed 24 "current practice" IMCI sessions
- 31 e-IMCI sessions
- Exit interview for each clinician

Adherence

- Measured adherence by 23 questions/ investigations IMCI asks the practitioner to perform
- e-IMCI significantly improved adherence to the IMCI protocol

Current Practice   e-IMCI

90.0000   84.7000
          77.4000

67.5000   61.0
          56.9

45.0000

22.5000

0

All Investigations   Advise

Percent observed

e-IMCI Future

- Funding from Rockefeller to do a more formal study
- e-IMCI for training
- Group questions
- More flexible

openrosa

>> aren't we all just collecting data?

OpenROSA Consortium

- Goals
  - Reduce duplication of effort among groups doing mobile data collection
  - Create open-source, standards based tools for collection, aggregation and analysis
- Implementation
  - Xforms for surveys/protocols/forms
  - J2ME code

Organizations

OpenMRS
EpiHandy
MRC of South Africa
DataDyne / EpiSurveyor
UC Berkeley
University of Washington
MIT
Cell-Life
Dimagi Inc.
D-tree International
IRD

>> **what happens outside
of health facilities?**

Motivation

- Populations in rural areas delay seeking care until it is too late
  - High opportunity cost
- Community Health Workers
  - Lay people in the community
  - Minimal training
  - High turnover

CommCare

- Software to help CHW manage time and data
  - Plan houses to visit and follow-up with
  - Send data back to facilitators
  - Push questions back to CHWs
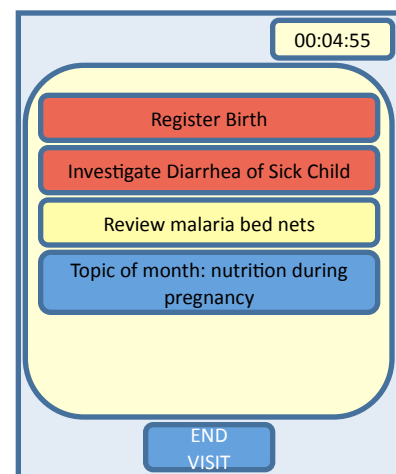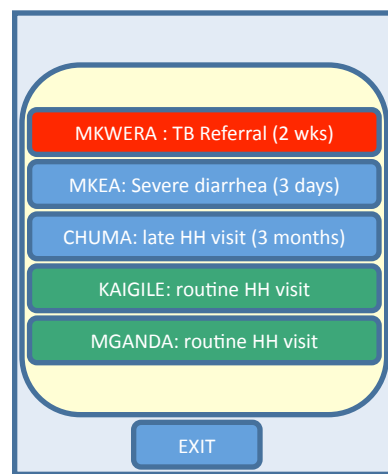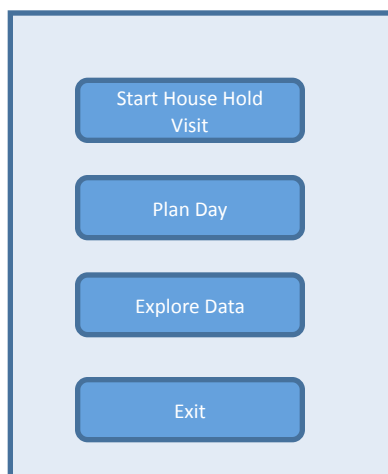
CommCare Future

- Tanzania in 8 days
- MVP deployment in Tabora, TZ
  - 34 CHWs
  - 30k people
- Others interested
  - Tanzania
  - Pakistan
  - Uganda
  - Sierra Leone…

UNIVERSITY OF
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Millennium Villages

Scaling up a Healthcare System in Rwanda

- The Rwanda Scale Up
- Deploying OpenMRS
- My Experiences in Rwinkwavu
- Two Research Questions

Yaw Anokwa hired year graduate student advised by Gaetano Borriello at UW and Tapan Parikh at Berkeley.

The Rwanda Scale Up

- Began in 2005 as first Partners in Health project in Africa. Strong partnerships with Ministry of Health, Clinton and Gates Foundations and TED.

- Scale up PIH model of health nationwide with services including HIV/TB, family planning, malnutrition, community health workers, housing, employment, schooling.

- Started in Rwinkwavu and in two years has grown into two hospitals and four health clinics. Training center and third hospital are being built.

- Technology is playing an important role in the scale up and OpenMRS is the vehicle.

before

after

In 94, one million Rwandans were killed in 100 days while the world stood by and did nothing. 13 years the guilt of inaction during the genocide has brought a lot of public attention and funding to the country, and the government has used this funding to turn things around.

The Rwanda Scaleup was part of Bill Clinton's TED prize to build a healthcare system in Rwanda. So the Clinton Foundation, the Gates Foundation and the Ministry of Health all pitched in to build this health care system. Partners in Health was the NGO brought in to do the work on the ground.

Partners in Health is an NGO which does healthcare in poor communities. If you don't know PIH and it's founder Paul Farmer, I encourage you to check out Mountains Beyond Mountains which chronicles Paul work in Haiti.

The most significant bit, here is that PIH is known for HIV and TB care for the poor, but they do it in a comprehensive and community based way. With PIH, when patients are hungry, they are fed. When they are homeless, houses are built. It's very expensive, but it works. And although it worked in Haiti for 30 years, it had never been scaled up and so Rwanda was a chance to prove it could scale.

Rwinkwavu, where I was based was where the scaleup is happening. It's a former mining town and the district hospital PIH built up has a catchment area on 425k. It's been two years and the scaleup is showing great results.

This is Jennipher who is this bright eyed friendly little girl who has both TB and HIV. She's still in Rwinkwavu, but these days, she's a little spoiled but is clearly much healthier and the turn around only took a few months.

This turn around is more than doctors and medicine though, because to do this on a large scale, you need technology and that's where OpenMRS comes in.

Deploying OpenMRS

- Open-source, enterprise electronic medical record system for resource-constrained healthcare environments. Modular design with active developers and users worldwide.

- Unlike malaria, HIV/TB needs good records and so OpenMRS chosen system to be used nationwide. Rwinkwavu has 6000 chronic care patients in the system.

- Clinicians fill out paper forms, data team enters the data into the system, reports generated and data analyzed.


http://openmrs.org

OpenMRS is a medical record system that is used worldwide, and you can tell from the picture in the bottom that the participants are all over the world. If you are interested in helping in the developing world from the comfort of your couch, you can join the project, add code – there is a lot of work to be done.

OpenMRS is important because unlike malaria, with HIV/TB you really need to keep track of regimens and symptoms to do the best care. Also, by tracking every service (food, pharmacy, etc) the patient encounters you can do much better reporting and tracking. Rwanda has chosen this for nation wide deployment and has 6000+ patients.

Completing the loop is hard because of infrastructure challenges (power, deploying networks, good interfaces, etc)
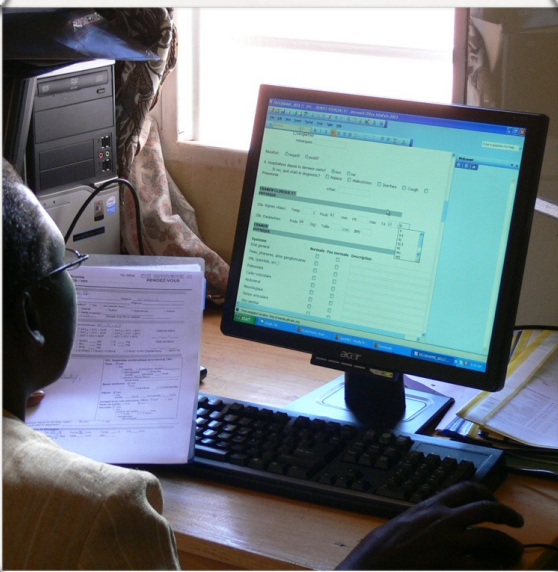
Six months in rural Rwanda
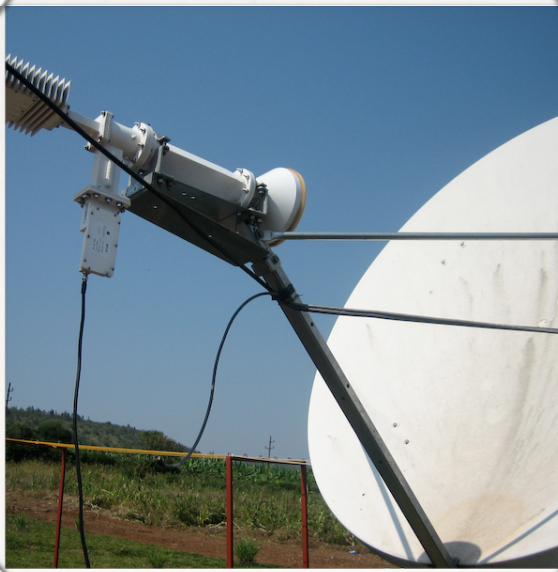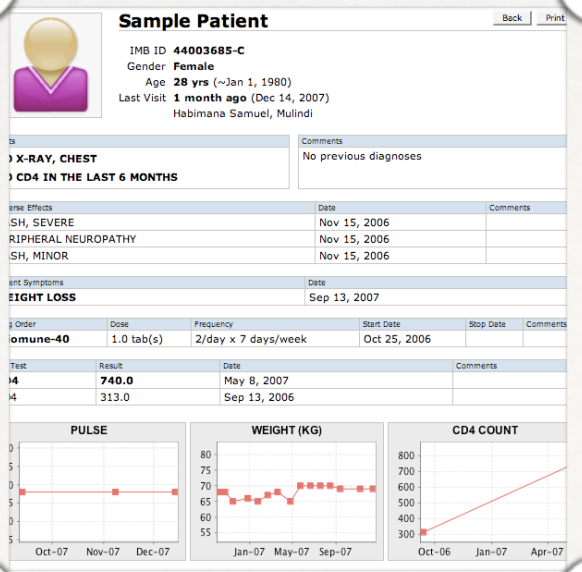

Deploying infrastructure

Training ICT staff

Observing clinical care

Managing data team

Adding to OpenMRS

Spent six months living in rural Rwinkwavu at the district hospital.

Each of PIH's six sites (2 hospitals and 4 health centers) have some infrastructure. They all have VSAT, WiFi, GSM, solar power, so there is a lot to deploy and maintain.

Along with the infrastructure comes training of the local technical staff. Mostly a lot of hardware repair, keeping the network up and computers virus free.

Observing care and how doctors both local and foreign work and interact. At the same time, I was in charge of the data entry team. Make sure data was entered correctly, and reports were done, etc.

Finally added a lot of bug fixes, usability changes, and some new functionality to OpenMRS. Primary one is a one page patient summary which doctors can use to get a broad overview of a patient.

All this was not computer science research, but coming back to Seattle, I've tried to tease out places where computer science research can be applied, and that's what I'm working on. If you are interested in working on any of these, please shoot me an email.

>> can we build simple yet powerful applications for data entry and report generation?

There is a widespread need for tracking and reporting of data generated in the developing world. This data is often captured on paper forms that serve as the information store for many organizations. These groups are often required to generate reports and make evidence based decisions – tasks which paper does not enable.

While tools such as Excel and Access are sometimes used, they are often not powerful enough to meet the data needs for many organizations. Many users also find it hard to use these tools to create easy to use systems for tracking and reporting on data.

To better address the frustrations with current tools we are planning on building a free and easy to use software framework called Karatasi. We envision Karatasi as a set of applications to enable data entry and report generation, but with less training than is currently required using programs like Excel and Access.

Before we build the software, we wish to understand the data entry and reporting needs of organizations. I'm heading down to TZ and RW in a few weeks to survey small NGOs.

>> are devices that help manage high latency low bandwidth network links?

Long distance Wi-Fi links, satellite connections, and other low bandwidth, high-latency, intermittent options are becoming the norm for providing connectivity in the developing world. For network administrators who must manage these connections, providing users the "best" (or even adequate) service is a nontrivial problem.

There is no reason why a $100 router can't come out of the box to handle basic things that they struggle with like web caching, bandwidth monitoring, worm blocking, etc.

Along with that, these devices should be able address the latency of these connections and make smart choices about traffic shaping. A file download or email upload can swamp dev world networks because of latency. Simply saying don't let port 80 traffic go beyond 64kbps isn't good enough, because all traffic is on port 80. You can't do it by IP or MAC address because the machines are shared.

We should be looking at individual flows and making smarter choices. The hardware and software exists, but the all important integration is lacking.

Teaching CS in Rwanda

- My Experience
- Why Local Developers?
- RITA and OpenMRS
- Rwandan Universities

My Experience

- 3 months at Rwanda Information Technology Authority (RITA)
  - Trained 6 programmers to develop modules for OpenMRS
- 2 months at Kigali Institute of Science and Technology (KIST)
  - Taught "Introduction to OOP Using Java" to third-year Computer Engineering and Information Technology (CEIT) students

Why local developers?

- Rwanda currently relies heavily on NGOs
  – If all the NGOs left, Rwanda would collapse
- Must become self-sufficient to advance in the global economy

RITA and OpenMRS

- Rwanda Information Technology Authority (RITA)
  - In charge of overseeing and developing IT infrastructure of Rwanda
- Software development training
  - Capacity-building program
  - Curriculum based around OpenMRS

Rwandan universities

- Kigali Institute of Science and Technology
  - Established in 1997
  - ~3300 students (2003)
- Low resources, but that's not the problem!
  - They have low resources, not nonexistent resources
  - Existing resources are not properly maintained

Rwandan universities

- Quality of instruction is very inconsistent and generally poor
  - Teaching seen as merely a job to many
- Students become teachers
  - Cycle of bad instruction must be broken

Questions?