

# Computing in the Developing World

Yaw Anokwa

[yanokwa@cs.washington.edu](mailto:yanokwa@cs.washington.edu)

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hello, my name is yaw anokwa and do research on computing systems for developing regions.

i'm originally from ghana. i came to the states when i was about ten, studied computer science and electrical engineering.

i worked in the defense industry and as a computer consultant before coming to grad school. my early research was in hci and ubicomp (mostly phone and research). these days, i primarily work in rwanda and tanzania on medical records or data gathering systems.

# **can computing help solve some of problems in the rest of the world?**

so there are \*a lot\* of problems with under-served populations all over the world. while i work with the very poor mostly in east africa, some of this research applies to places as close as the yakima valley.

i really do feel computer science can help solve some of these problems, and i'd like to show you a few examples.



**farming**

this is my uncle.

he farms palm nut trees in ghana. he has a cell phone which knows how to use. that technology can help him answer questions he has.

like, what are the best practices for growing palm nut trees? of the five near by markets, where should i sell my palm oil?

# education



this is a child at a rural hospital in rwanda.

good teachers don't like working in rural places where children like these live.  
education is the key to surviving in the global market place.

how do we education the children of the poor? could we give them phones with  
educational material? or ship video recorded from the best school in the country to  
them?

# microfinance



this is off the coast of tanzania where local fishermen are being squeezed out of their waters. to compete, they need to organize and maybe get a loan.

if they do, what are low cost ways for the microfinance agency to track payments?  
software automation and transactions performed over a cell network can help drive down costs.



# healthcare



this child likely has an ear infection which can easily be treated. but what about his mother? if she has hiv an tb. how will her complex care be managed at a rural hospital? recording keeping is important and computers can help here.

# Scaling up a Healthcare System in Rwanda

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

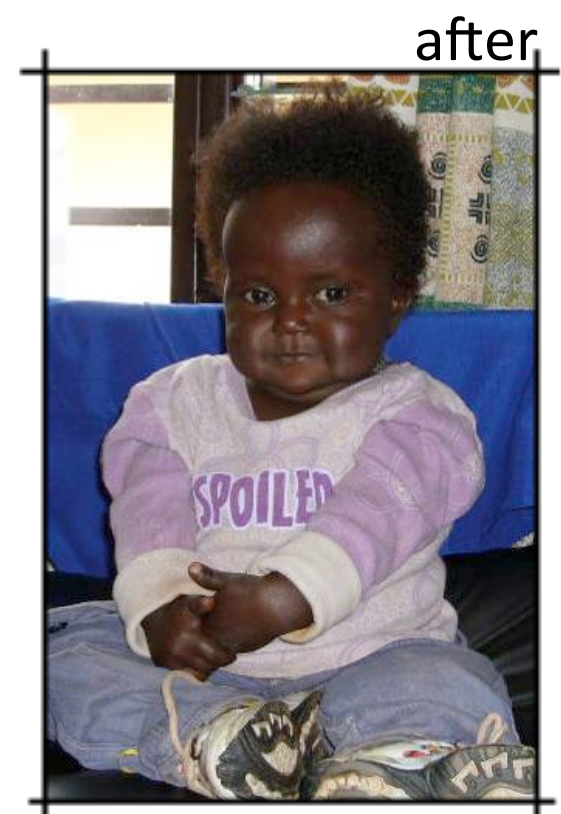


i work in healthcare, so i want to talk about my work for a bit...



# 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.



in 94, one million rwandans were killed in 100 days while the world stood by and did nothing. 13 years later, 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. you can see the turnaround in these images. she's still in rwinkwavu, but these days, she's a little spoiled but is clearly much healthier.

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.



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.

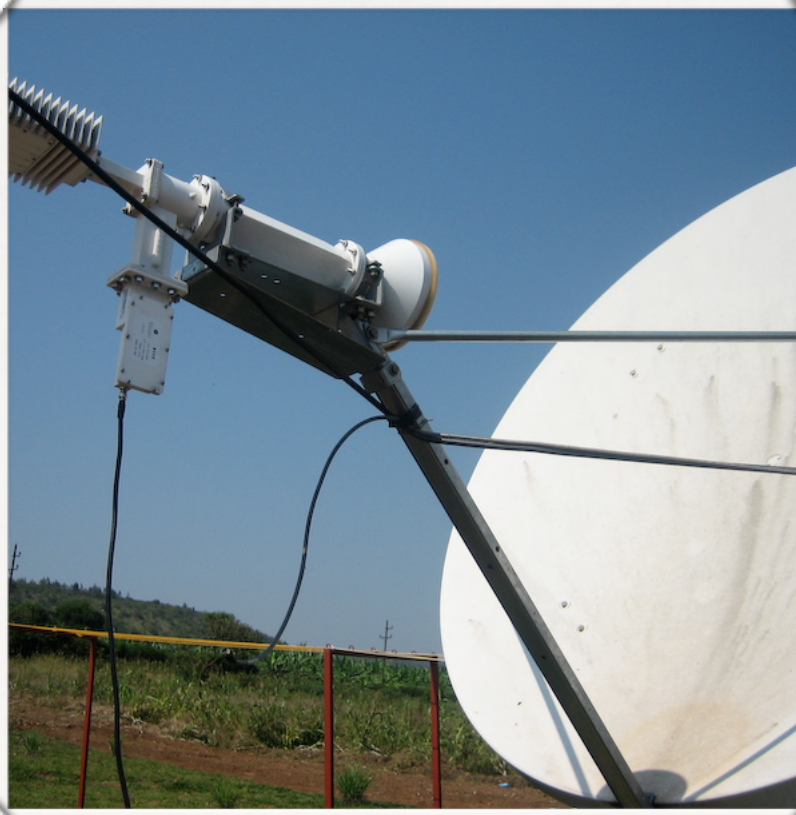
openmrs is important because unlike malaria, with hiv/tb you really need to keep track of regimens and symptoms to do the best care. also, by tracking every service (food, pharmacy, etc) the patient encounters you can do much better reporting and tracking. rwanda has chosen this for nation wide deployment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

it's not just code. openmrs is hard because of infrastructure challenges (power, deploying networks, good interfaces, local capacity etc). part of the scaleup deals with the other challenges.





**Six months in rural Rwanda**



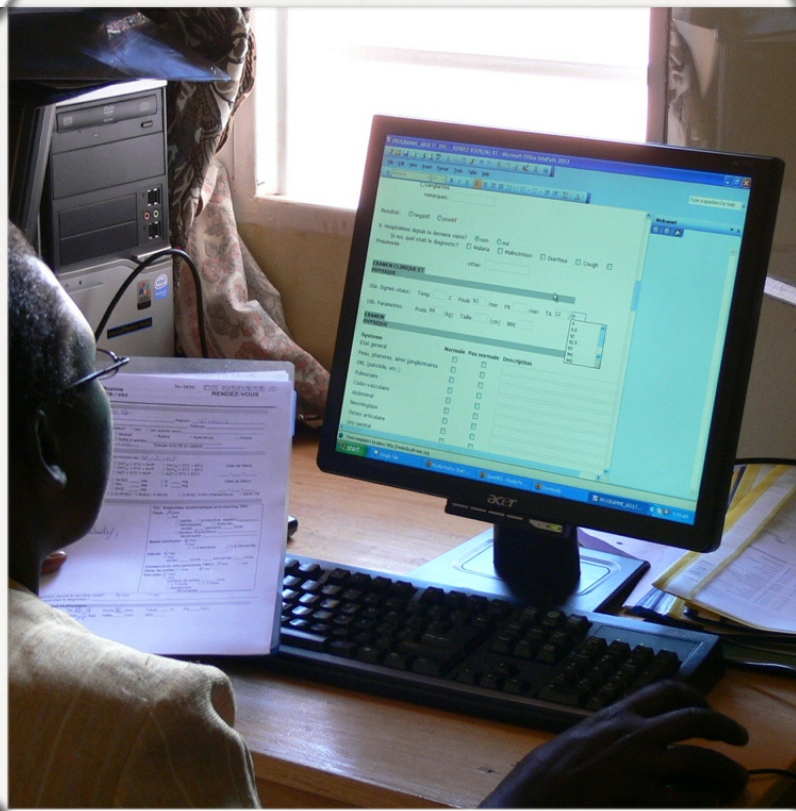
**Deploying infrastructure**



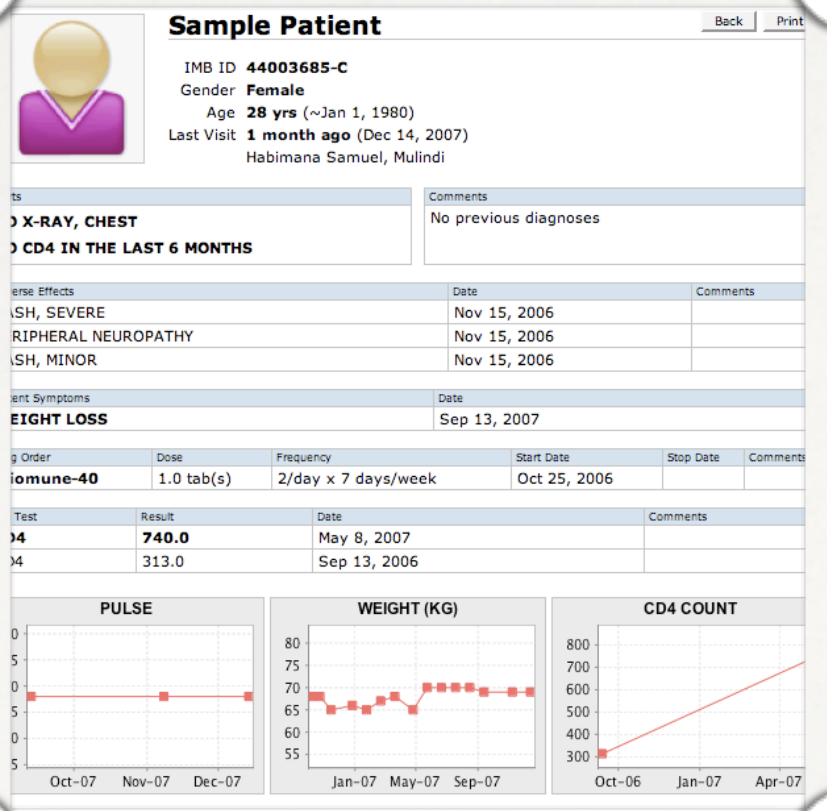
**Training ICT staff**



**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.

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. this is a a one page patient summary which doctors can use to get a broad overview of a patient.





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

the big research question i'm working on is this.

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 to enable data entry and report generation, but with less training than is currently required using programs like excel and access.



# Other Work

- Microsoft Research India
  - <http://research.microsoft.com/research/tem/>
- Tier Group at Berkeley
  - <http://tier.cs.berkeley.edu>
- Change Group at UW
  - <http://change.cs.washington.edu>
- Stanford, MIT, CMU, Gatech, UCI, Cape Town, etc.

there are a lot of ongoing projects and this is a very small sampling.

msft: digital study hall, digital green, multipoint, textfree ui, kiosks

tier: wireless test beds, mobile learning, telemedicine

ischool: producer mis, mobile data capture for producers

change: openmrs, openrosa, gather, e-imci

others: pdas for animal trackers, curriculum for programming phones, etc

**computing can help  
solve some of  
problems in the rest  
of the world, but we  
need your help.**

this is a growing field that needs young energetic students to keep it moving forward. this is why we need your help! computer science is more than just writing code in seattle. it can really make the difference in the lives of the 'bottom billion'



Yaw Anokwa

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if you are interested, go to this site, and sign up on the mailing list and we can work together! you can also email me and we can chat.