Open Data Kit

Building Data-Driven Apps for Developing Regions

Yaw Anokwa, Carl Hartung, Waylon Brunette,
Adam Lerer, Clint Tseng, Mitch Sundt, Gaetano Borriello

http://opendatakit.org

Yaw Anokwa is a Ph.D. candidate in computer science at the University of Washington. Originally from Ghana, Yaw first realized the impact technology could have on the world's poor while working on a medical record system in rural Rwanda. That experience was the driving force behind his current work on Open Data Kit.

Yaw Anokwa is a Ph.D. candidate in computer science at the University of Washington. Yaw is best known for defeating Jeff Bigham in an epic light saber battle during the 2006 UW CSE holiday skit.

http://www.cs.washington.edu/orgs/student-affairs/gsc/history/2006-2007/holidayparty/live-skit-rc2.wmv

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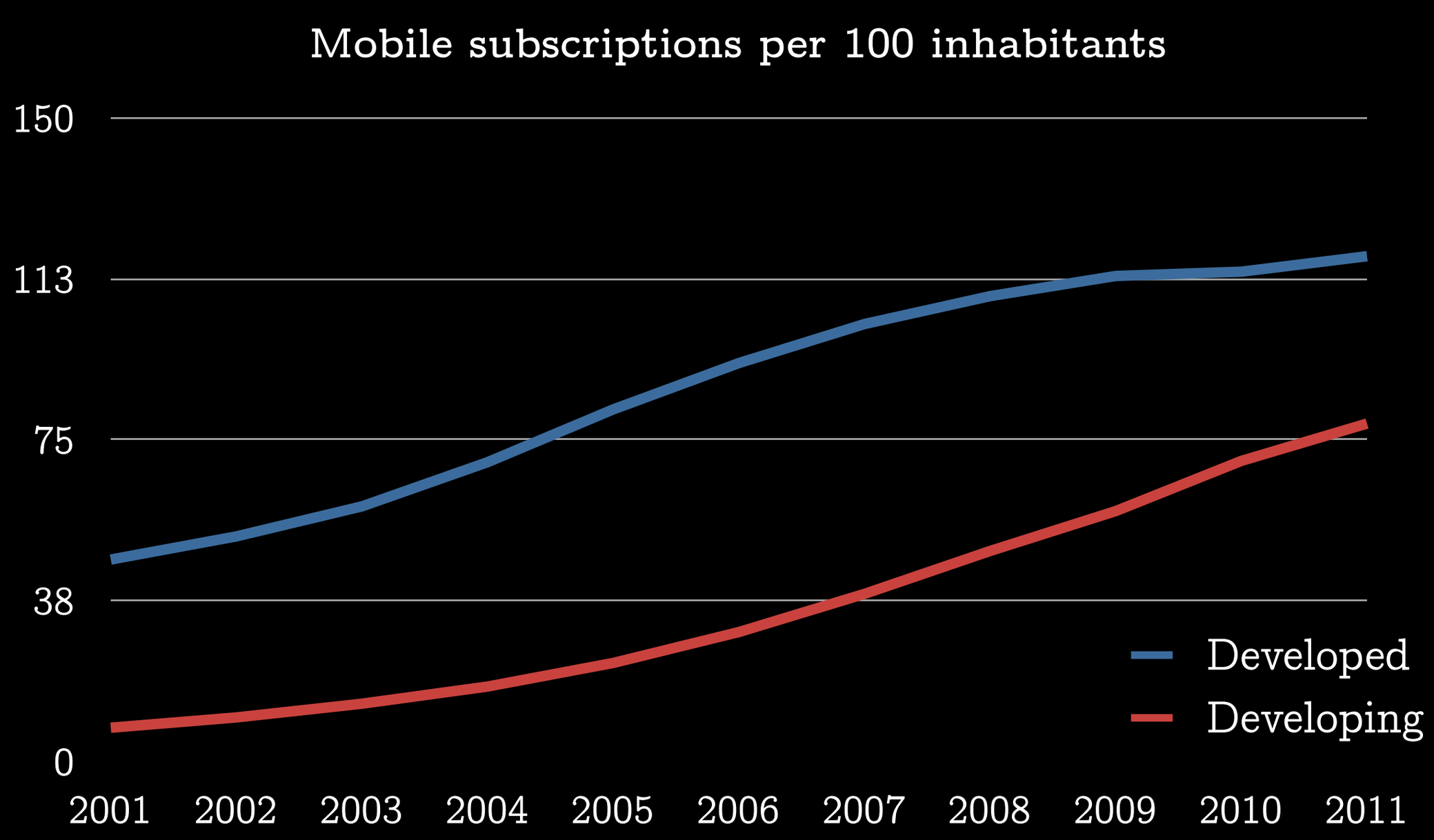
My name is Yaw Anokwa. I'm a Ph.D student in Computer Science from the University of Washington and this talk is about Open Data Kit our free and open source set of tools for building data-driven apps in developing regions.

This is work that is done with Carl Hartung, Waylon Brunette, Adam Lerer, Clint Tseng, and our advisor Gaetano Borriello. All of us are from UW except for Adam, who was a Masters student from MIT.

Our team mostly works in sub-Saharan Africa, so maybe I can share some of the context in which we work.

26% of Kenyans have Internet with 98% using cell for access.



can anyone tell me what this graph is?

the red curve is developing countries and the blue curve is developed countries. and this is over time. i'll give you a hint. it has to do with mobile phones.

so it's mobile subscriptions per 100 inhabitants and the thing to take away is that there is incredible growth in developing countries.

so that's amazing right? and with this growth of cell usage has come a growth in internet usage.

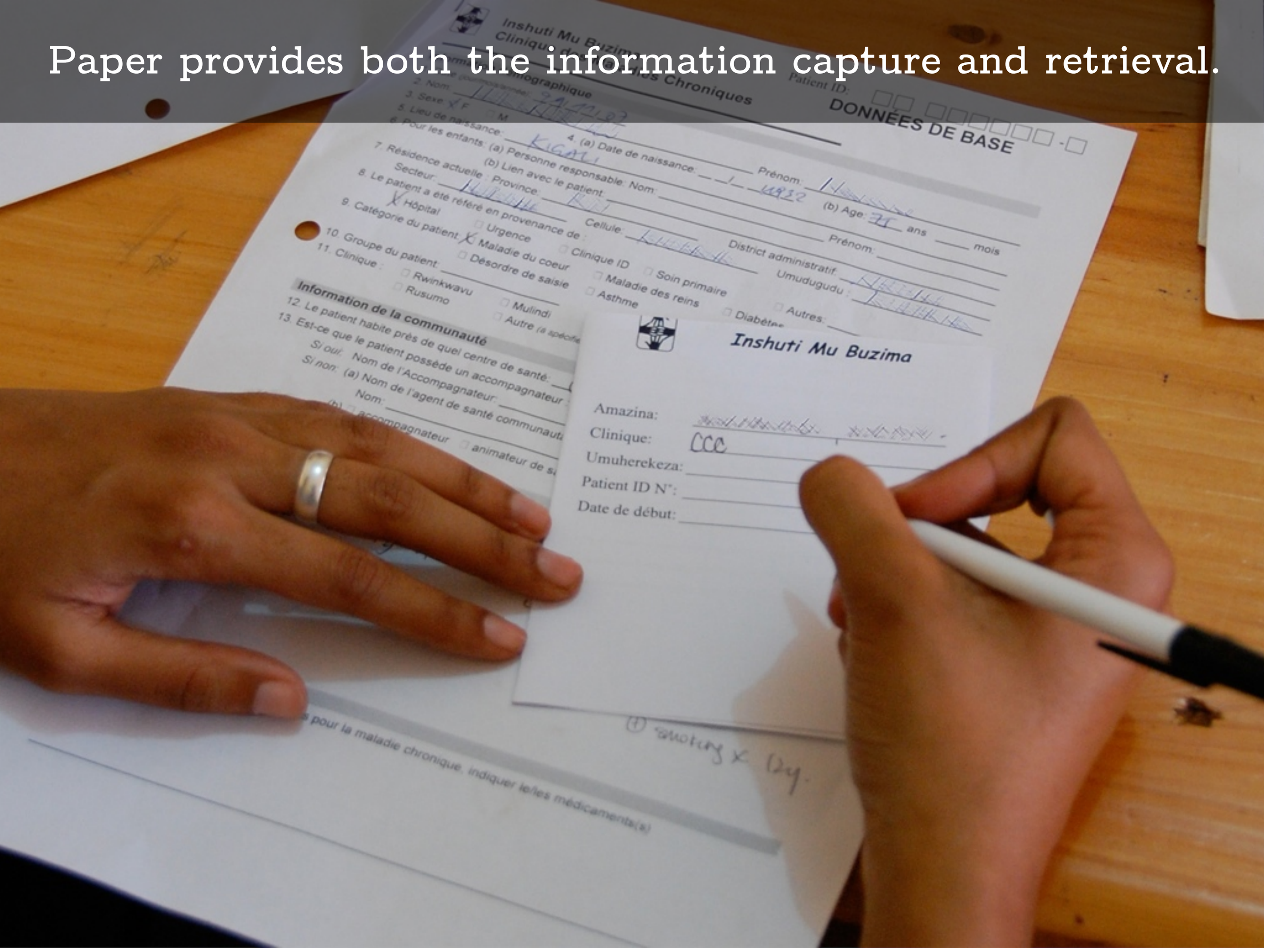
let's take kenya as an example.

currently 26% of kenyans have internet access. and 98% of those people get online through the cell networks -- so either on their phone or using a usb dongle.

and these aren't always feature phones. in kenya, the price of the basic smartphone (the android ideos) is about $80-$90. and it sells well at that price with some 350k buyers.

so the punchline here is that there is growing internet access and smartphone usage in sub-saharan africa. and on that infrastructure we can build systems that increase the efficiency of organizations and individuals. this is a theme at the heart of what our research group does.

so let me give you an example in health care in africa.



Paper provides both the information capture and retrieval.

When a patient comes into a clinic, the doctor fills out a paper form about the visit.

The paper form goes into a folder, and when the patient comes back a few months later, the doctor reviews the information in that folder and uses that to make decisions.
*
So paper provides both the information capture and retrieval.

With a paper-based system like this becomes really easy to make clinically relevant mistakes like missing a trend in a record or misread someone's handwriting.

Even if you are really careful, when you get thousand of patients,

Paper-based systems are hard to search or transport

The system becomes hard to search or transport.

This is especially important if you are treating HIV/TB patients who generate a lot of paper records.

add to that the fact that these clinics (especially the remote ones) are very busy and under-resourced.

just for some perspective on how under-resourced, the us has one clinician per 400, kenya has one clinician per 7,000.

Lag between data collection and actionable information.

There is a substantial lag between data collection and actionable information.

That is, if you are in remote desert, it's going to take you some time to get all those paper forms back to a city so you can get it double entered.

There are also more complex examples of where paper just doesn't work. so if you want to add gps coordinates or pictures to the data collection, you are out of luck.

so our claim is

Mobile phones and cloud servers can increase the scale and speed of interventions.

Mobile phones and cloud servers can increase the scale and speed of interventions.

And with the growth of cell phone usage all over the world, there have been lots of projects where people use phones and computers to replace paper.

We looked at a lot of those tools before building ODK, so let me give you three high level reasons some of those tools are lacking.

Staying with the medical domain, here is a picture of a nurse using a PDA to do some decision support.

A lot of projects use PDAs and basic phones. Much of this is cost driven because everyone wants the cheapest device possible...

But

There is a tradeoff between the cost of device and functionality, usability and sustainability of your project
*
and we argue that important features are lost when using basic technology.

For example, on basic phones, you can't easily take high resolution picture or store a complex medical record system.

Training is also sometimes an issue. We worked with a group who was spending hours just training people on how to capture a location on an external GPS and enter it into a PDA. All that training can be expensive.

We should be able to make that process much easier!

Domain-specific tools are inflexible and keep data siloed.

flickr: RaGardner4

The second issue is many of the existing systems are
*
domain-specific and keep the data siloed.

Why can’t we build a modular system that works well for healthcare and crisis mapping and surveying?

Why can’t we make small pieces so each organization can pick just what they need to connect to their existing systems?

Sustainability is hard to achieve with a small team.

And finally, there is the issue of sustainability and scale.
*
Growing a project is hard with small academic team.

Instead of a few people working on ODK, we wanted to build a community of developers and implementers and users and enable that community to grow the project as needed.

This way when we finished the research, the project would continue.

So to recap some of the problems are...

Important features are lost when using the most basic technology.

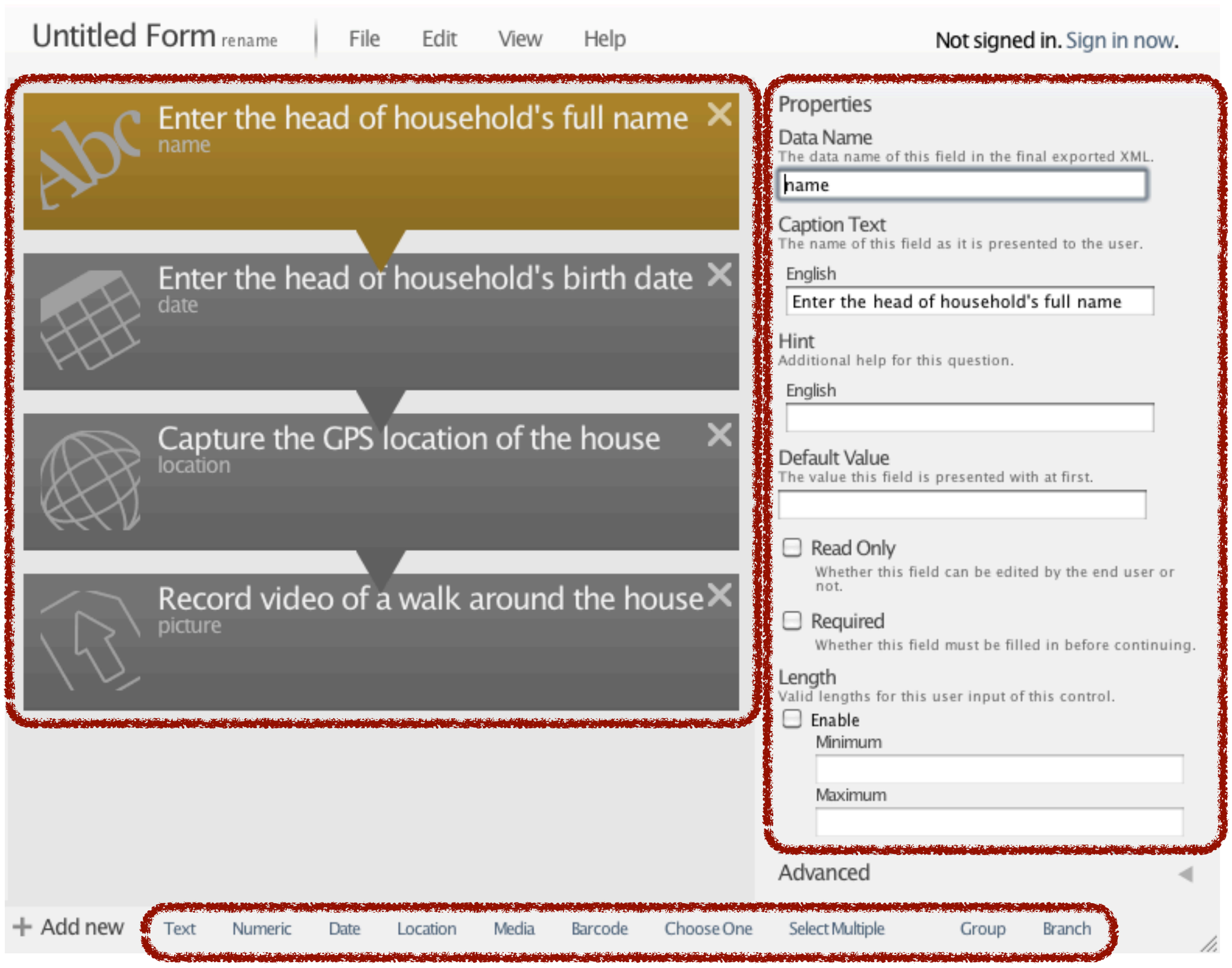
Domain-specific tools are inflexible and keep data siloed.

Sustainability and scale are hard to achieve with a small team.

Important features are lost when using the most basic technology.
*
Domain-specific tools are inflexible and keep data siloed.
*
Sustainability and scale are hard to achieve with a small team.

So with that, let’s take a look at three of the popular ODK tools.

Build: Drag and drop prompts for form creation.



ODK Build is an HTML5 web application where you drag and drop prompts to create forms. It runs in the browser but can also be used offline. It looks like this.
*
To design a form, you drag and drop each prompt the user will interact with from this button pane
*
to the canvas. Each prompt has a set of properties which users can edit here.
*
The prompts are pretty powerful. For example, you can have multiple languages for each prompt, make prompts relevant based on previous answers, or make prompts loop some number of times.

When you are done, the Build gives you a file that describes the form logic and the schema of your data.

XForms describes the form logic and data schema.

```
        <instance>
            <data>
                <name/>
                <date/>
                <location/>
                <picture/>
            </data>
        </instance>
        <itext>
            <translation lang="eng">
                <text id="/data/name:label">
                    <value>Enter the head of household's full name</value>
                </text>
                <text id="/data/date:label">
                    <value>Enter the head of household's birth date</value>
                </text>
                <text id="/data/location:label">
                    <value>Capture the GPS location of the house</value>
                </text>
                <text id="/data/picture:label">
                    <value>Record video of a walk around the house</value>
                </text>
            </translation>
        </itext>
        <bind nodeset="/data/name" type="string"/>
        <bind nodeset="/data/date" type="date"/>
        <bind nodeset="/data/location" type="geopoint"/>
        <bind nodeset="/data/picture" type="binary"/>
    </model>
</h:head>
<h:body>
    <input ref="name">
        <label ref="jr:itext('/data/name:label')"/>
```

That file is an XForm. W3C XForms are a well-defined open standard for forms and we use it to describe the form logic and data schema.

*

If you can read some of this text, you'll see some of the elements of the form I showed you earlier, like the english translation for the text.

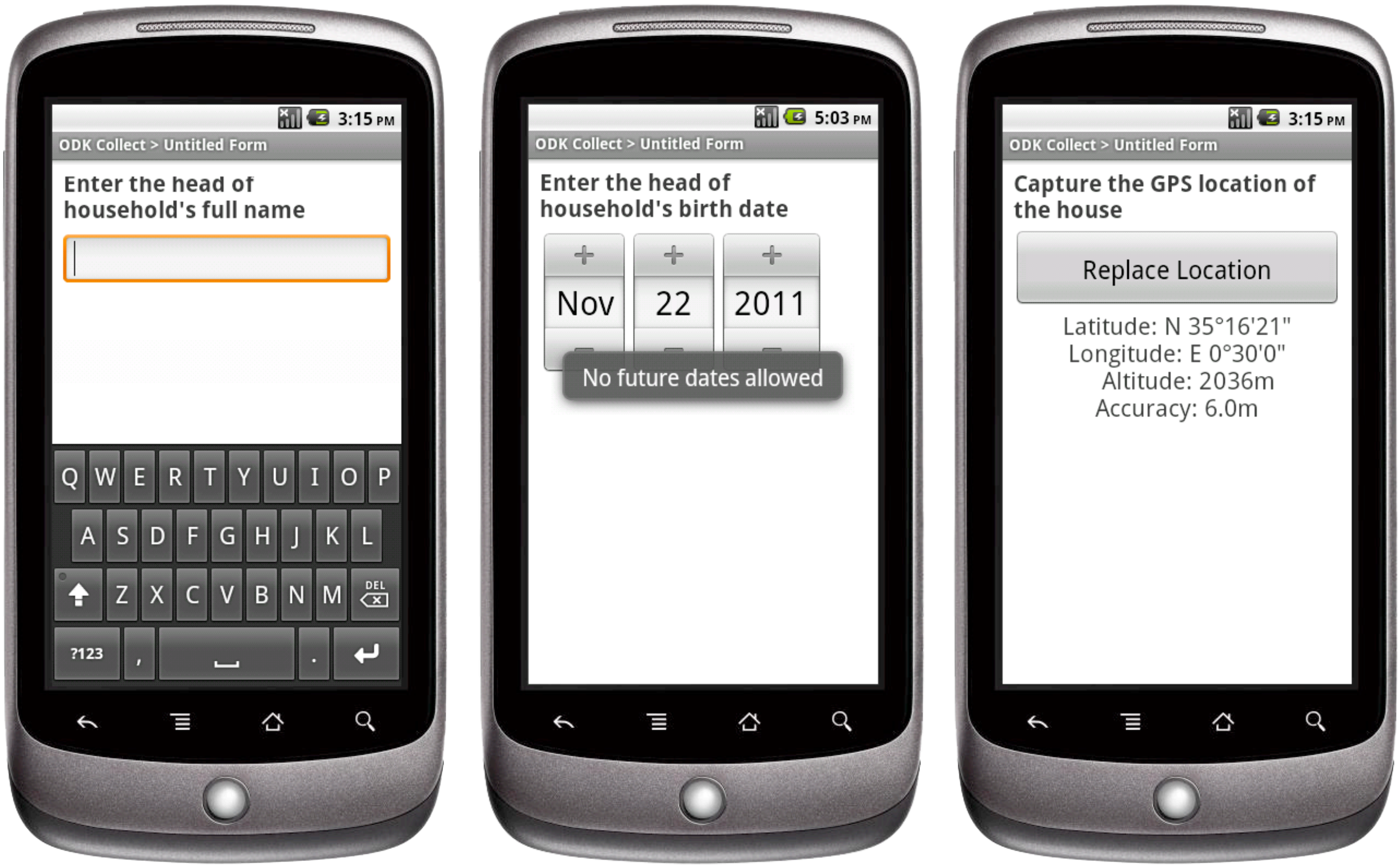
*

You see also data types -- string, date, geopoint and binary.

*

Once you have a form, you can give it to a device you want to show it -- like our mobile client, ODK Collect.

Collect: Display prompts for data collection and delivery.



ODK Collect is an client that takes the XForm and can display prompts to collect and deliver different types of data.

Collect runs on the Android operating system so you can use it on phones, tablets and netbooks. It runs great offline and looks like this.

*

You can collect text, numbers

*

dates

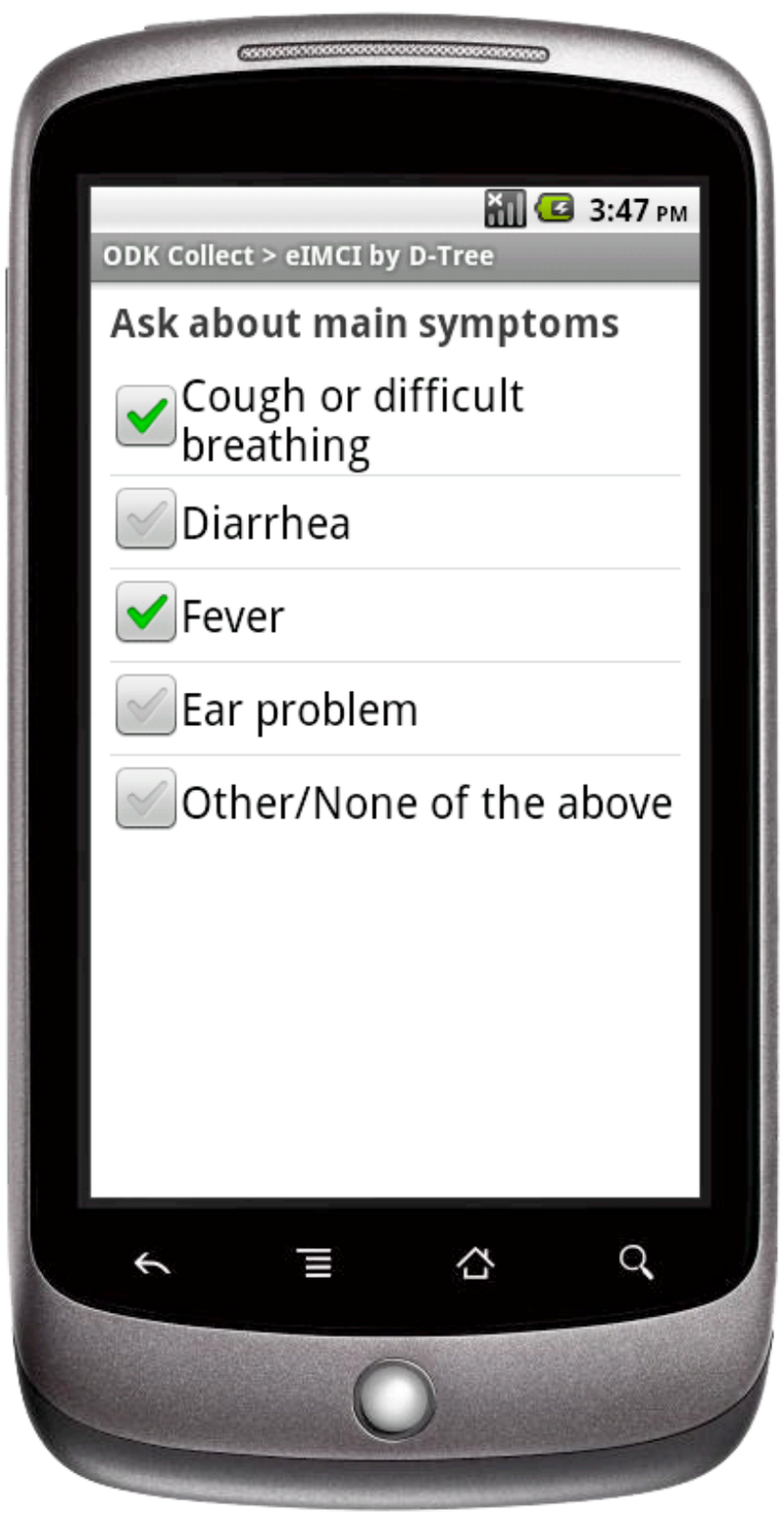
*

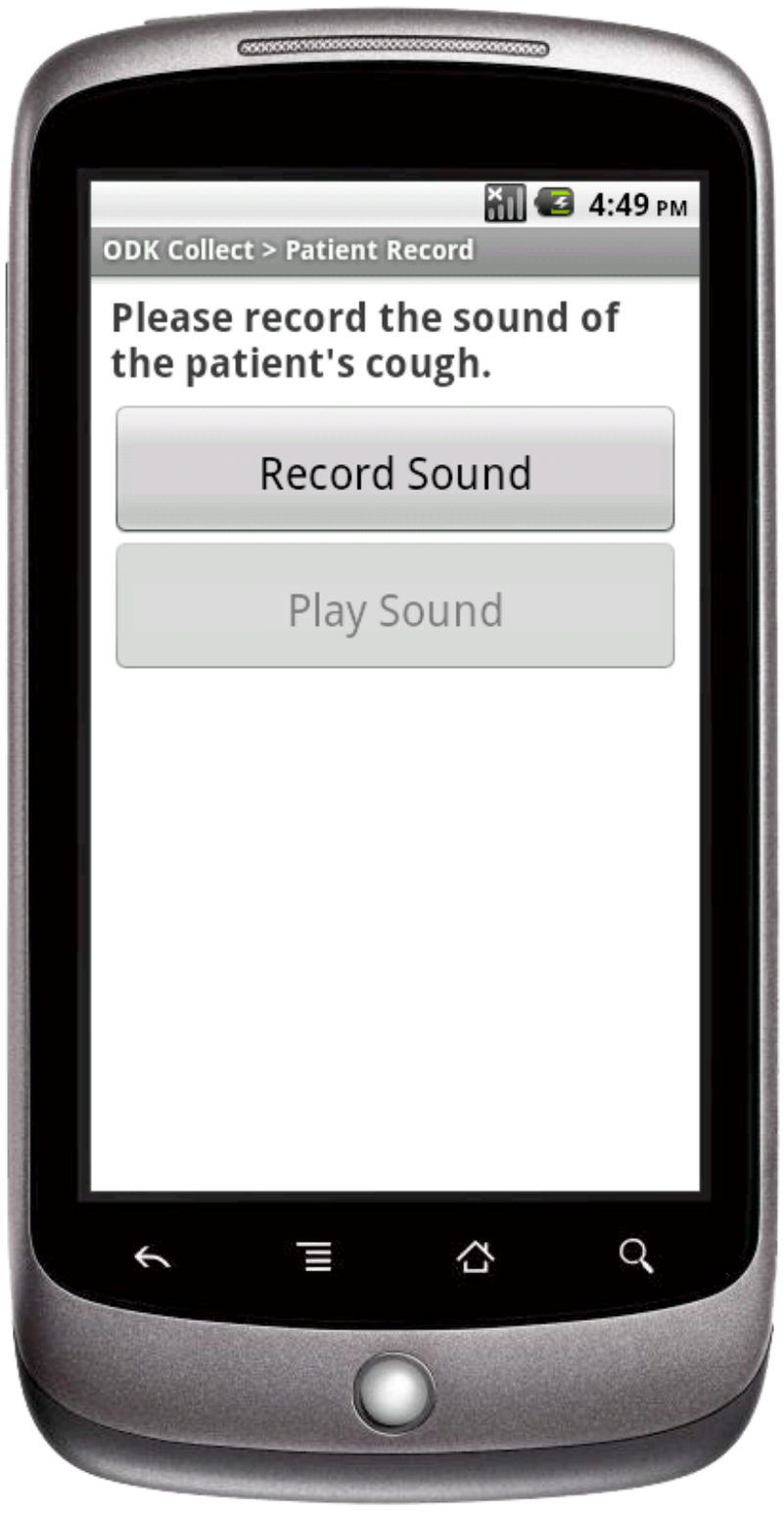
you can put constraints on all prompts. So for example, birth dates can't be in the future.

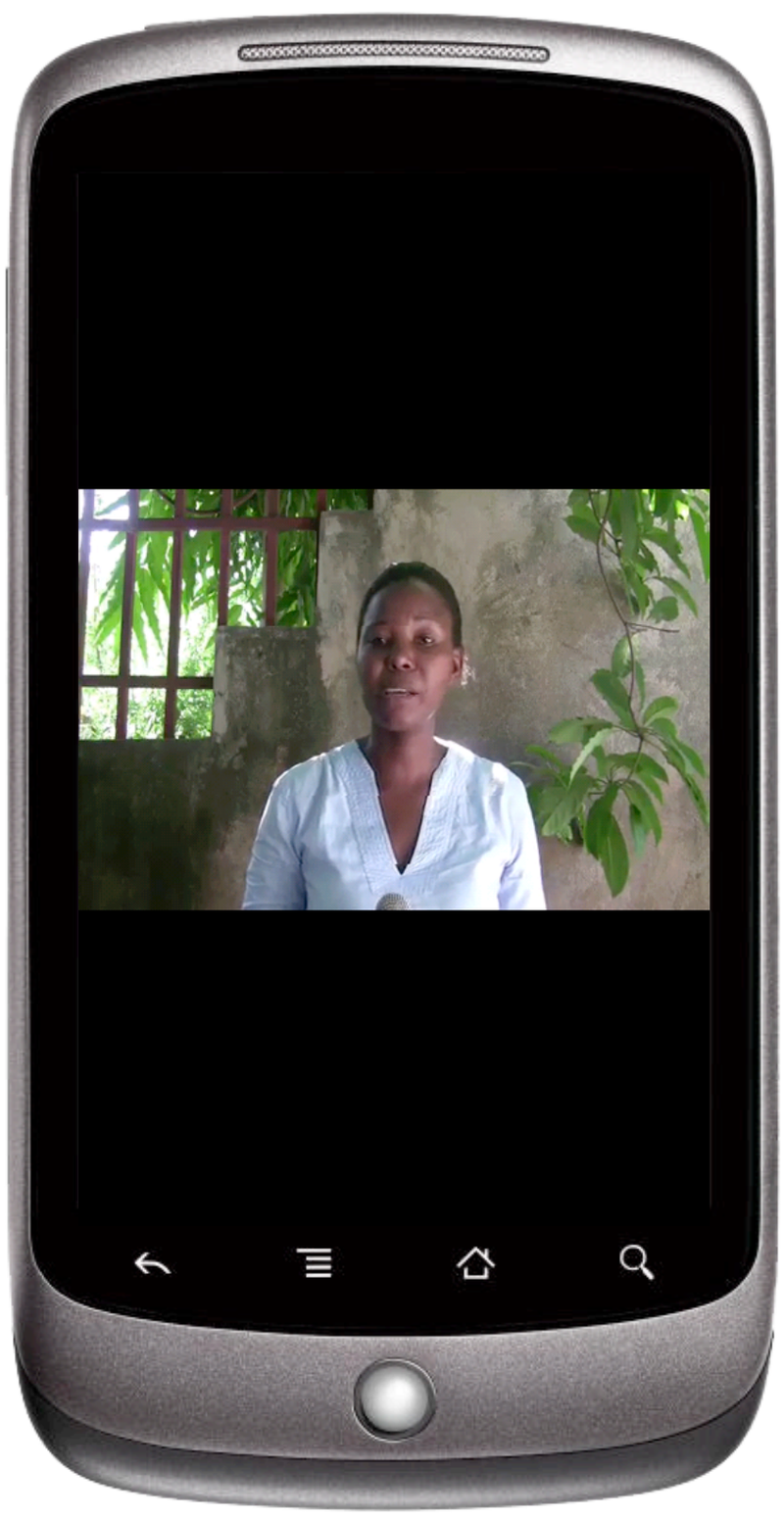
*

You can also capture GPS location using one click.

Collect: Display prompts for data collection and delivery.







the forms themselves are really powerful. so here is an example of imci in swahili.

imci is the integrated management of childhood illnesses. it's basically a triage protocol for children under five.

my swahili is weak, so let's switch to english. with odk collect you can do this on the fly.

and if i enter that the child is coughing and has a fever, in the next screen, i can record the sound of the cough and then i can show the mother a video about how to treat fever.

so there is this collection of data, but also a delivery of information using complex logic. any data i gather can be stored offline and then be sent off to a server.

so the hct program encoded their protocol as a form kind of like this and deployed it. that was in early 2010.

Aggregate: Host data and provide extraction interfaces.

cation-Latitude	Location-Longitude	Location-Altitude	Location-Accuracy	Des
374240020636755	151.1692304632708	28.0	5.0	End other side
37486958941743	151.1690486118154	29.0	5.0	Willow
37504302300135	151.16903599729017	29.0	5.0	Cigarette dump
375864156698455	151.16889189846407	28.0	5.0	Wite flowers
37685209640148	151.1684238513032	28.0	10.0	Trees
37923633851942	151.16784138112294	40.0	5.0	Start white creek
9163298333333	-105.22232958333333	1633.1	12.0	Eddy at dog park
26413130760193	-80.32614648342133	1.0	4.0	Baseball fieldin trop
37890696525574	151.16791605949402	28.0	6.0	Whites creek algae
4937171666667	-121.93441071666666	27.4	3.0	Bob at Santa Clara U
37871921062469 5	151.1679643392563	21.0	3.0	White creek running
37857973575592	151.16811990737915	25.0	3.0	Rubbish
37859582901001	151.16813600063324	28.0	3.0	Blue tongue lizard
4937171666667	-121.93441071666666	27.4	3.0	Bob at Santa Clara U
9163298333333	-105.22232958333333	1633.1	12.0	Eddy at dog park
26413130760193	-80.32614648342133	1.0	4.0	Baseball fieldin trop

Aggregate hosts the submitted data and provides extraction interfaces such as
*

spreadsheets, maps, and queries. We don’t run one big server, you download an installer, and it configures one just for your organization.

Aggregate: Codebase runs locally and in the cloud.

flickr: theplanetdotcom

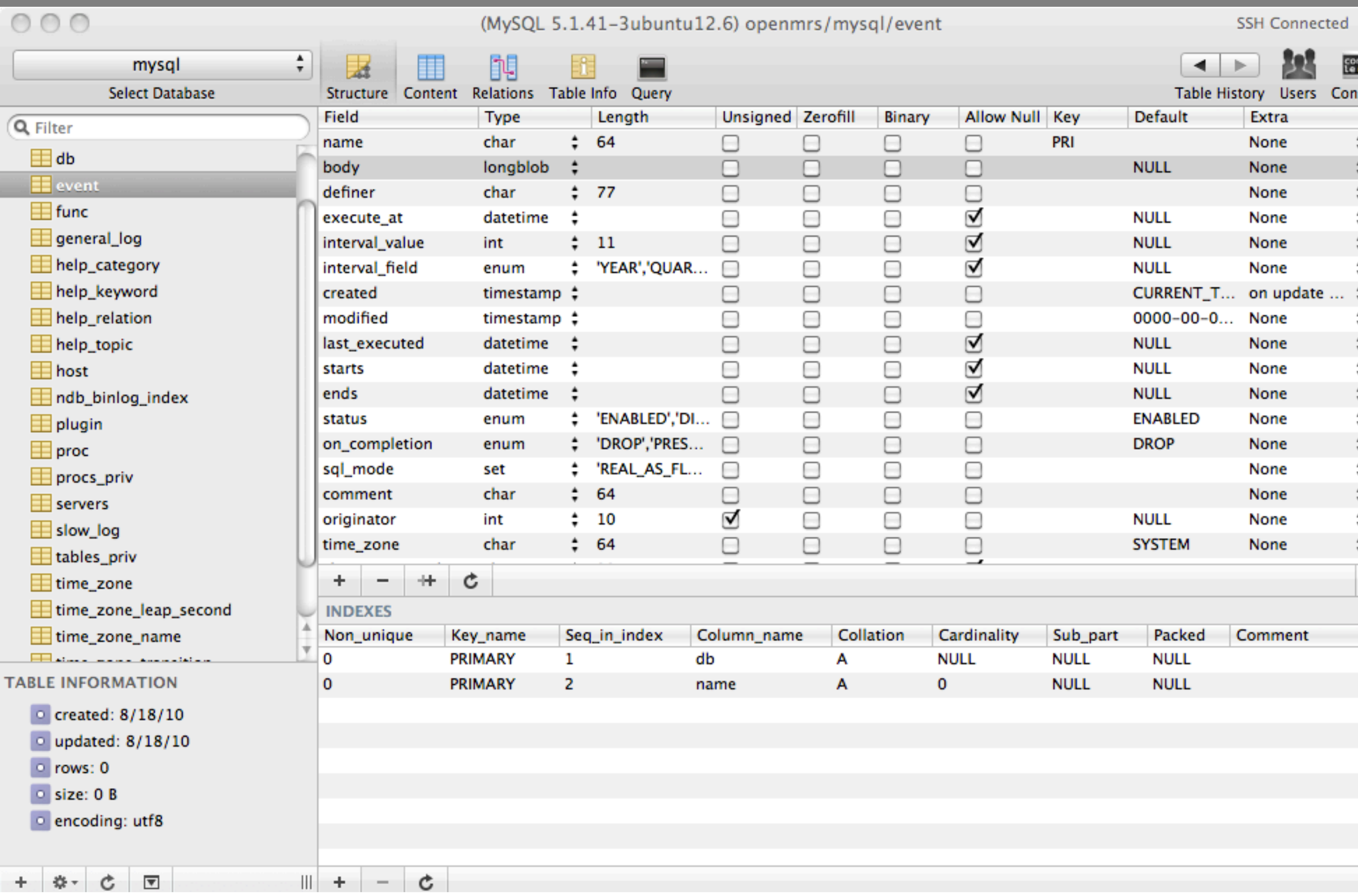
Aggregate is designed to run on local machines as well as run in the cloud.

In fact, the same code base that runs on a local server backed with MySQL will run on Google App Engine or Amazon Web Services.

The benefit of the cloud over the local server is with a double click and you get a fast server that is basically free.

You don't have to worry about viruses, maintenance, scaling, or the other problems of running a server in a low-income region.

Aggregate: Designs database backend using XForm.



Another feature that makes Aggregate unique is that it designs the database backend for you using the XForm.

*

You don’t have to know how to use complex relational tools databases like these.

You give Aggregate the same form you give to Collect, and it builds a custom database for you.

Aggregate: Stores or forwards data to external systems.

DeviceId	351676030226627
SurveyorName	Shadrack
TreeLocation-Latitude	-4.9192410707473755
TreeLocation-Longitude	29.60762321949005
TreeDBH	57.0
TreeName	Myombo
TreePicture	View

Finally, Aggregate can either store or forward your data to other systems.

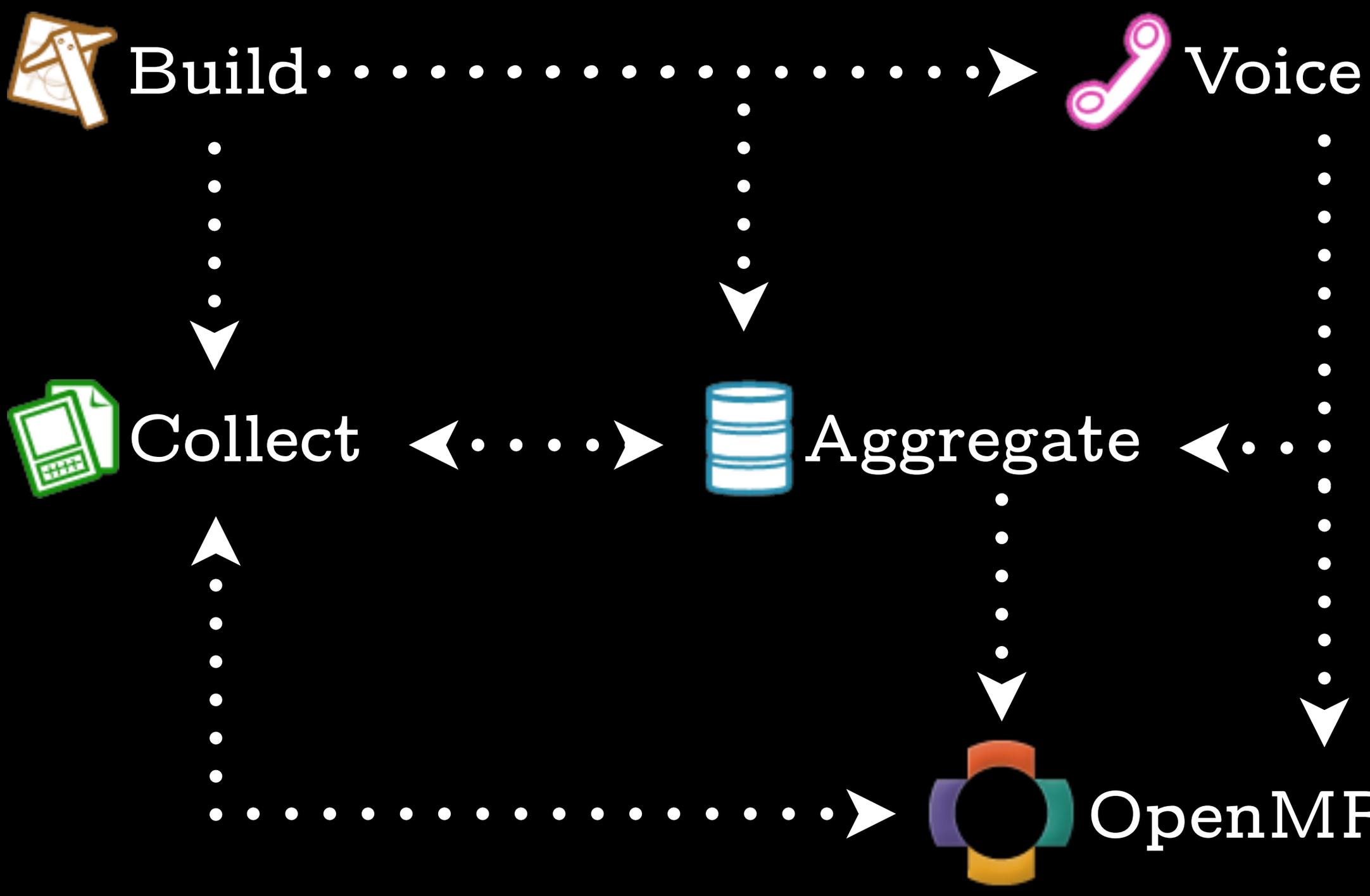
In this example, forestry workers with the Jane Goodall Institute in Tanzania, submitted data from Collect to Aggregate and then exported to Google Earth.

Managers could then click on each yellow point and get the data that was submitted.

The process of multilingual form design, training people who hadn't seen smartphones, data collection and reporting took half a day.

So I've showed you three of the ODK tools, let me show how they fit together.

ODK tools are designed to fit together.



You use Build to design a form
*
and you give that from to Collect to display it.
*
You give it to Aggregate, and it will build the storage for the responses.
*
To complete the loop, Collect can send data to Aggregate, and it can also download new forms from the Aggregate.

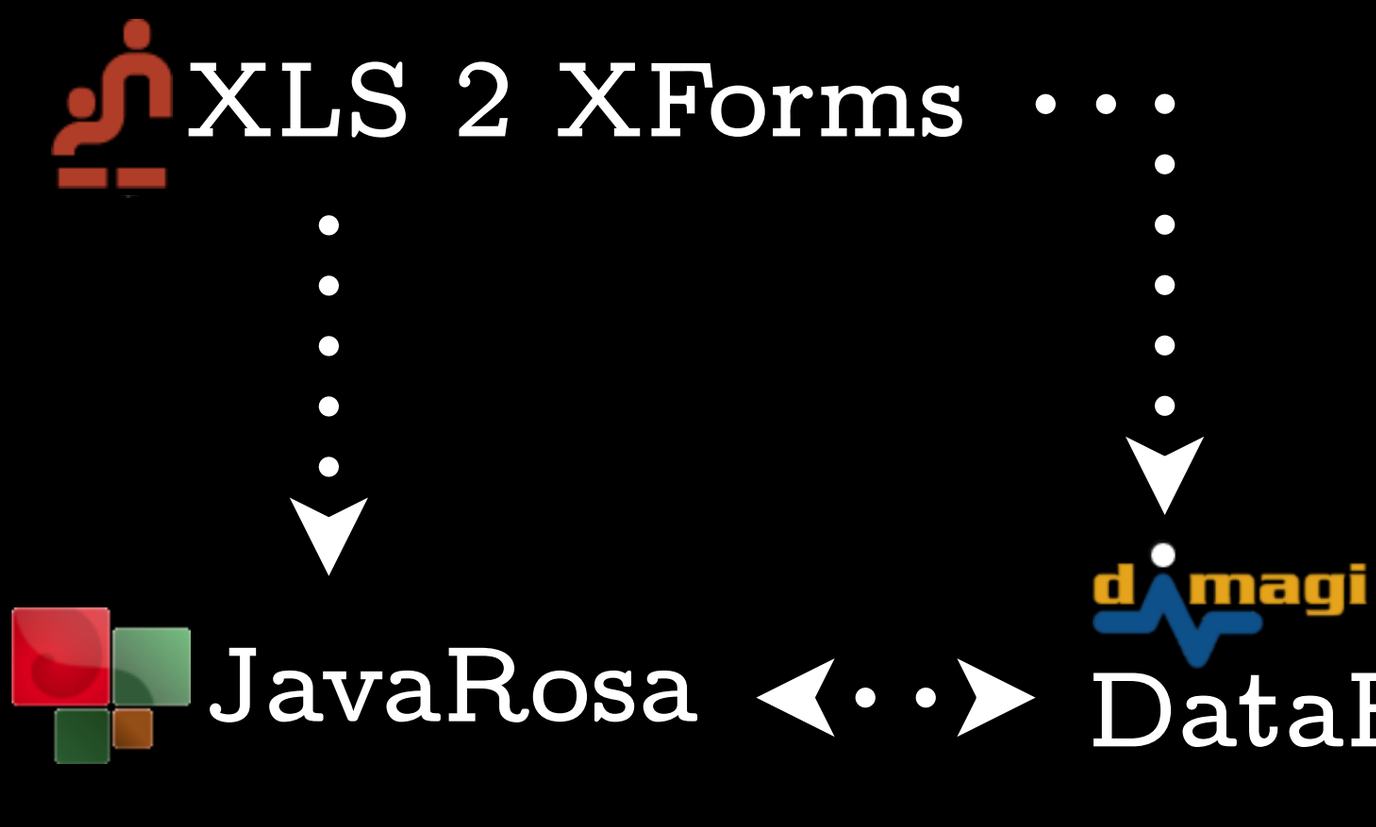
But ODK is more than those three tools.
*
For example, you can give the form to ODK Voice.

Voice is a tool we have that builds an IVR tree out of that form and connects it to the phone network. It does all the things Collect does with logic and multiple languages, but it does it using the voice channel on basic phones.

For example, you can have Voice call all the people in a district and ask them for their gender and language.

Based on their responses with their keypad, you can play the women pregnancy advice and the men farming advice. And it will do that in their native language.
*
Naturally, all their responses get fed back to Aggregate.
*
We support connecting to other systems, say like OpenMRS.
*
You can treat OpenMRS just like Aggregate, and use it to share medical forms and data with Collect.

Users can design an end to end system in under an hour.



You might be asking how long it takes to build the basic end to end system.
*
If you are an implementer with basic computer skills you can be up and running with the form, the mobile client and the server in about hour.

More importantly, we are compatible with a bunch of other tools that may work better for organization.

If you have really large forms, you might want to use ChildCount's XLS2XForms and that will work just fine.
*
If you think Android phones are too fancy, you can use a J2ME client like JavaRosa. You loose the Android specific features, but everything will work.
*
If you don't like our Java server, Dimagi makes an awesome Python one called DataHQ -- you can use that as well.

Now these are nice ideas, but does any of this actually work in the field?

We surveyed a few groups who were familiar with existing systems and had used ODK.

The details of the survey are in the paper, but I want to highlight two of these groups.

AMPATH's health workers have used ODK to counsel and test over half a million people for HIV.

AMPATH finds that ODK is faster and more cost-effective than previous PDA-based or paper-based systems.

AMPATH uses 300 community health workers equipped with ODK-powered smartphones to do home-based counseling and testing.

This image shows one of those workers using the barcode scanner on the phone to identify a patient.

The project started in early 2010 and as of mid-2011 has visited 568k individuals and tested 355k.

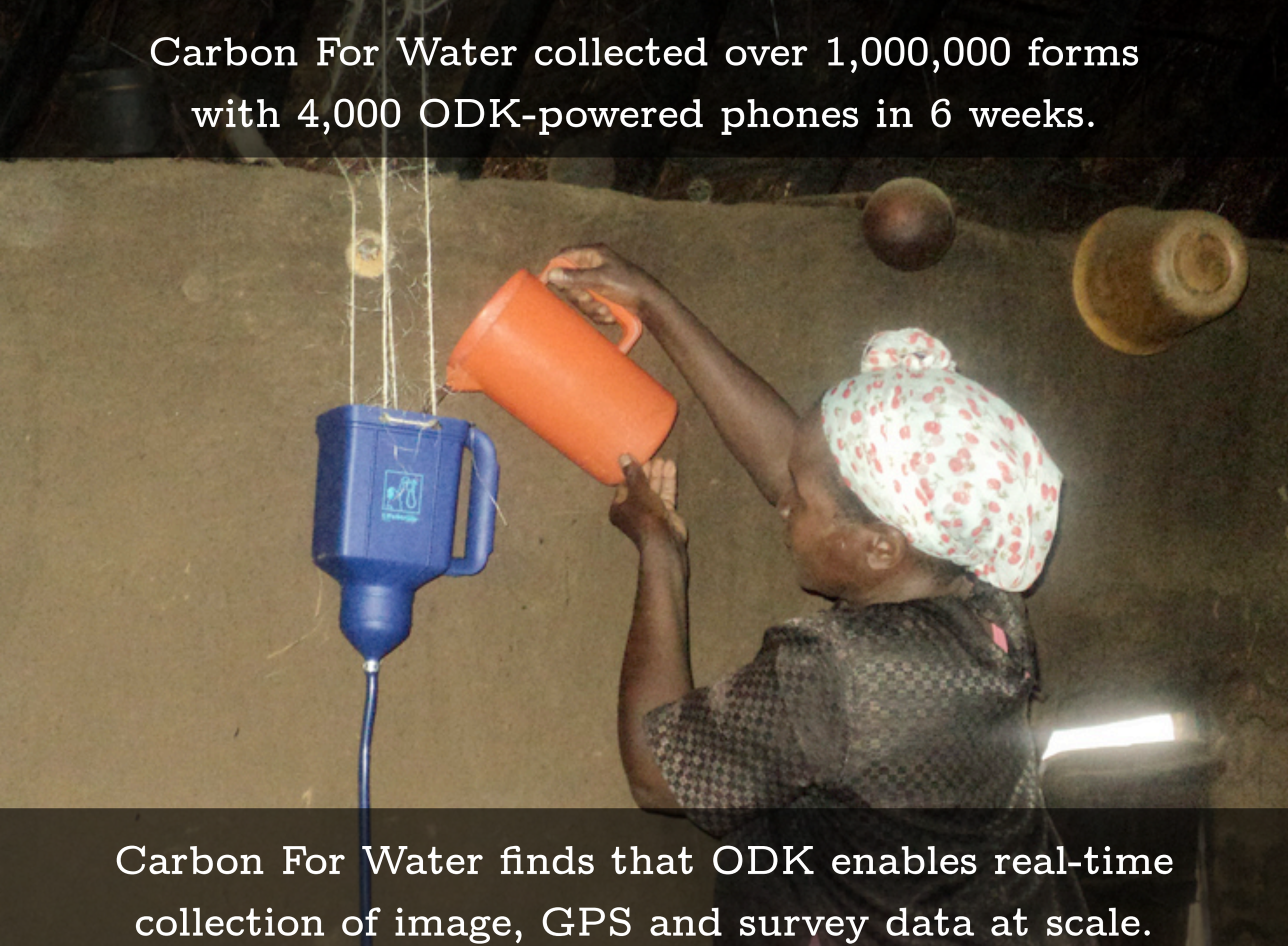
Users found the system easy to use and thought it allowed them to collect higher quality data.

Supervisors saw higher cost savings over our previous PDA-based system as well as over pen and paper systems.

Electronic collection also facilitated earlier reporting, which means more people get on treatment much faster.

http://ampathkenya.com

Carbon For Water collected over 1,000,000 forms with 4,000 ODK-powered phones in 6 weeks.



Carbon For Water finds that ODK enables real-time collection of image, GPS and survey data at scale.

Carbon For Water used 4000 ODK-enabled phones to collect over a million forms in six weeks.

The data is used to support Vestergaard Frandsen's campaign to distribute LifeStraw Family water treatment units to 4 million people in Western Kenya.

http://www.vestergaard-frandsen.com/carbon-for-water/index.html

Deployments: 10-50k active users of ODK tools globally.

There are 5,000-10,000 users of stock ODK tools and 10,000-50,000 users of ODK derivatives. ODK is used at scale on in 30 countries (six continents with Antarctica coming soon) and used in a variety of domains.

We scale horizontally. We build a platform and enable people to use it.

* Jane Goodall Institute, Amazon Conservation Team and Google is using ODK for deforestation monitoring.

* New York City's Department of Health uses ODK to gather emergency preparedness and response-related data in the field.

* The Africa Soil Information Service (AfSIS) uses ODK to map soil conditions.

* Johns Hopkins uses ODK to improve provider communication and education through their eMOCHA project.

* Makerere University's uses ODK for automated diagnosis and mapping cassava mosaic disease.

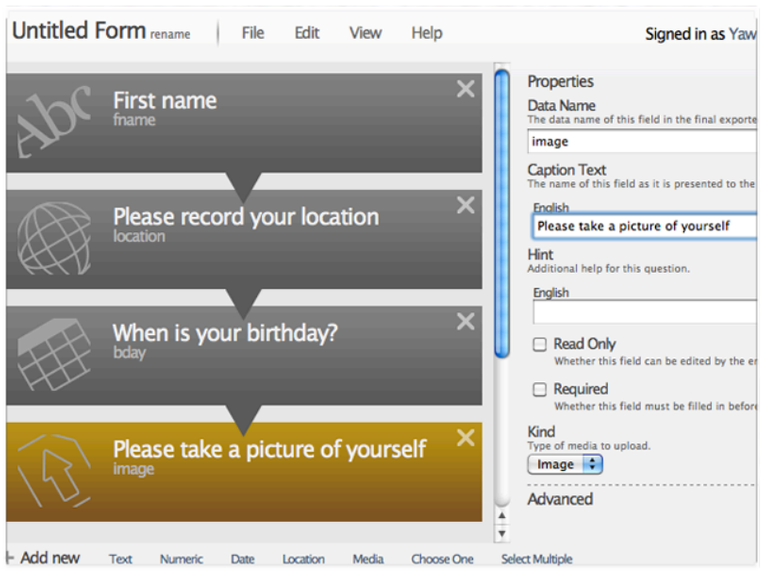
* D-Tree is using ODK in a UNICEF-funded project to better to identify and treat severely malnourished children.

* ODK has been used for as an Early Grade Reading Assessment instrument to measure student literacy.

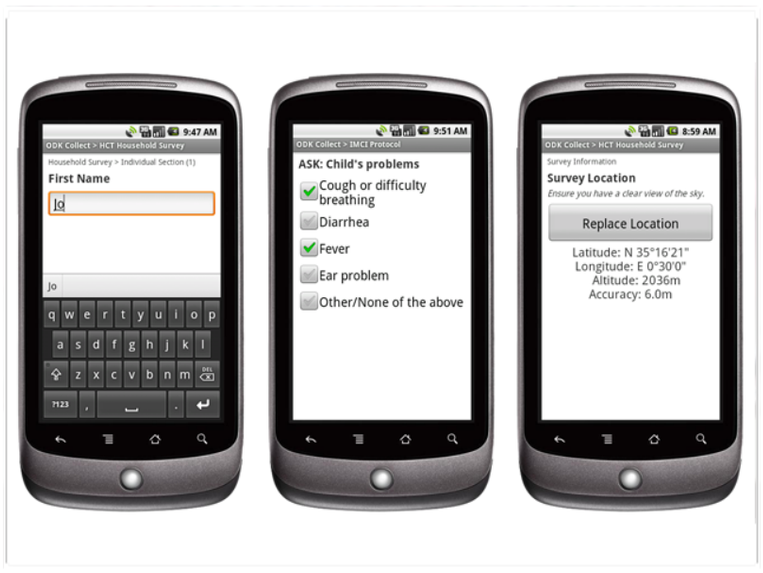
* Berkeley Human Rights Center uses ODK to documenting human rights violations.

Using paper to collect data is difficult and inefficient.
ODK uses phones and servers to digitize data collection.

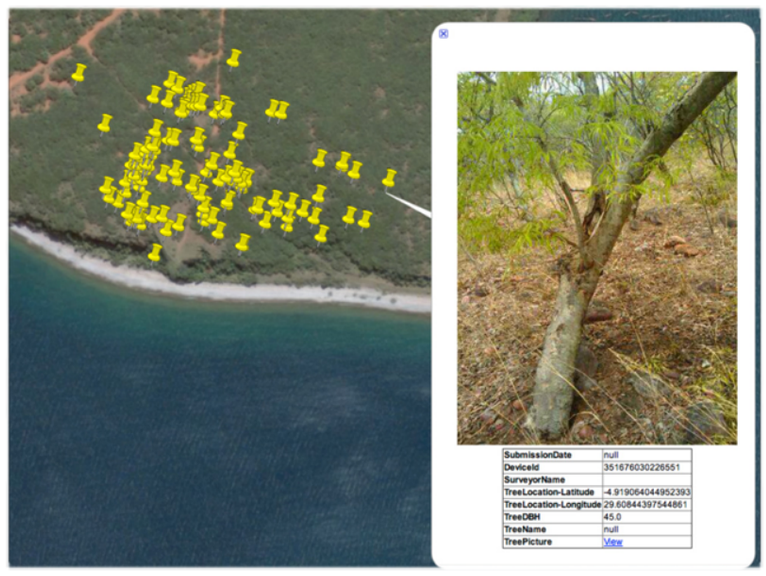
1. Build form



2. Collect data



3. Aggregate results



http://opendatakit.org

Open Data Kit (ODK) is a free and open-source set of tools which help organizations create mobile data collection solutions.

ODK provides an out-of-the-box solution for users to:
1. Build a data collection form or survey;
2. Collect the data on a mobile device and send it to a server; and
3. Aggregate the collected data on a server and extract it in useful formats.

ODK Clinic

Design of a Phone-Based Clinical Decision Support System for Resource-Limited Settings

Yaw Anokwa, Win Ribeka, Martin Were,
Tapan Parikh, Gaetano Borriello

http://opendatakit.org

my name is yaw anokwa. i'm a ph.d student in computer science from the university of washington and this talk is about the design of a phone-based clinical decision support system for resource-limited settings.

that's a bit of a mouthful so i call the system odk clinic.

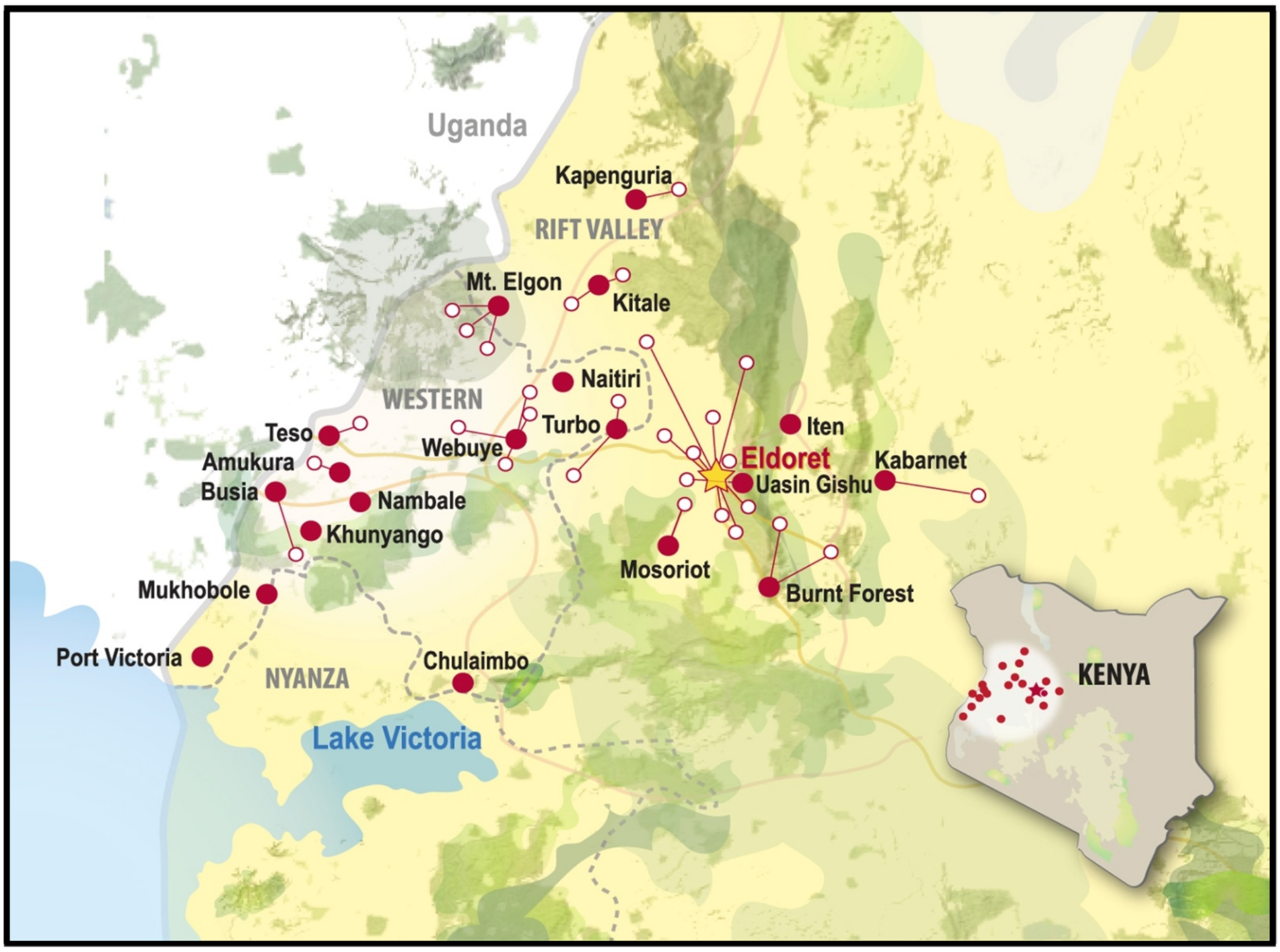
this is work that is done in very deep collaboration with win ribeka and martin were. win and martin work with regenstrief institute in indianapolis.

tapan parikh and gaetano borriello are my academic advisors. tap is at ischool in berkeley and gaetano in cs at uw.

i should note that we published a paper at ictd2012 with a lot more detail than i can get into here, so i'll give you links to that at the end of the talk.

so let's get started, and oh, please feel free to ask questions at any point.

AMPATH's catchment area has over 2 million individuals



let me tell you a bit about ampath...

usaid-ampath is the one of the largest hiv treatment programs in sub-saharan africa and is kenya's most comprehensive initiative to combat the virus.

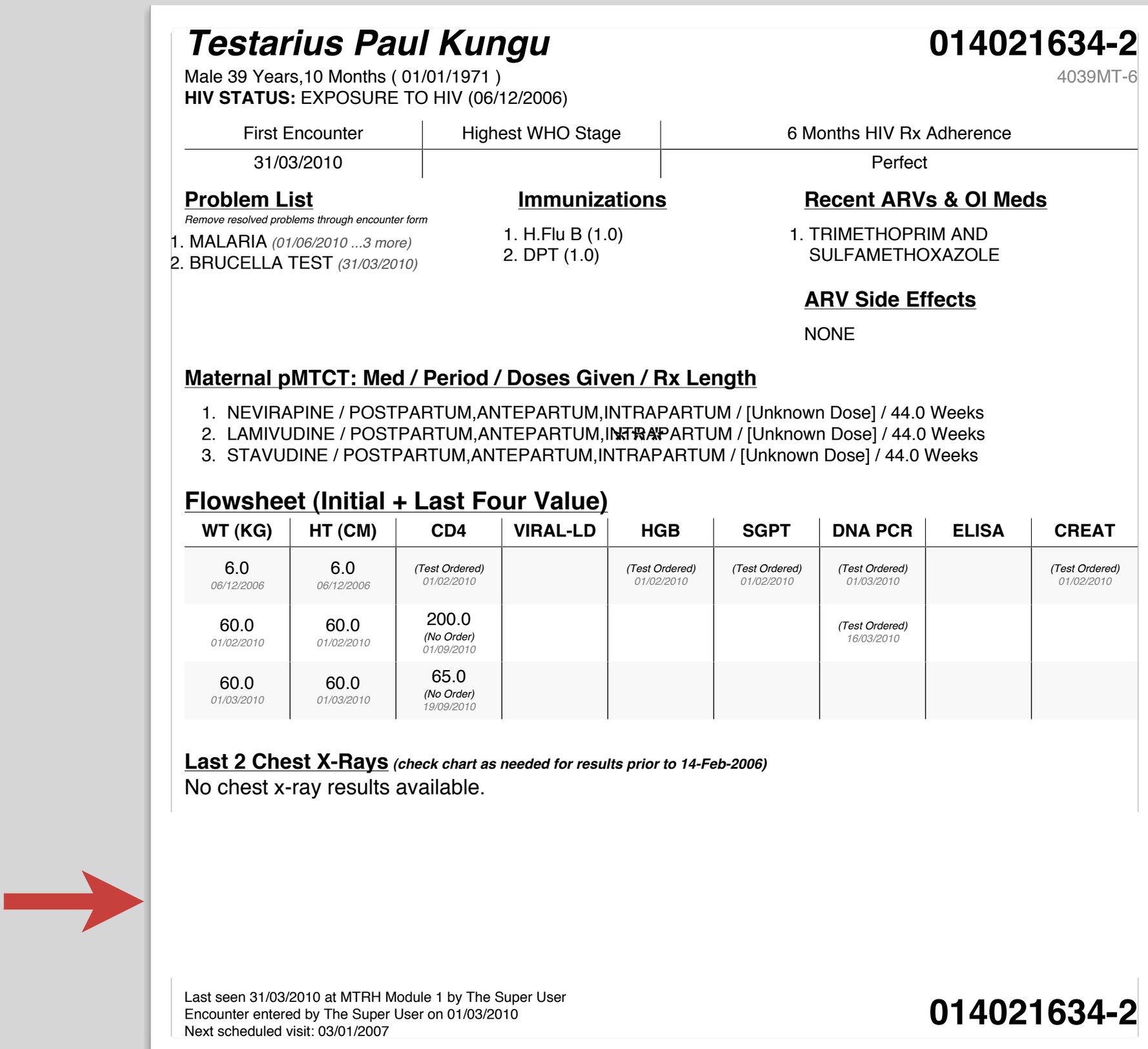
their catchment area has some 2 million people and the program provides care to more than 130,000 active HIV patients through 26 parent and 26 satellite clinics. eldoret, which you can see in the middle, is their main location.

when you get to this size, being efficient is really important and that's again, is where technology can play a key role.

with the success of smartphones in hct, i went back to ampath looking for more problems, this time at the point of care.

and that's when the idea for a phone-based clinical decision support system was born.

Summaries and reminder are good decision support tools



Testarius Paul Kungu **014021634-2**

Male 39 Years,10 Months (01/01/1971) 4039MT-6
HIV STATUS: EXPOSURE TO HIV (06/12/2006)

First Encounter	Highest WHO Stage	6 Months HIV Rx Adherence
31/03/2010		Perfect

Problem List
Remove resolved problems through encounter form
1. MALARIA *(01/06/2010 ...3 more)*
2. BRUCELLA TEST *(31/03/2010)*

Immunizations
1. H.Flu B (1.0)
2. DPT (1.0)

Recent ARVs & OI Meds
1. TRIMETHOPRIM AND SULFAMETHOXAZOLE

ARV Side Effects
NONE

Maternal pMTCT: Med / Period / Doses Given / Rx Length
1. NEVIRAPINE / POSTPARTUM,ANTEPARTUM,INTRAPARTUM / [Unknown Dose] / 44.0 Weeks
2. LAMIVUDINE / POSTPARTUM,ANTEPARTUM,INTRAPARTUM / [Unknown Dose] / 44.0 Weeks
3. STAVUDINE / POSTPARTUM,ANTEPARTUM,INTRAPARTUM / [Unknown Dose] / 44.0 Weeks

Flowsheet (Initial + Last Four Value)

WT (KG)	HT (CM)	CD4	VIRAL-LD	HGB	SGPT	DNA PCR	ELISA	CREAT
6.0 06/12/2006	6.0 06/12/2006	(Test Ordered) 01/02/2010		(Test Ordered) 01/02/2010	(Test Ordered) 01/02/2010	(Test Ordered) 01/03/2010		(Test Ordered) 01/02/2010
60.0 01/02/2010	60.0 01/02/2010	200.0 (No Order) 01/09/2010				(Test Ordered) 16/03/2010		
60.0 01/03/2010	60.0 01/03/2010	65.0 (No Order) 19/09/2010						

Last 2 Chest X-Rays ***(check chart as needed for results prior to 14-Feb-2006)***
No chest x-ray results available.

Last seen 31/03/2010 at MTRH Module 1 by The Super User
Encounter entered by The Super User on 01/03/2010
Next scheduled visit: 03/01/2007

014021634-2

ampath now has paper-based clinical summaries for patients. it's one page sheet that is generated from the electronic medical record system and put in all the patient charts when the patient presents.

it gives a nice overview of all the relevant patient data and solves the problem of having to find and go through paper records when you see a patient. the paper summaries are in all sites and are well-liked.

there are a variety of summaries -- adult/peds hiv, pmtct, antenatal and primary care.

when ampath analyzed the data after they rolled out that system for adult hiv patients, they found out that half of the patient visits with summaries were failing to confirm to the cd4 lab ordering schedule that the ampath/moh say is good care.

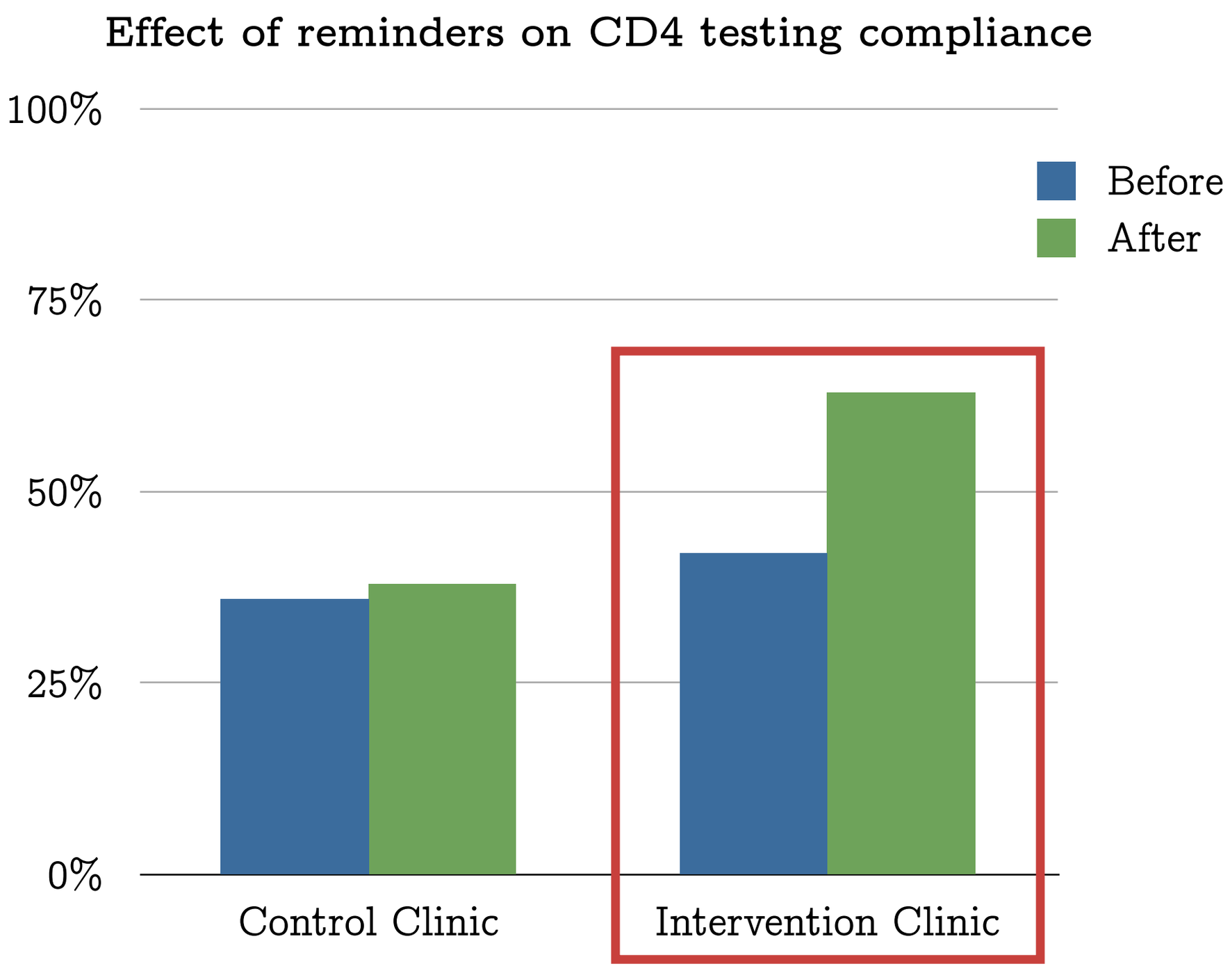
cd4 is a basic and very critical hiv indicator, and if you don't get it measured regularly, you really can't tell how a patient is responding to arv drugs.

to address this problem, ampath decided to add automatically generated reminders about the lab ordering schedule to the summary. if the system notices you are late for a cd4 test (or any other important lab), it prints a friendly reminder.

now these are patient specific and they build on more than just one lab value. they look at the entire patient record to make decisions. in addition to cd4, there were reminders about overdue labs, start/stop medications, referrals, etc.

so then the question is, can clinical summaries and reminders improve the problem of cd4 ordering schedule that i mentioned earlier.

Reminders increase compliance with care guidelines



Were et al. Evaluation of computer-generated reminders to improve CD4 laboratory monitoring in sub-Saharan Africa. JAMIA, 2011.

ampath ran a study measure the effect of reminders on cd4 testing compliance. this is work published at jamia.

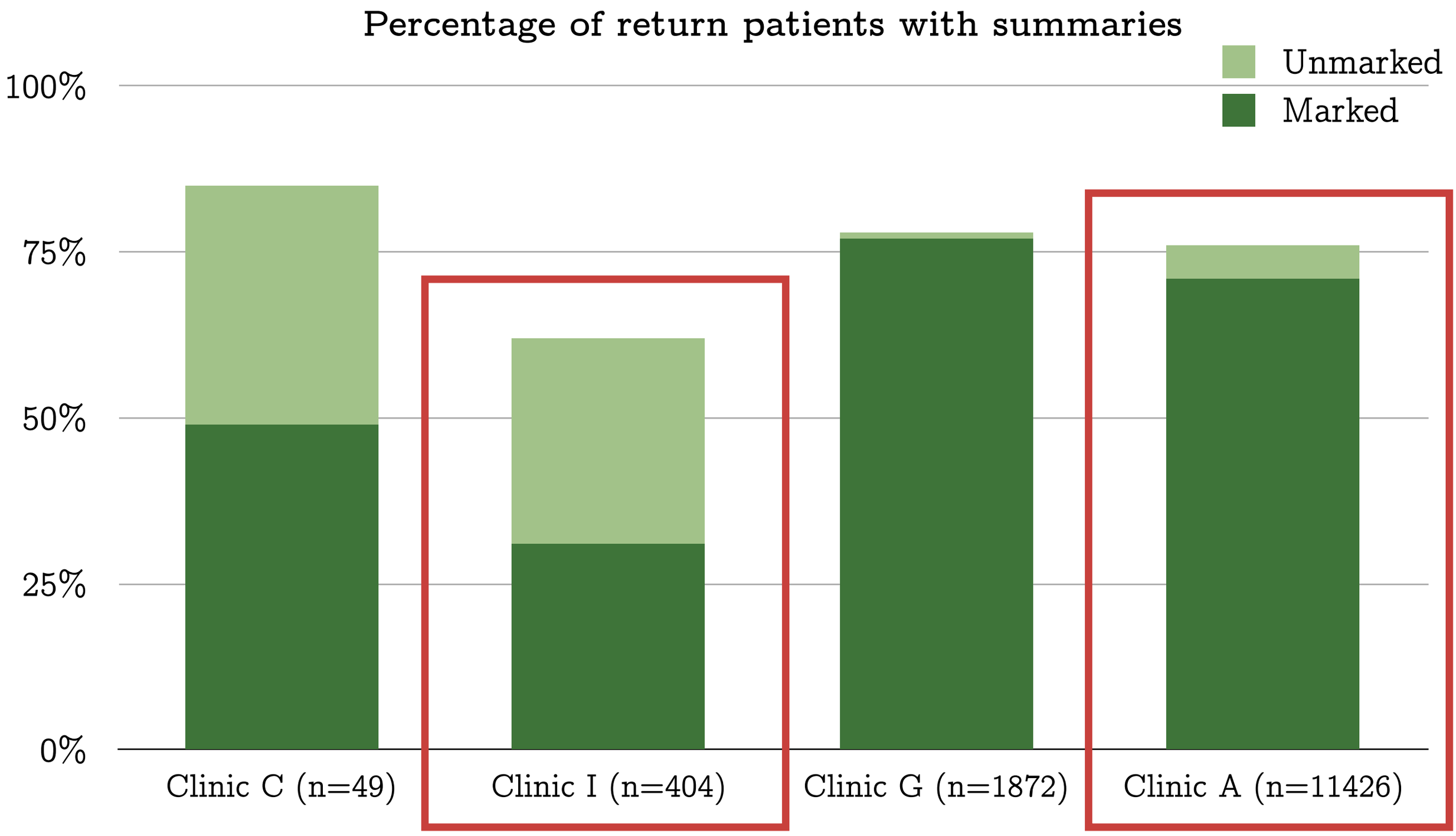
on the y-axis, is compliance. the more compliance the better.

on the x are the two arms of the study -- the control and the intervention. you don't necessarily need 100% compliance, but given that these are basic indicators they should be pretty high.

so in the intervention, you see that before reminders, compliance is around 42%. add the reminders and that increases to 63%. this is statistically significant and strongly suggests that better care is being delivered.

great, why not do more of this?

Across AMPATH sites, 20% of patients get no summaries



Anokwa et al. Design of a Phone-Based Clinical Decision Support System for Resource-Limited Settings. ICTD, 2012.

well, it's really hard to get the summaries at the point of care.

let's look at the percentage of return patients with summaries. focus on clinic a first.

marked (dark-green) means the clinician put a physical mark that said they had seen the summary. unmarked (light-green) means there was a summary, but we don't know if the clinician looked at it.

and the gap between the top of the bars and 100% are the patients who didn't have summaries. so in clinic a, 25% of patients didn't get summaries.

you can see that marking rates are worse at the more rural and smaller sites.

so for example in clinic i, half of the summaries aren't marked -- that is, we don't know even if clinicians looked at them.

across 50k visits in 18 sites where we have data and it turns out 20% of visits had no summaries available.

why is this?

the basic problem is that logistics of running the paper system are hard to get right in these settings. it's very failure prone.

take this picture as an example. here is a top down view of a nurses desk next to a computer and a printer.

so the patient sits on the left, the nurse sits on the right.

you see where the problem is?

it's right there in the computer cables.

if the patient is a mother and has some children with her, those kids are going to yank on those cables of the printing computer. even if she has no kids, it's possible that her feet will get caught on those cables and yank something out.

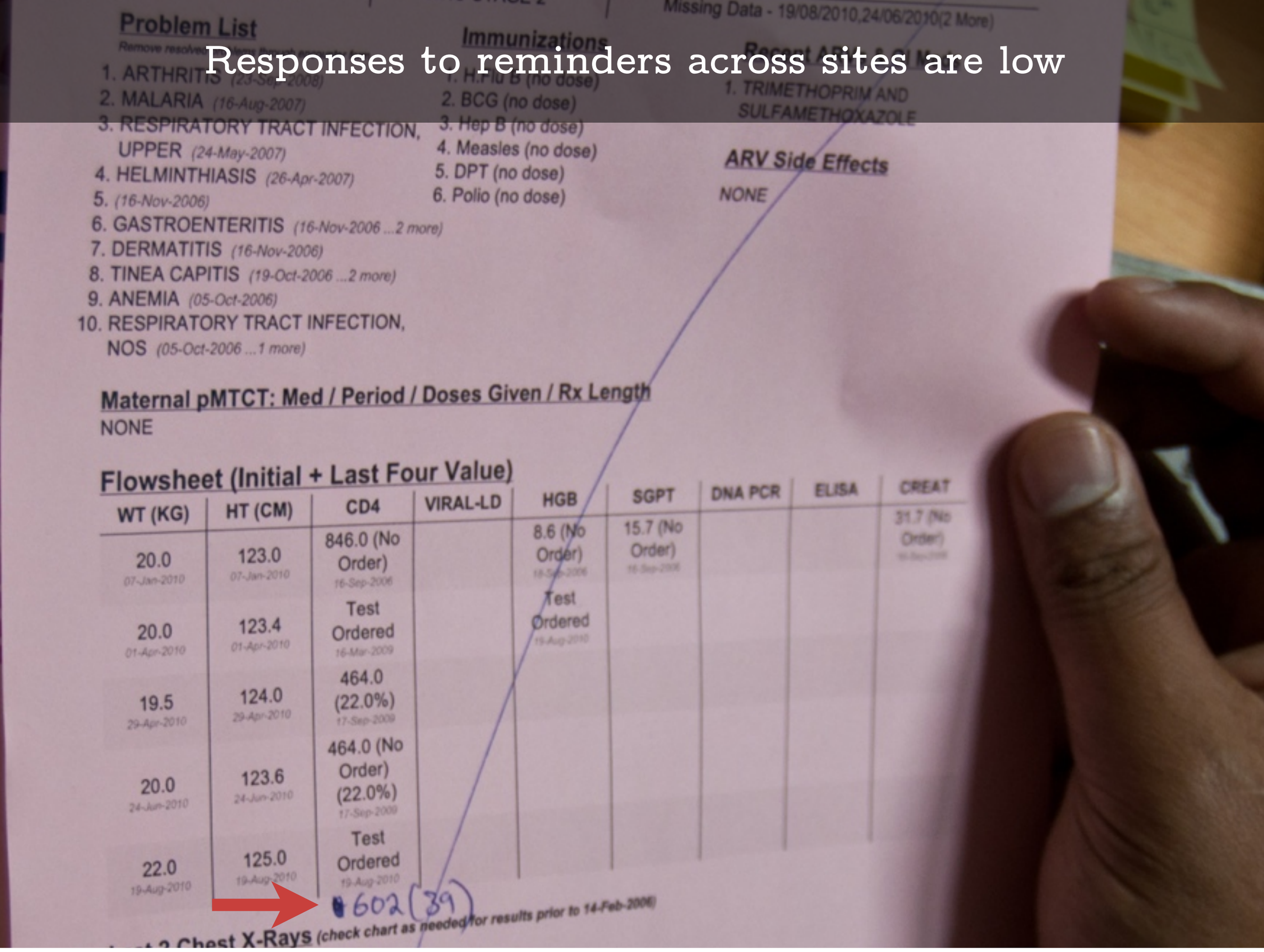
in most places in the world, this wouldn't be a problem.

the reality of ampath is that the nurses won't know what has gone wrong -- printing of summaries will just be broken.

and they won't necessarily tell the supervisor that printing isn't working. and even if they did, that information won't necessarily bubble up to someone who can fix it -- no one wants to get into trouble.

some of this is training, some of it is culture, some is power dynamics, but the bottom line is that the most efficient way to catch these problems is with a more real-time transparent monitoring system.

Responses to reminders across sites are low



and even of the patients that get summaries with reminders, responses to the reminders are very low. in my interviews with clinicians, there were lots of underlying problems.

for example, reminders build on data in the medical record system, so when that data is incorrect, the reminder is also incorrect. when clinicians see a mistake in the summary.

they are supposed to try to correct it on the summary, like this, and send that piece of paper in for data entry.

this is a great idea in theory, but each time you create a new reminder for clinicians to respond to, it exposes a lot of bad data, and that correction process overwhelms the data entry staff and so corrections can take a long time.

clinicians are human and so after they see the mistake and correct it three or four times, they end up getting irritated and loosing faith in the system.

and so ampath staffers have to continuously go find these clinicians and do their best to enforce or facilitate responses to reminders. again, that's inefficient.

so these are the kinds of problems that inspired our work on odk clinic. and to guide our design, we created a few design principles.

Principles that guided design of ODK Clinic

- Support a variety of summary types
- Assume unreliable or disconnected servers
- Use large, minimal, and consistent widgets
- Model UI on the existing paper summary
- Discard any functionality that duplicates work

the first principle was to support a variety of summary types. for example, the system should be able to create a summary for a pharmacist with prescribed medications and reminders about drug interactions.

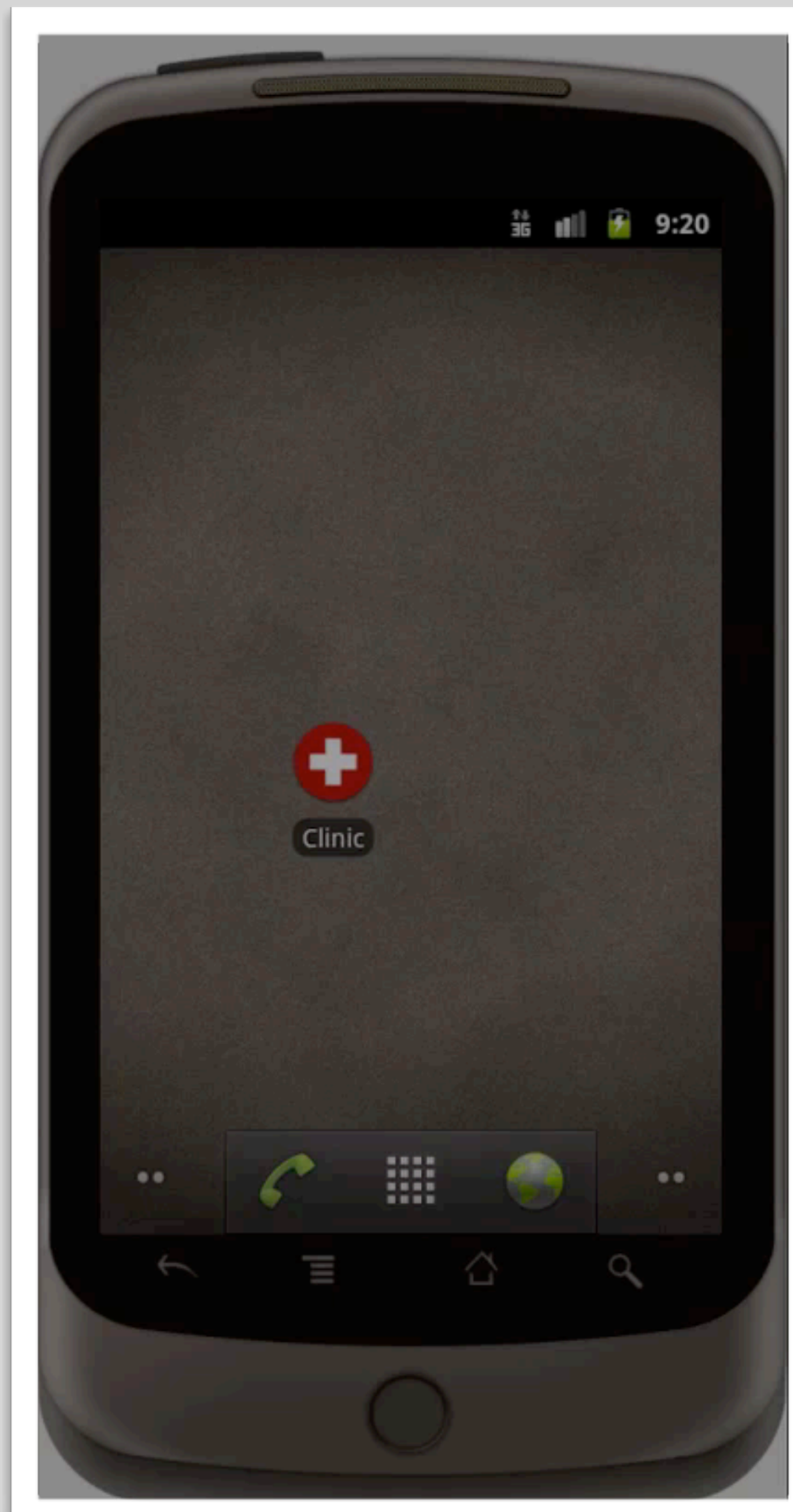
network connections, even internal to ampath are unreliable. we wanted the mobile client to work offline by default and download/upload intelligently. this also helps with making everything as fast as possible for clinicians.

in our work on odk collect, we've learned that a lot of our users have calloused fingers and uncorrected vision. this makes it hard to use a touchscreen -- they need soft fleshly fingers to work. so, we use large, high contrast, and consistent widgets that users can hit. these are pretty standard ui tricks, but it's even more important when you want to drive down training costs.

we mirror the paper summary as much as possible. for example, because clinicians are trained on reading lab values in columns, we do not graph lab values. we also only display data that is important to decision-making. as users grow familiar with the phone-based system, we expect this to change.

odk clinic is just for the summary sheet and nothing else and so that's all the functionality we provide. clinicians still have to use the encounter form, even though it could be implemented as a form on the phone with odk collect.

why? well, encounter forms are at the heart of every patient encounter at ampath. changing the process is logistically impractical. instead, ampath sees replacing paper summaries with odk clinic as the first step in understanding how to replace the paper encounter forms with tools like odk collect.

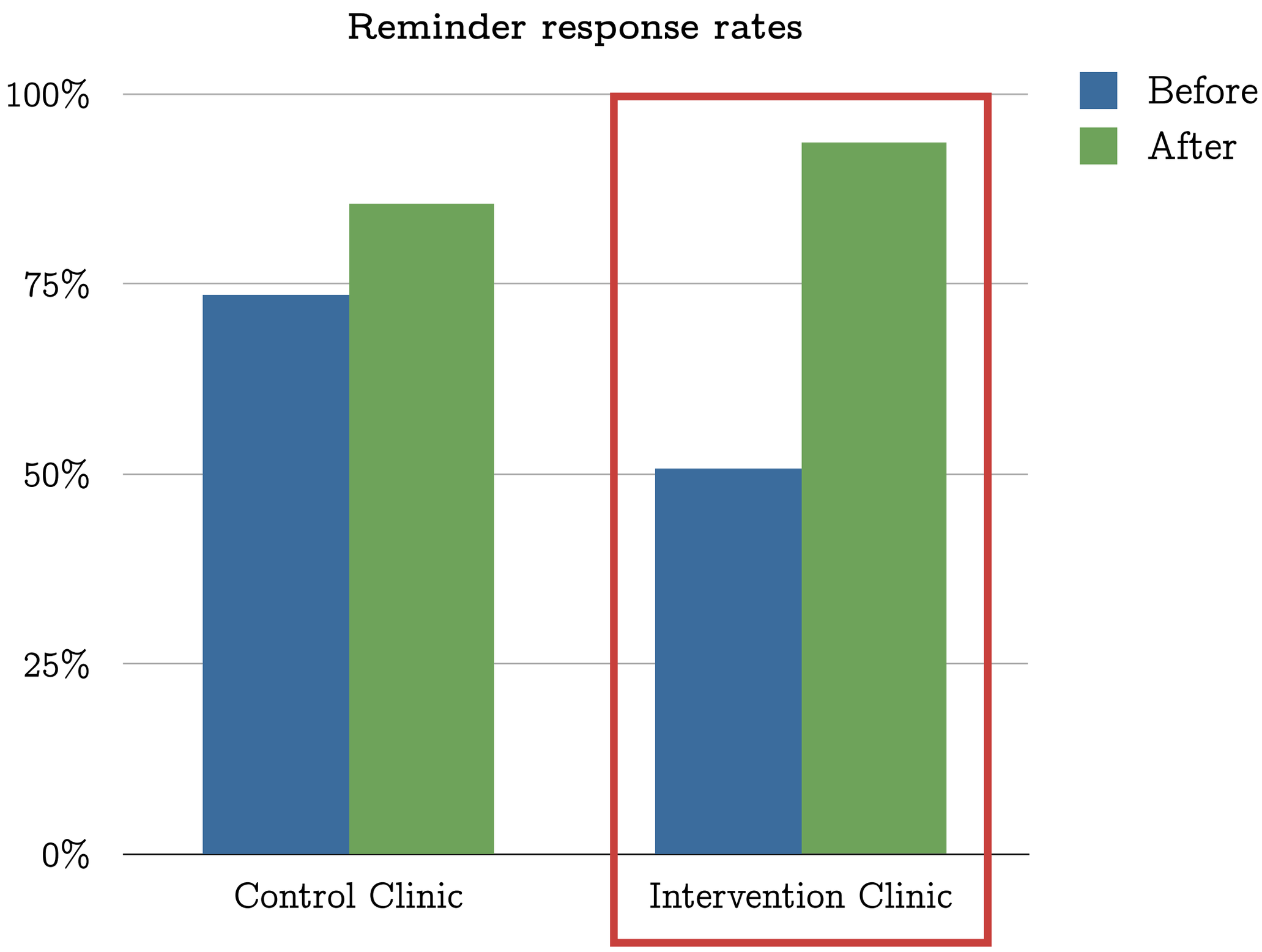


i think it was steve jobs that said, focus is about saying no. we said no a lot during this design and the result is a really a tightly focused app that replaces just the summary sheet. we think this gives us a great foundation to innovate going forward.

so here is what it looks like end to end. i'll try my best to talk through the interesting bits.

http://www.youtube.com/watch?v=skV25YchXlE

Phone-based response rates are higher than paper



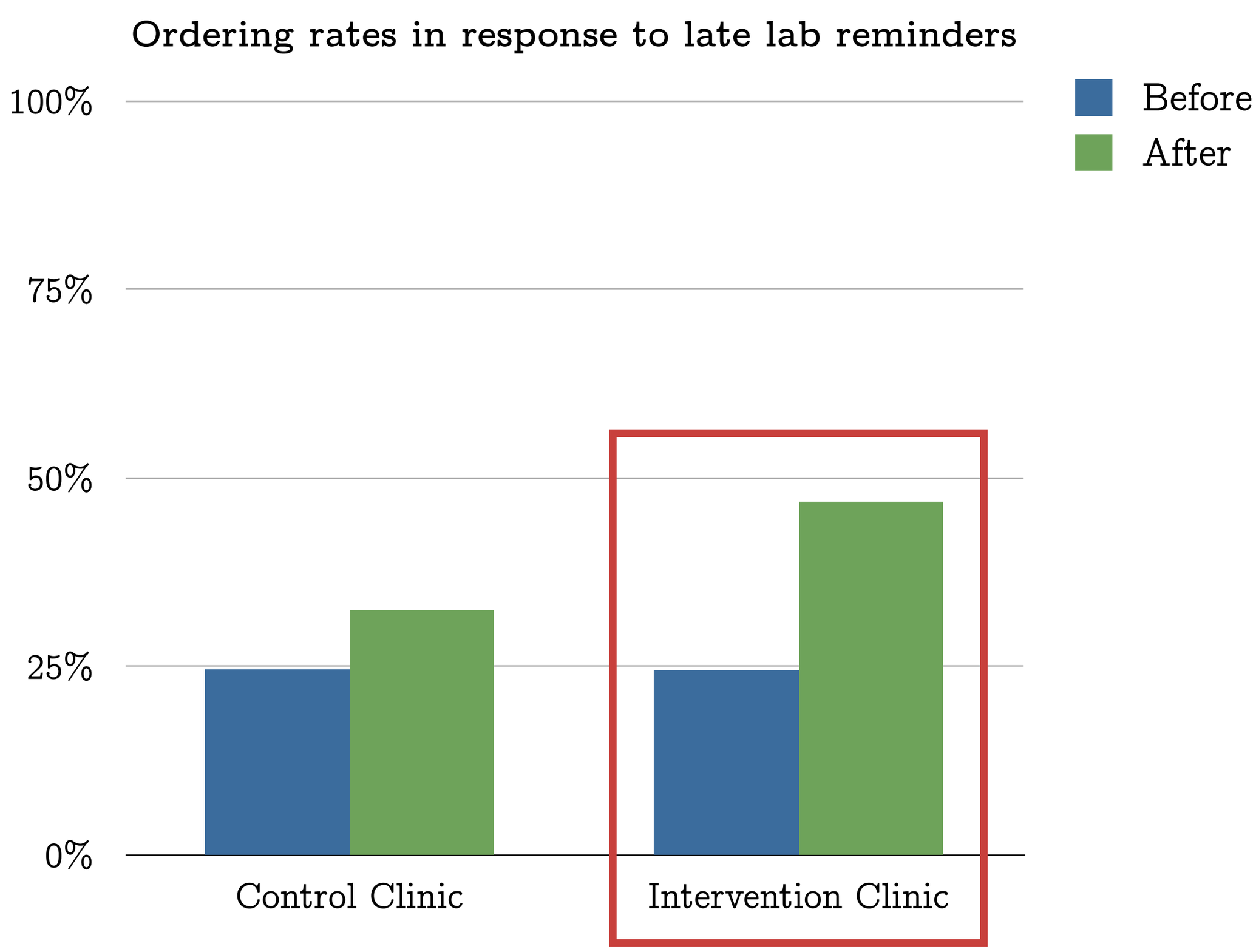
first, let's look at responses to reminders.

y-axis is response rate. the higher, the better. the x-axis has the different arms of the study.

in the intervention clinic, you see they've gone up from 51% to about 94%.

and this is compared to the control which is one of the better clinics. the bump in control is probably done to increased oversight during the study period.

Ordering in response to missing labs also higher



clinicians are also, as far as percentages, are responding by ordering labs more frequently.

you can see this here in the intervention clinic. they've gone up from 24% to about 46%.

and we don't think this is a case of ordering unnecessary tests. these reminders are about baseline lines so we think this will translate to greater compliance with best practices and thus better care. we are looking at the data right now.

Initial findings from deployment

- Availability of decision support at point-of-care is much better than with paper system.
- Clinicians can now quickly correct wrong drugs and labs seen in patient record.
- Supervisors have detailed and objective view of decision support process.

there are some other benefits that we've seen.

availability at the point of care is basically perfect now -- when a clinician needs patient data, they just look it up. it works well even when the medical record system is down.

clinicians can now correct mistakes (wrong drugs, wrong labs) they see in the patient record and that data goes directly to the medical record system.

supervisors now get a detailed and real time view of what is going on. they know when clinicians see patients, how long they see them, if and when they respond to reminders. and this is great information that is needed to make reminders more useful.

so now if supervisors see a deviation in care or something going wrong, they know who they have to talk to. and it's all transparent and objective -- the data speaks for itself.

“I can't see a patient without this phone”

i was just in eldoret a few weeks ago, and one of the things the clinicians said over and over again was that they can’t see a patient without the phone.

i’ve been working with clinicians for a while now, and i hate to stereotype, but they definitely let you know if there is a problem. so far, there haven’t been any complaints and that’s been great.

it’s fast and easy for them to use and they’ve gained a lot of functionality. they can look up patient data whenever they want, they know when they correct mistakes it goes directly to the medical record system, and the application helps them conform to doing the right thing.

ODK Clinic evolves and magnifies an existing system

for me, the bottom line is odk clinic, is really an evolution of a system that ampath created. we've been able to make that system better with odk clinic. and that's what my goals are. take a process that works, make it more efficient, and try to magnify the impact.

ampath is convinced that this is improving adult hiv care so we are now moving on to maternal and peds care. we already have paper summaries and i'm hoping we will have similar impact there.

A group at the University of Washington exploring how technology can improve the lives of underserved populations.

http://cs.washington.edu/homes/yanokwa (@yanokwa)

http://change.washington.edu (@uwchange)

http://opendatakit.org (@opendatakit)

if you are interested in this kind of work, i founded a group at uw called change that does projects of this kind. check us out http://change.washington.edu or on twitter.

we do a lot of mobile health work, everything from portable ultrasounds, spirometers that run on phones, management tools for community health workers, algorithms that can detect fake data, low cost sensing platforms for dumb and smartphones, vision apps for reading assay cards, etc. most of our work is actually out in the field and working.

my website also has links to the papers that i referred to in this talk. so with that, are there any questions?