ODK Clinic

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

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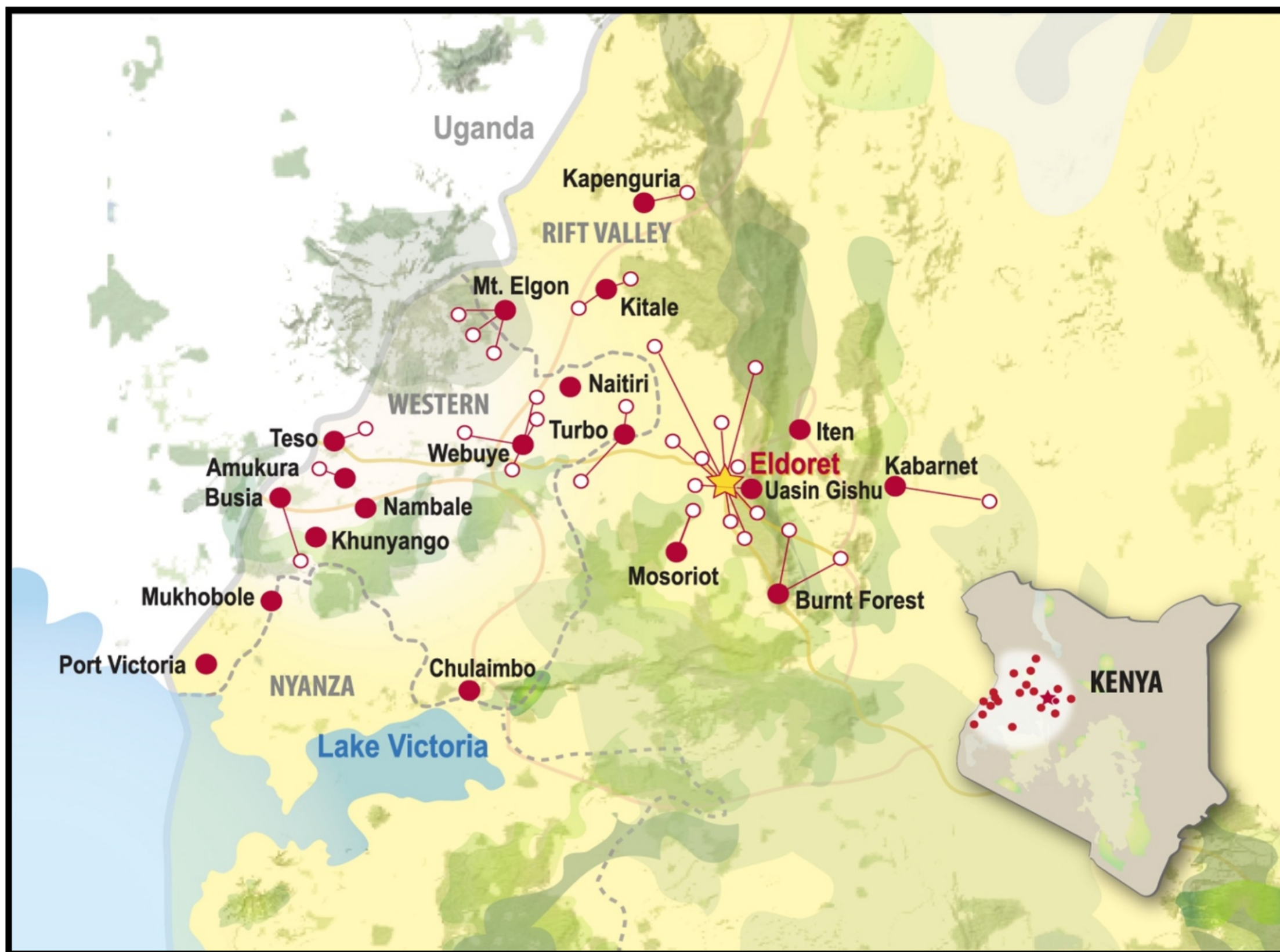Tapan Parikh, Gaetano Borriello, Martin Were

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. we call the system odk clinic.

this is work that is done with nyoman ribeka, tapan parikh, gaetano borriello and martin were. win and martin are from regenstrief institute and ampath in kenya, tap is at the ischool at berkeley, and gaetano is obviously from uw.

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. the program provides care to more than 130,000 active hiv–positive patients through 26 parent and 26 satellite clinics. eldoret is their main location, and catchment area has some 2 million people.

ampath is unique in that they've really invested in building out a medial records system based on openmrs that supports these patients, and they are doing it at really massive scale.

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

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for the last few years, ampath has had paper-based clinical summaries for all return hiv patients. it's one page sheet that they generate from the electronic medical record system and put in all the patient charts when the patient show up.

it gives a nice overview of all the relevant patient data and solves the problem of having to find and go through tons of paper records when you see a patient.

when ampath analyzed the data after they rolled out that system, 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.
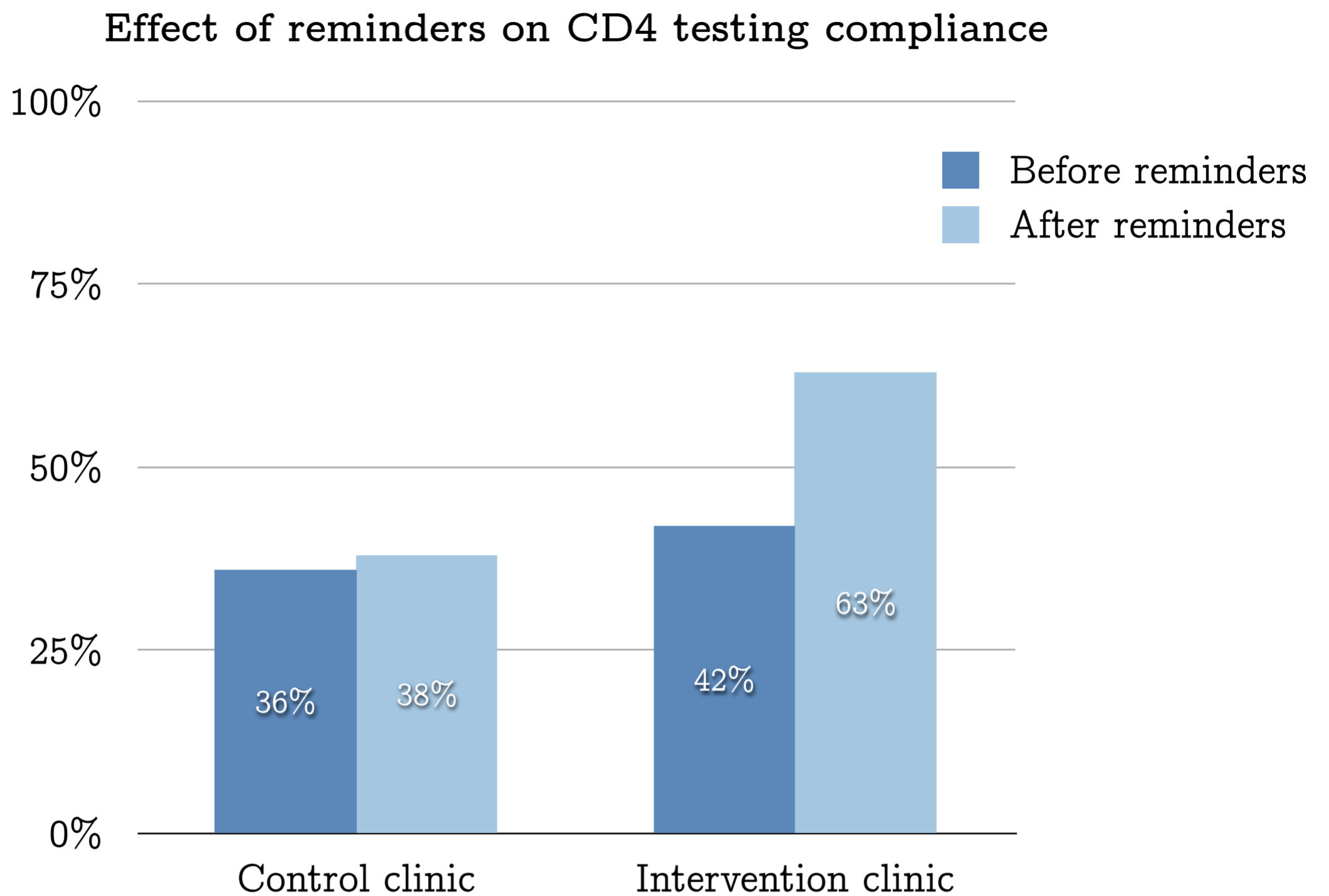
cd4 is a basic and very critical hiv indicator, and if you don't get it measured regularly, you really can't tell how a patient is responding to arv drugs.

to address this problem, ampath decided to add automatically generate 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.

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now these are patient specific and the build on more than just one lab value. they look at the entire patient record to make decisions.

so then the question is, can clinical summaries and reminders improve care?

Effect of reminders on CD4 testing compliance

Control clinic: 36% (Before reminders), 38% (After reminders)
Intervention clinic: 42% (Before reminders), 63% (After reminders)

Legend: Before reminders, After reminders

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

we ran a study at ampath to measure the effect of reminders on cd4 testing compliance. this is work published at jamia.
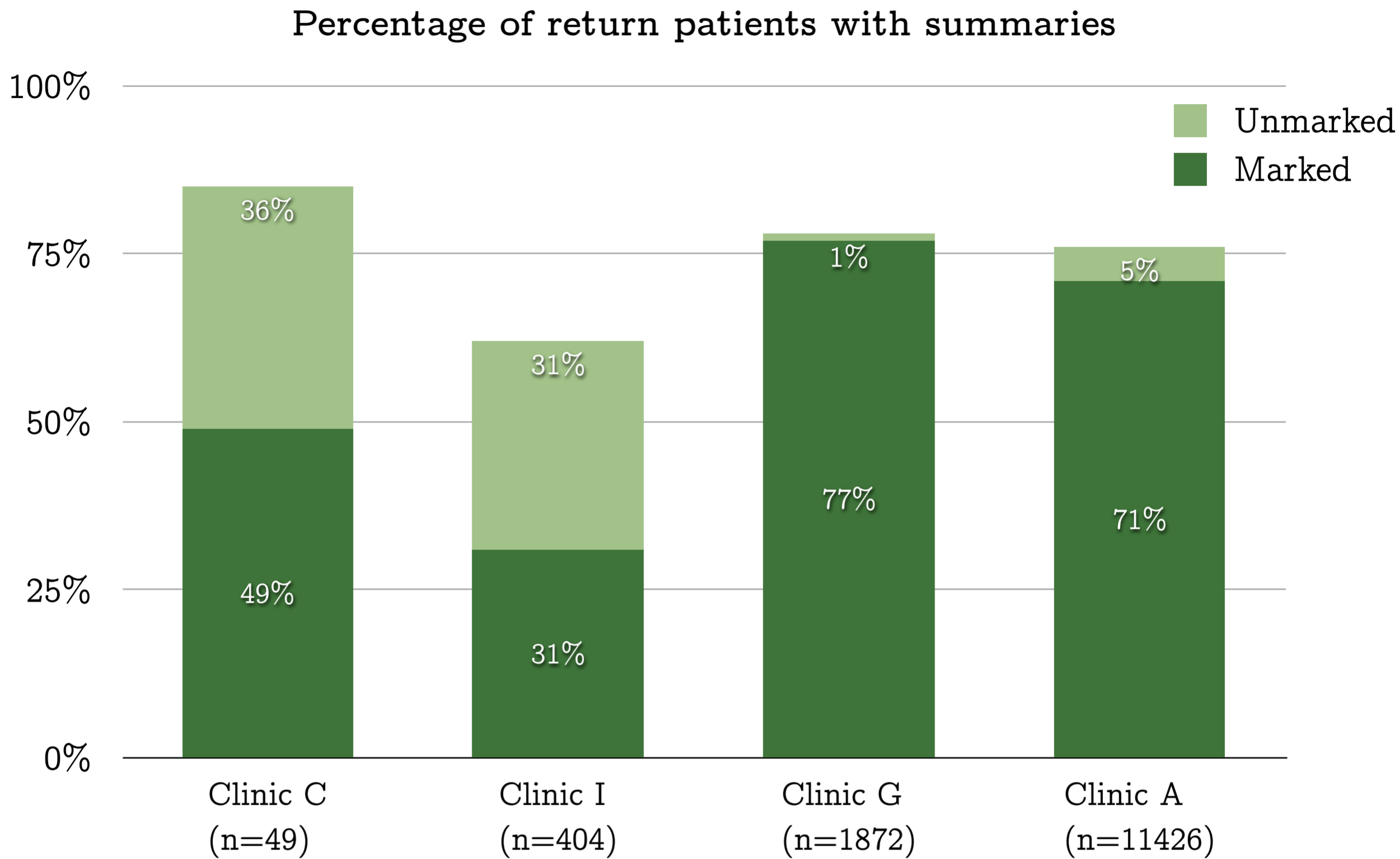
so on the y–axis, is compliance. the more compliance the better. on the x are the two arms of the study –– the control and the intervention.

so in the control, you see that compliance with these rates is around 42% for the intervention clinic. add the reminders and we can show an increase to 63%, and so better care is being delivered.

so and it turns out that these summaries and reminders do improve care.

great, why not do more of this?

Percentage of return patients with summaries

Legend: Unmarked, Marked

- Clinic C (n=49): Unmarked 36%, Marked 49%
- Clinic I (n=404): Unmarked 31%, Marked 31%
- Clinic G (n=1872): Unmarked 1%, Marked 77%
- Clinic A (n=11426): Unmarked 5%, Marked 71%

well, it's really hard to get the summaries at the point of care. we looked at 50k return visits, and of those, only 80% had summaries available. let me dive down into some of the clinics..

marked means the patient put a physical mark that said they had seen the summary. the gap is the patients who didn't have summaries.

so on the y-axis, the more marking, the better. on the x are a few of clinics we looked at in detail.

you can see that marking rates are bad (especially at remote sites). even at the big sites where marking is high, some 25% of summaries don't even get printed.

why is this?

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

take this picture as an example. you see where the problem is? if the patient sits at the left, and has some children with her, those kids are going to yank on those cables of the printing computer. and no one will report it because of the power dynamics.

without a more transparent monitoring system, it is difficult to correct these failures.
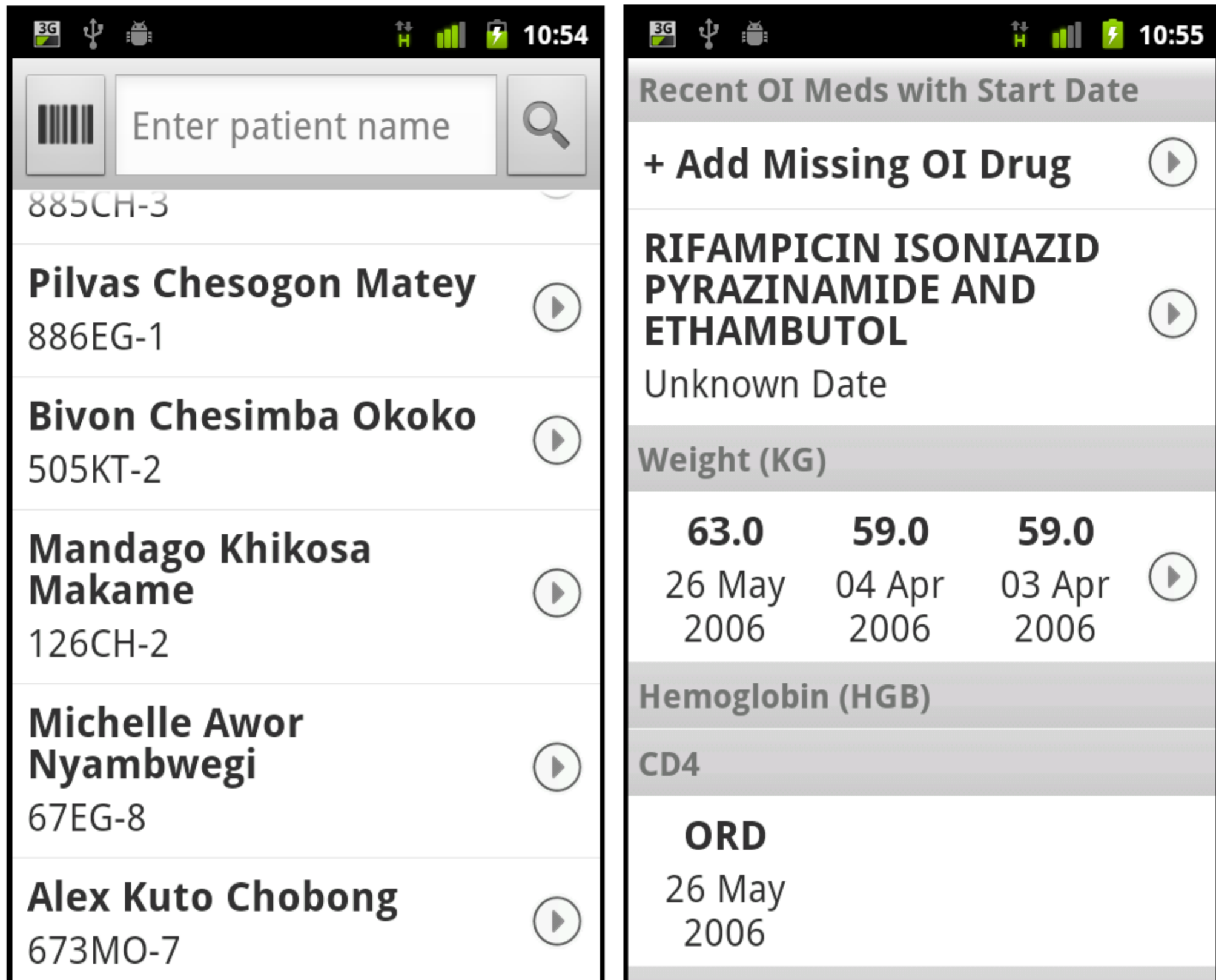
and even of the patients that get summaries with reminders, responses to the reminders were very low.

it turns out when there are mistakes in patient data, doctors have no easy way to correct it. and so the summaries aren't up-to-date or accurate and doctors really loose faith in the system.

and monitoring this so you can intervene is hard too. so are they looking at the summary? are they responding to reminders? there are potentially hundreds of reminders, and you need regular insight into what the doctors are doing so you can ensure the best standard of care.

so those were the problems i found with ampath's old system. our team has had good luck deploying smartphones at scale in western province. 300 of chws have used our tools for hiv testing and counseling some 500k people, so we decided to do try another smartphone app.

Anokwa et al. Design of a Phone-Based Clinical Decision Support System for Resource-Limited Settings. ICTD, 2012.
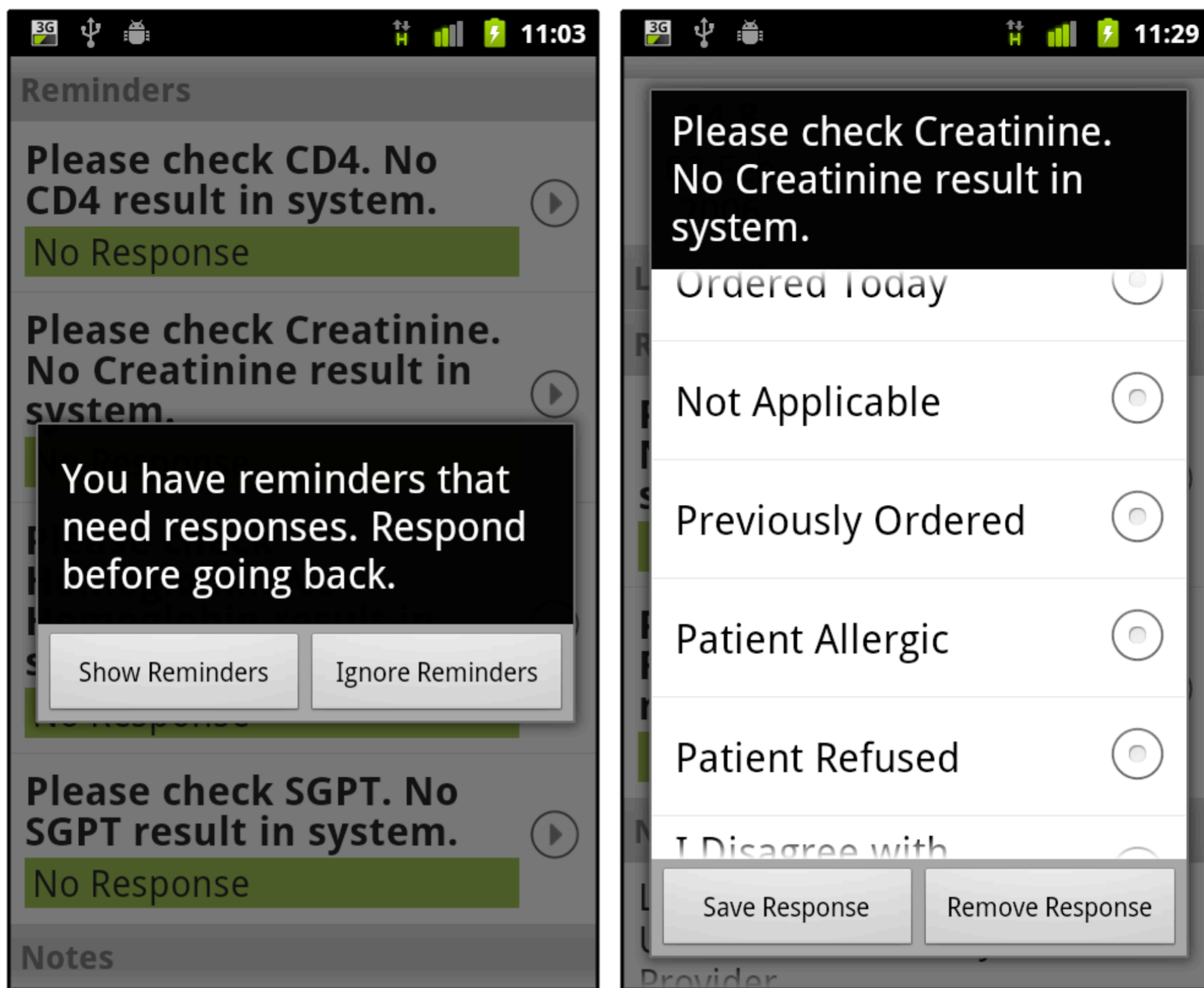
so we built a mobile app that addresses the failures we saw at scale and we did a lot of leg work before hand to guide the design. so you have a list of patients here, and when you tap on it, it gives you the summary for that patient.

i think the big things are, it's really a tightly focused app that replaces just the summary sheet. so whatever you do on that sheet, you do in the app. it even looks like the sheet because we really want to drive down training costs.

the other thing is that everything that you need to know about the app is in front of you and we use a fixed and consistent set of interactions. the doctors get how to use it immediately and it's fast to use.

also, the connection issues, we've been able to make downloading big cohorts of patients really fast, even over terrible network connections.
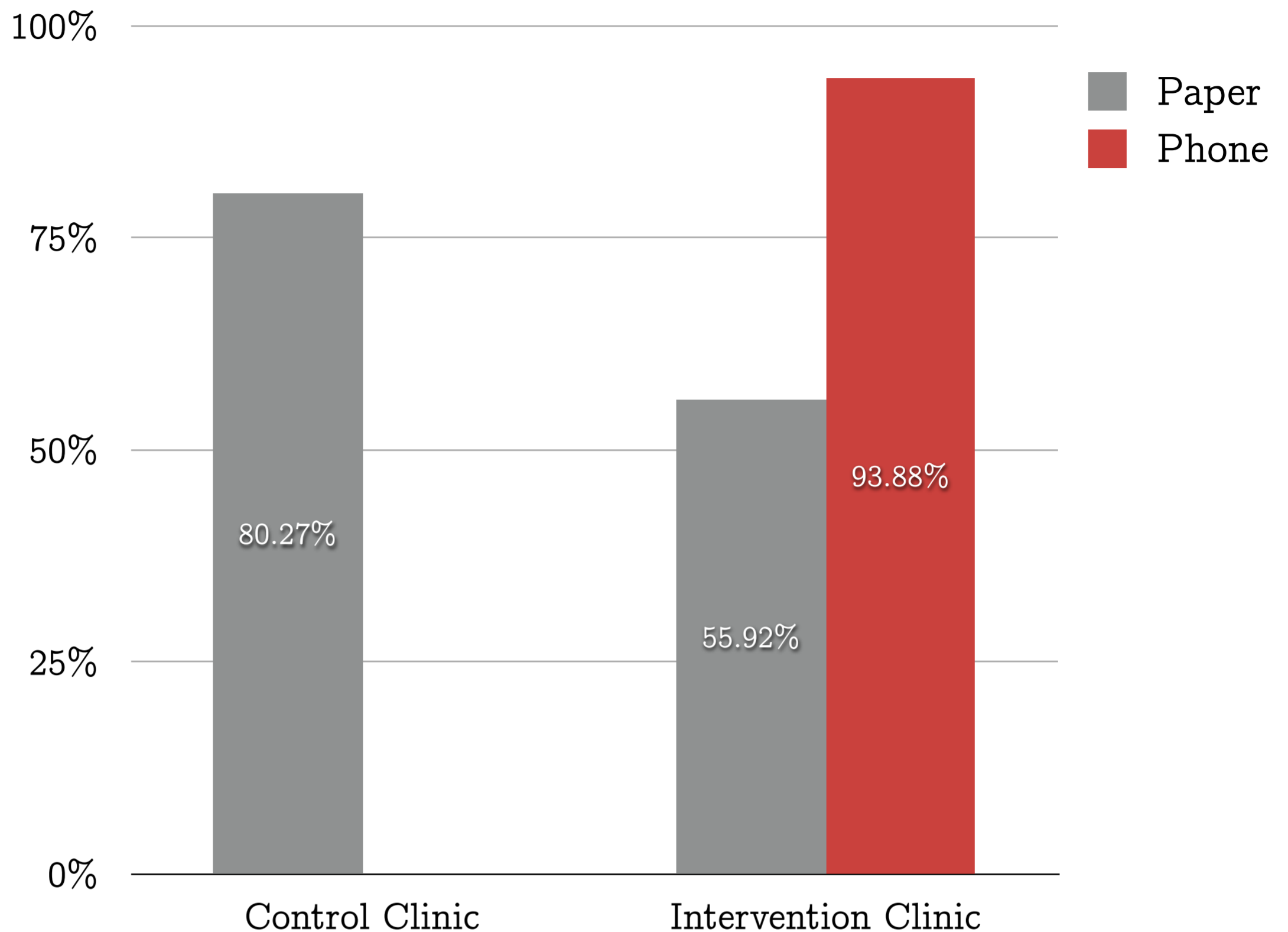
to address the more training and decision support that we improve care, we have dialogs that remind about the reminders and make it easy to respond.

more importantly, we can track everything. we know when you see patients, how long you see them, when you respond, how long you look at reminders, etc, etc.

we now have the system in two adult hiv clinics in ampath, it's been running for about a month for about 4k patients, and the results have been great all around.

Phone-based response rates are higher than paper

and it turns out it's also likely going to improve outcomes.

it's been running in two clinics for about a month now (about 13 doctors, 6k patients) and the metrics we care about are all very promising. these are just descriptive stats, so don't read too much into them!
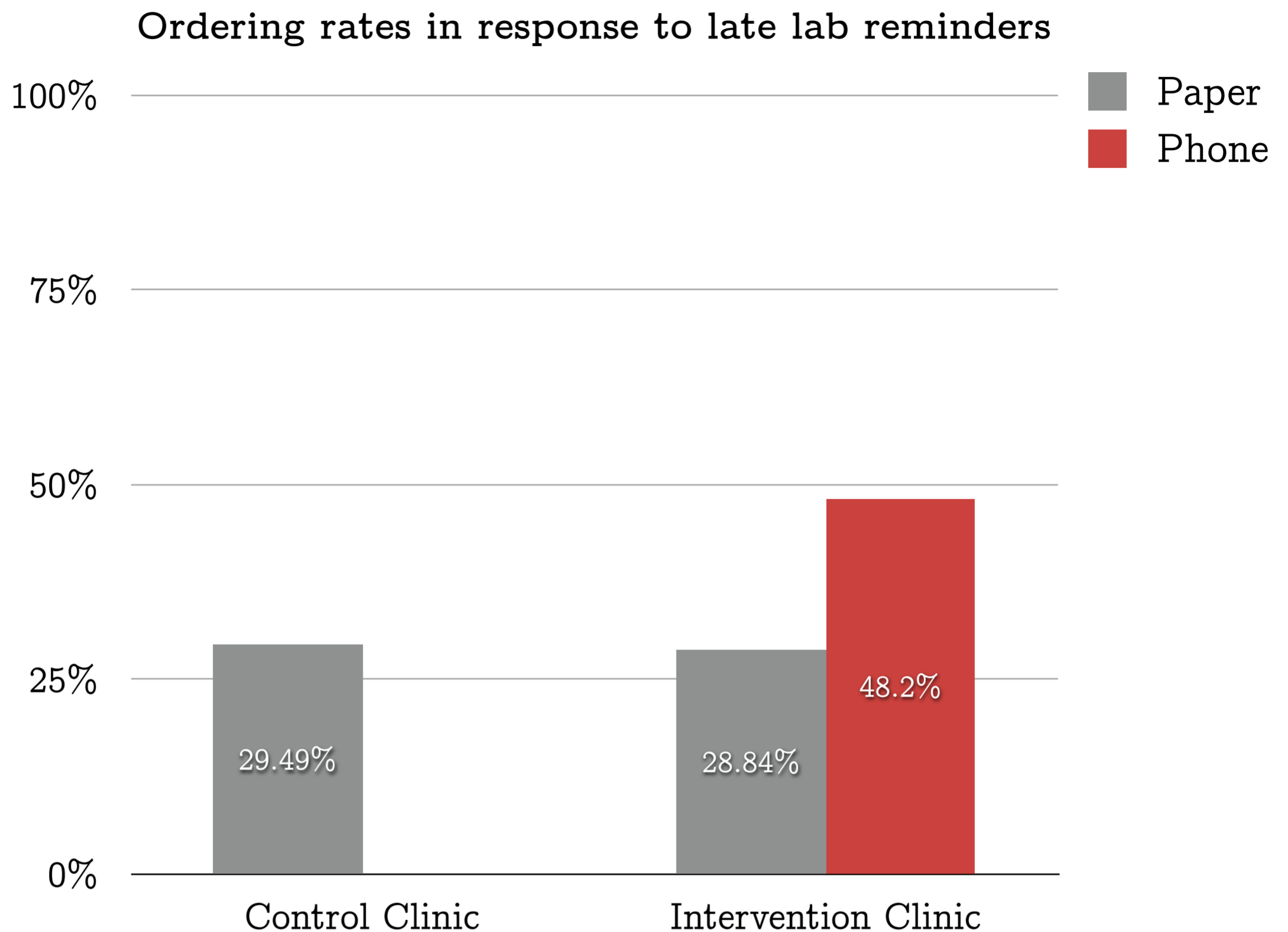
availability at the point of care is basically perfect now -- when a doctor needs patient data, they just look it up. it works well even there is no connection to the medical record system.

here is some initial analysis.

y-axis is response rate. the higher, the better. the x are the different arms.

you can see response rates have gone up from 55% to about 94% in the intervention. and the control is one of the better clinics.

Ordering rates in response to late lab reminders

Legend: Paper (grey), Phone (red)

Control Clinic: Paper 29.49%
Intervention Clinic: Paper 28.84%, Phone 48.2%

more importantly, clinicians are responding greater percentage to the really important reminders (like cd4).

there are some other benefits. doctors can now correct mistakes (wrong drugs, wrong labs) they see in the patient record, and supervisors have a detailed and real time view of what is going on. if they see a deviation in care or something going wrong, they know who they have to talk to.

this is all objective, which is great. we don't have to take the doctor's or data assistant's word for it. the data speaks for itself.

"I can't see a patient without this phone"

clinicians enjoy using the phone and want to use it more.

it's part of me now. i can't see a patient without this phone.

we have gotten used to the phones. no going back to paper summaries.

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 the smartphone app. and that's what our goals are. we take a process that works, we make it more efficient, and we 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 summeries and we think we'll have the similar impact.