Task Support

Lecture 21:   CSE 490c

Announcements

- No class Wednesday, November 21

Topics

- ODK Sensors

- ODK 2.0 Application

- ODK 2.0 Technical Challenges

- ODK Research Projects
  - ODK Clinic
 - ODK Scan
  - ODK Sensors

ODK Sensors

- Build a user-level sensing framework with sensor drivers
  - No operating system modifications
  - Allows convenient reuse between applications
- Create a single sensor interface
  - Access wired, wireless, and built-in sensors
  - Support multiple sensors over multiple channels
- Focus on ease of deployment and development
  - Distribution through existing app store model
  - Reduce complexity
  - Without adverse effects on performance

University of Washington, Winter 2015
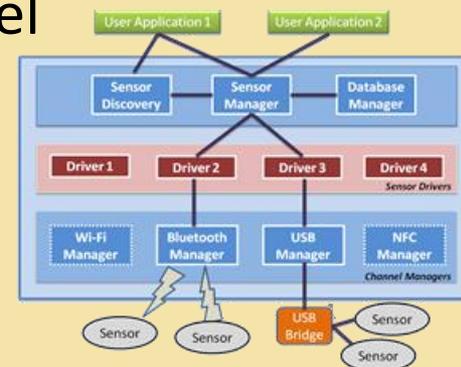
Fone Astra

- Sensor connection to low cost phone
    - Phone for communication and output

- $25 board + $25 phone

- Temperature monitoring
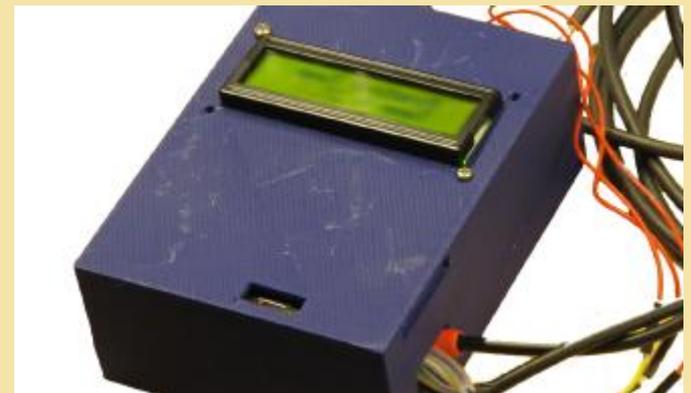
Android Fone Astra

- Version 2 of FoneAstra replaced basic phone with Android phone

- Communication by bluetooth or USB

- Separate power for FoneAstra device
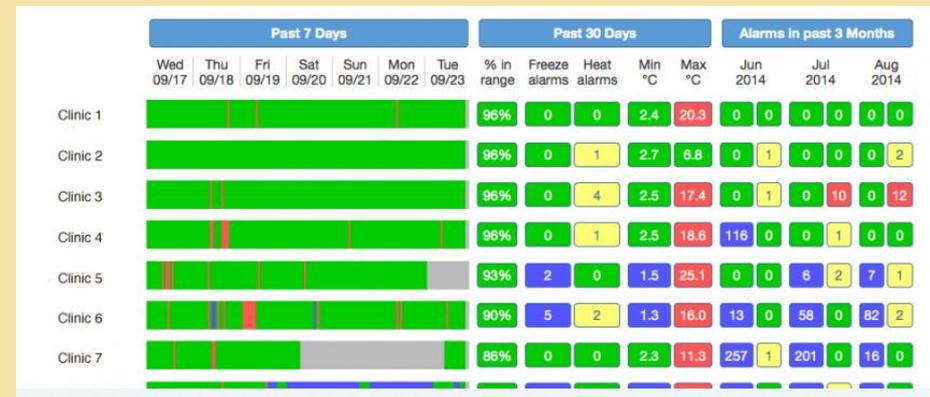
- Programmability and UI on phone

Milk Pasteurization

- Human milk pasteurization

- Replace high price pasteurizer with hotplate

- Temperature monitoring to ensure proper heating and verify quality

Cold Trace

- Remote temperature monitoring

- Connection through audio port to Android phone

- Deployments now rely on a single model of low cost Android phone

- Well engineered product with substantial support

- Need for multi sensor device

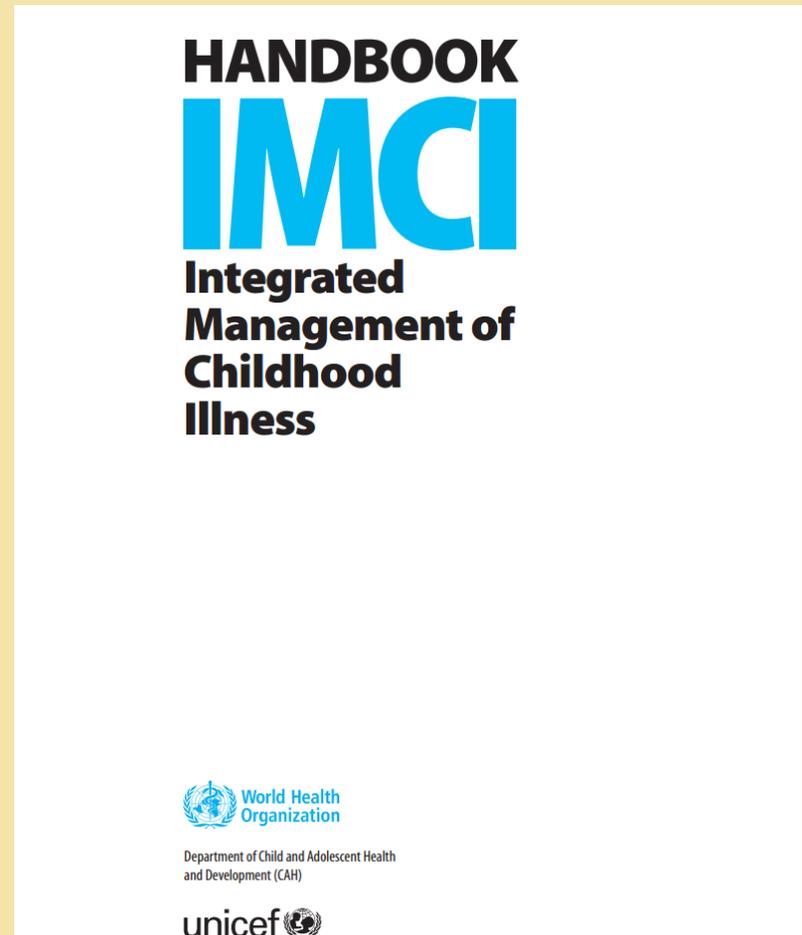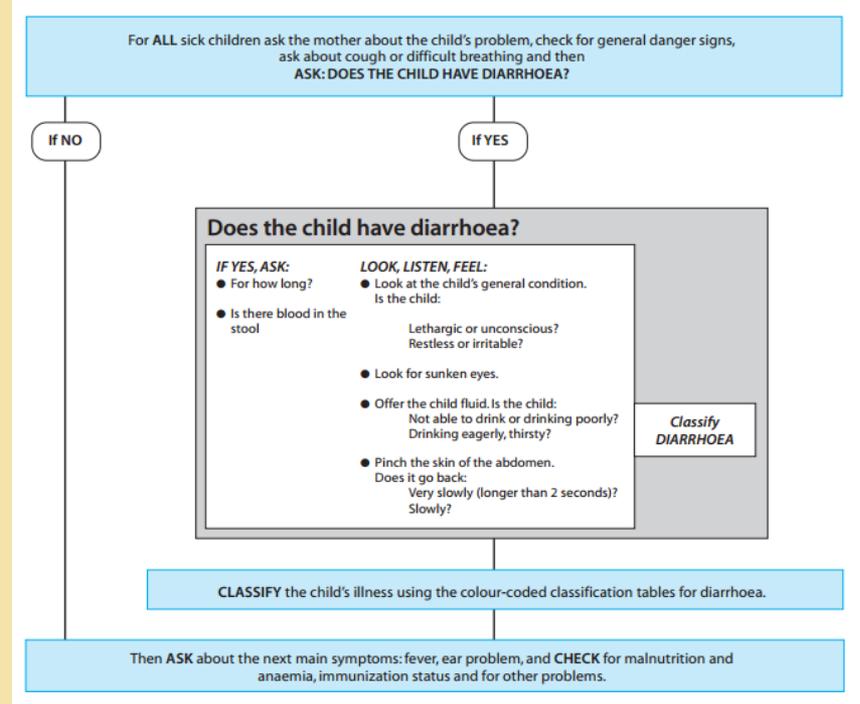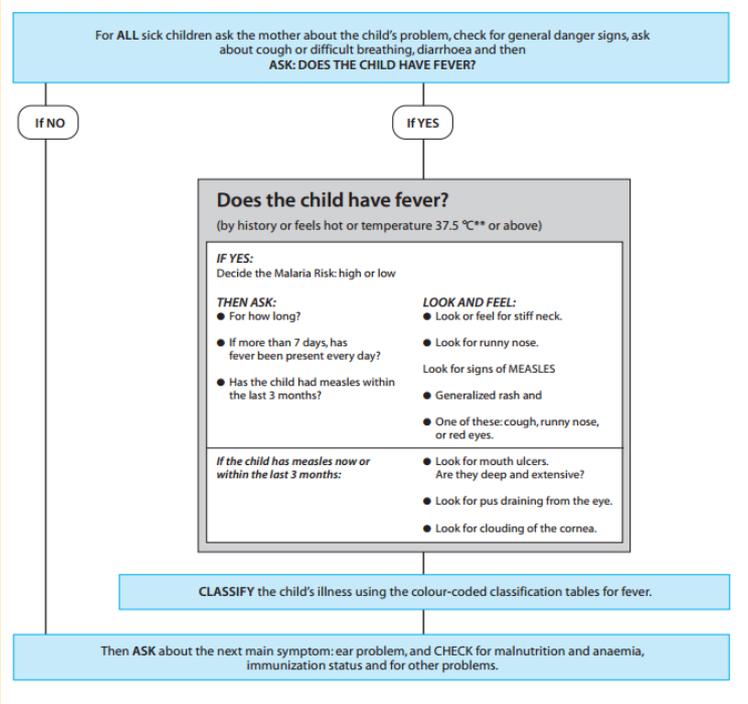|	Past 7 Days							Past 30 Days					Alarms in past 3 Months					
	Wed 09/17	Thu 09/18	Fri 09/19	Sat 09/20	Sun 09/21	Mon 09/22	Tue 09/23	% in range	Freeze alarms	Heat alarms	Min °C	Max °C	Jun 2014		Jul 2014		Aug 2014	
Clinic 1								96%	0	0	2.4	20.3	0	0	0	0	0	0
Clinic 2								96%	0	1	2.7	6.8	0	1	0	0	0	2
Clinic 3								96%	0	4	2.5	17.4	0	1	0	10	0	12
Clinic 4								96%	0	1	2.5	18.6	116	0	0	1	0	0
Clinic 5								93%	2	0	1.5	25.1	0	0	6	2	7	1
Clinic 6								90%	5	2	1.3	16.0	13	0	58	0	82	2
Clinic 7								86%	0	0	2.3	11.3	257	1	201	0	16	0

Cold Trace V5

IMCI

- WHO Designed protocol on diagnosing/treating childhood illness

- Step through diseases with flow chart

- Target nurses/health workers

- Standardize care

HANDBOOK

IMCI

Integrated Management of Childhood Illness

World Health Organization

Department of Child and Adolescent Health and Development (CAH)

unicef

IMCI

Fever Algorithm

For **ALL** sick children ask the mother about the child's problem, check for general danger signs, ask about cough or difficult breathing, diarrhoea and then
ASK: DOES THE CHILD HAVE FEVER?

If NO | If YES

Does the child have fever?
(by history or feels hot or temperature 37.5 °C** or above)

IF YES:
Decide the Malaria Risk: high or low

THEN ASK:
- For how long?
- If more than 7 days, has fever been present every day?
- Has the child had measles within the last 3 months?

LOOK AND FEEL:
- Look or feel for stiff neck.
- Look for runny nose.

Look for signs of MEASLES
- Generalized rash and
- One of these: cough, runny nose, or red eyes.

If the child has measles now or within the last 3 months:
- Look for mouth ulcers. Are they deep and extensive?
- Look for pus draining from the eye.
- Look for clouding of the cornea.

CLASSIFY the child's illness using the colour-coded classification tables for fever.

Then **ASK** about the next main symptom: ear problem, and CHECK for malnutrition and anaemia, immunization status and for other problems.

EXAMPLE 11: CLASSIFICATION TABLE FOR LOW MALARIA RISK AND NO TRAVEL TO A HIGH RISK AREA

SIGNS	CLASSIFY AS	IDENTIFY TREATMENT (Urgent pre-referral treatments are in bold print.)
• Any general danger sign • Stiff neck	**VERY SEVERE FEBRILE DISEASE**	➤ **Give quinine for severe malaria (first dose).** ➤ **Give first dose of an appropriate antibiotic.** ➤ **Treat the child to prevent low blood sugar.** ➤ **Give one dose of paracetamol in clinic for high fever (38.5° C or above).** ➤ **Refer URGENTLY to hospital.**
• NO runny nose and NO measles and NO other cause of fever.	**MALARIA**	➤ **If NO cough with fast breathing, treat with oral antimalarial.** **OR** **If cough with fast breathing, treat with cotrimox-azole for 5 days** ➤ **Give one dose of paracetamol in clinic for high fever (38.5° C or above).** ➤ Advise mother when to return immediately. ➤ Follow-up in 2 days if fever persists. ➤ If fever is present every day for more than 7 days, REFER for assessment.
• Runny nose PRESENT OR • Measles PRESENT OR • Other cause of fever PRESENT.	**FEVER— MALARIA UNLIKELY**	➤ **Give one dose of paracetamol in clinic for high fever (38.5° C or above).** ➤ Advise mother when to return immediately. ➤ Follow-up in 2 days if fever persists. ➤ If fever is present every day for more than 7 days, REFER for assessment.

Diarrhoea Algorithm

For **ALL** sick children ask the mother about the child's problem, check for general danger signs, ask about cough or difficult breathing and then
ASK: DOES THE CHILD HAVE DIARRHOEA?

If NO | If YES

Does the child have diarrhoea?

IF YES, ASK:
- For how long?
- Is there blood in the stool?

LOOK, LISTEN, FEEL:
- Look at the child's general condition. Is the child:
  - Lethargic or unconscious?
  - Restless or irritable?
- Look for sunken eyes.
- Offer the child fluid. Is the child:
  - Not able to drink or drinking poorly?
  - Drinking eagerly, thirsty?
- Pinch the skin of the abdomen. Does it go back:
  - Very slowly (longer than 2 seconds)?
  - Slowly?

Classify DIARRHOEA

CLASSIFY the child's illness using the colour-coded classification tables for diarrhoea.

Then **ASK** about the next main symptoms: fever, ear problem, and **CHECK** for malnutrition and anaemia, immunization status and for other problems.

EXAMPLE 6: CLASSIFICATION TABLE FOR DEHYDRATION

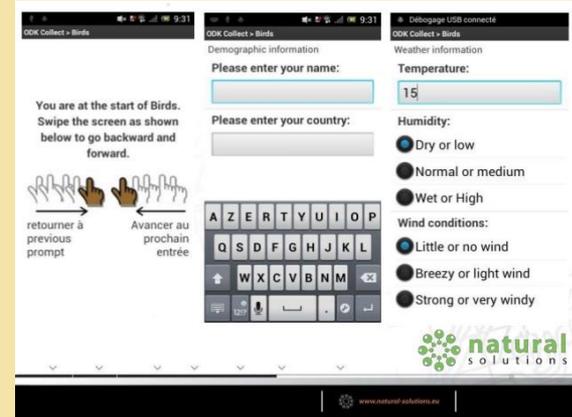| SIGNS	CLASSIFY AS	IDENTIFY TREATMENT (Urgent pre-referral treatments are in bold print.)
Two of the following signs: • Lethargic or unconscious • Sunken eyes • Not able to drink or drinking poorly • Skin pinch goes back very slowly	**SEVERE DEHYDRATION**	➤ If child has no other severe classification: — Give fluid for severe dehydration (Plan C). OR If child also has another severe classification: — **Refer URGENTLY to hospital with mother giving frequent sips of ORS on the way.** **Advise the mother to continue breastfeeding** ➤ If child is 2 years or older and there is cholera in your area, give antibiotic for cholera.
Two of the following signs: • Restless, irritable • Sunken eyes • Drinks eagerly, thirsty • Skin pinch goes back slowly	**SOME DEHYDRATION**	➤ Give fluid and food for some dehydration (Plan B). ➤ If child also has a severe classification: — **Refer URGENTLY to hospital with mother giving frequent sips of ORS on the way.** **Advise the mother to continue breastfeeding** ➤ Advise mother when to return immediately. ➤ Follow-up in 5 days if not improving.
Not enough signs to classify as some or severe dehydration.	**NO DEHYDRATION**	➤ Give fluid and food to treat diarrhoea at home (Plan A). ➤ Advise mother when to return immediately. ➤ Follow-up in 5 days if not improving.

Tanzania e-IMCI Study

- Implement IMCI on a PDA, c. 2007
- Goal:
  - Demonstrate improved compliance to IMCI protocol
  - No increase in time of visits
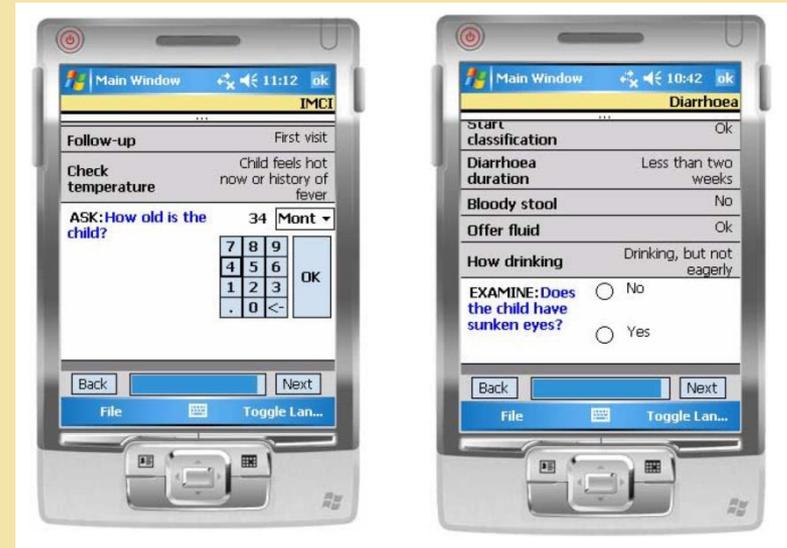
Open Data Kit

- Collect
  - Forms based data collection application running on Android device

- XLSForm
  - Form creation tool reading in Excel spreadsheet

- Aggregate
  - Backend server to receive data

IMCI to ODK

- Convert IMCI Protocol to decision tree
- Encode in forms
- Establish branching logic
- Implement in spreadsheet
  - Compile to ODK

- Challenges
  - Extracting the decision tree
  - Verification of wording and workflow
  - Usability
- Medical review of IMCI
  - Difficulty in adapting protocol
  - Official approval of protocol
  - Determining correspondence of electronic and paper version

IMCI + Pulse Oximetry

- Measure blood oxygen level

- Low oxygen levels can indicate pneumonia

- Add blood oxygen level into pneumonia questions

- Pulse oximeter connected to mobile phone so readings entered automatically

mPneumonia Menu

Assess the child's feeding

ASK CAREGIVER:

During this illness, has the child's feeding changed?   Yes   No

Is the child breastfed?   Yes   No

How often is the child being fed per day?   [   ]

Back   Next

mPneumonia Menu

Record pulse & oxygen saturation.

Connect pulse oximeter and place it correctly on the child's finger.

Press 'Record Reading' when status reads 'Acceptable to Record'.   23
    44

Results have been masked and should be used for demonstration purposes only.

Do NOT diagnose or treat the child based on the results of the mPneumonia application.

Back   Next

Mobile video for patient education: The midwives' perspective

Overview

- Study of Nurse Midwife reaction to using mobile videos to support patient education

- Based on a one year project conducted in Udaipur, India

- Key contribution
  - Focus on the acceptability of a mobile device to help a midwife's work

Sustainability

- **Technical feasibility:** the device must work reliably in the field.
- **Usability:** the target users must be able to operate the device.
- **Acceptability:** the users must be willing to use the device in the course of their work.
- **Maintainability:** it must be possible to keep the devices running at low cost.
- **Affordability:** the total cost of the system must be low enough that the health system can pay for it and sees commensurate value.

Acceptability

- In order for a technology to be adopted, it must provide perceived value to those that are expected to use it

University of Washington, Autumn 2018

ARTH, Udaipur India

- Action Research and Training for Health

- Two maternal health clinics for a population of 64,000

- Clinic and outreach services by two doctors and eight nurse midwives

- Post Natal Care (PNC) visits using ARTH protocol
    - Two visits
    - In clinic or home

Mobile Midwife Platform

- Mobile data collection to support PNC visits
  - Data collection
  - Protocol support
- Open Data Kit application
- Android phones deployed with nurse midwives
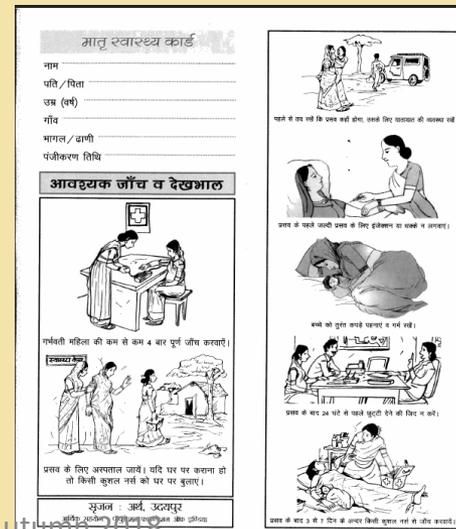
Health videos

- Three videos created
    - Maternal nutrition
    - Breast feeding
    - Thermal care
- Videos shown during PNC
    - Launched from ODK form at specific points in visit
- Nurse midwives were already expected to address these topics

ARTH [www.arth.in]   Not for Distribution

Mobile device use

- One year pilot for data collection and visit support
- Nurse midwives had difficulty with data collection and continued to use paper forms
- Device logging showed that the videos were shown regularly
- Midwives identified video the most successful component of the project

	Nutrition	Breast-feeding	Thermal care	Total
Video played entirely	554 (77.1 %)	497 (77.7 %)	288 (62.5 %)	1339 (73.4 %)
Video partially played	46 (6.4 %)	52 (8.1 %)	26 (5.6 %)	124 (6.8 %)
Video stopped	110 (15.3 %)	89 (13.9 %)	146 (32.7 %)	345 (19.0 %)
Video play extended	9 (1.2 %)	2 (0.3 %)	1 (0.2 %)	12 (0.7 %)

Study methodology for evaluating video

- Ethnographic observations of 22 PNC visits

- Semi-structured interviews with the 8 nurse midwives

- Iterative coding scheme of qualitative data using Atlas.ti

- Triangulation with quantitative data from deployment

Summary of results

- The use of video is feasible in PNC visits
- The PNC environment is complicated
  - Patient education occurs throughout visits with various levels of effort
  - Multiple settings and participants
- Authority and trust
  - Nurses viewed video as being authoritative and enhancing their communication

Feasibility

- Video used consistently on PNC visits

- Midwives reported a favorable reaction and identified this as the best feature of the mobile device

- Minor difficulties in using videos in the mobile app

"The video that we show is very good – it becomes very easy for the people to understand. There is a big difference between telling something and showing it. On watching the video people understand that yes, this is how it is to be done."

Complexity

- Multiple people might be present for home and clinic PNCs
- Process of doing an examination did not fully align with the protocol on the device
- Introduction of videos made educational component more explicit

"When we do PNC before, only the patient and I are present . . . Now I am showing the video, now others too come on hearing the sound from the video, so they too remember that yes, we have to do this, so more people come inside, we tell the patient, and everyone hears."

Multitasking

- Nurses used time while video played for other activities

- Multiple ways of showing the video

- Video was rarely stopped for discussion

- Time for playing the video was an issue

"[The good thing about the video] is that the video explains how to feed the baby and gives advice, so we don't have to talk much. So while they watch the video, we can continue with our work"

Authority

- Videos extended nurses ability to deliver complete messages

- Some nurses felt that by featuring older nurses the videos had additional authority

- No conflicts with the video messaging

"We explained that this too is showing how to feed the baby, the things that you should eat, is it necessary for you to have the tablets or not. We are telling you through the mobile. It is just like the nurse used to tell you. You should take it the same way. We show the video and they feel it is right"

Trust

- Video considered to be trustworthy
- Nurses had a theory that people understand by seeing
- Advantages identified: clarity of message, use of local language, and local participants

"What will the mother think? She thinks the video is correct. A movie has been made, so it is right because there is a lady in it, a patient and a nurse, so she understands. . . She understands on seeing the patient. If there had been only two nurses, she wouldn't have understood"

ARTH

Action Research and Training for Health

Diagnostics

- Issues
  - Cost of test
  - Precision of test
  - Accuracy of test
    - Error profile
  - Action on positive test
  - Action on negative test
  - Goals
    - Individual treatment
    - Public health goals

	Positive Test	Negative Test
Have disease	True Positive	False Negative
Don't have disease	False Positive	True Negative
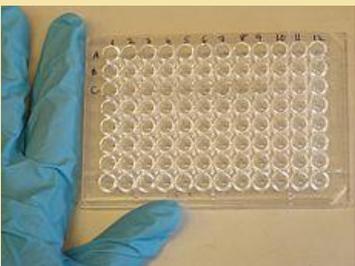
Diagnostics
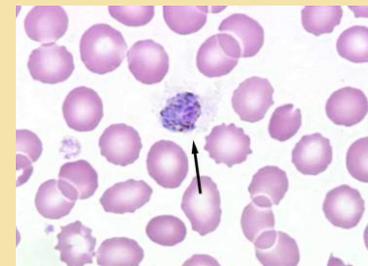
- Highly accurate tests
  - E.g., Enzyme-linked immunosorbent assay (ELISA)
  - Microscopy
- Requires infrastructure, trained staff, equipment
- Issues
  - Costs
  - Transport of samples
  - Delays in processing or notification

Lab Information System

- Internal lab management

- Tracking of samples and tests

- Interoperability with medical records

- Notifications

- Probably not much difference between developed and developing world

Rapid Diagnostic Tests

- **Point of Care Tests**
  - Deliver results without sending test to lab
  - Fast turn around
  - Limited test preparation

- **Lateral flow immunochromatographic assays**

- **Large number of tests available**
  - Blood, Urine
  - HIV, Malaria, Syphilis
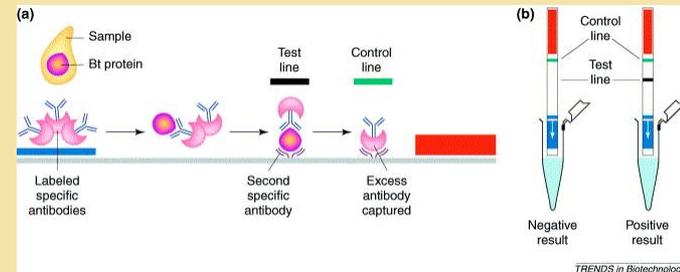
ODK Diagnostics

- Image analysis on SmartPhone to read RDT
  - Computation done locally
  - Template to adapt to multiple tests
- Use cases
  - Enable lesser trained health workers to conduct tests
  - Support tests which are not frequently used
  - Supervision
  - Quality control
- Field trials
  - Zimbabwe