Mobile Applications

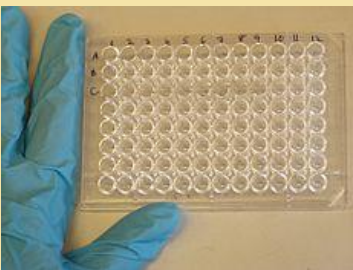Lecture 22:   CSE 490c

Topics

- Diagnostics
- Mobile Videos

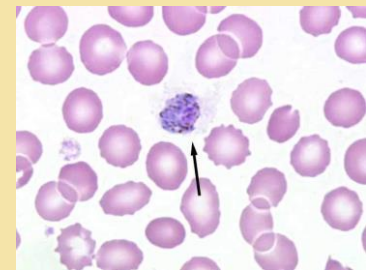# Diagnostics

- 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

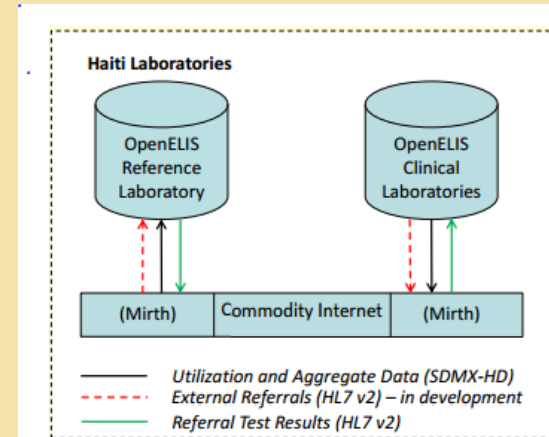|	Positive Test	Negative Test
Have disease	True Positive	False Negative
Don't have disease	False Positive	True Negative

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
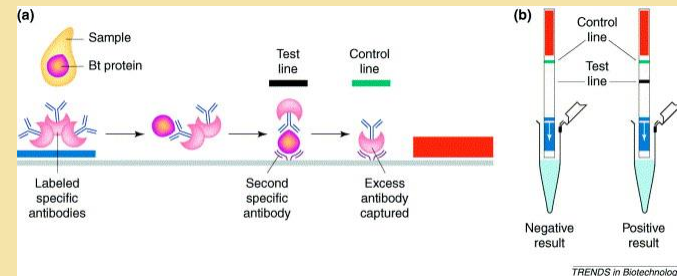
ODK Diagnostics

- 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
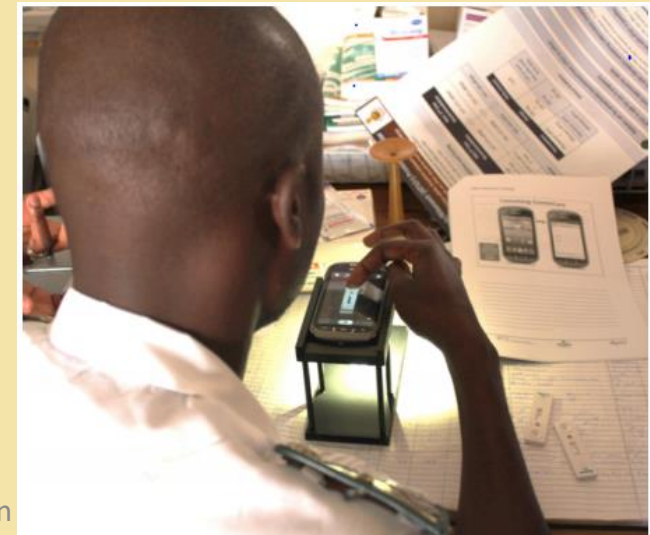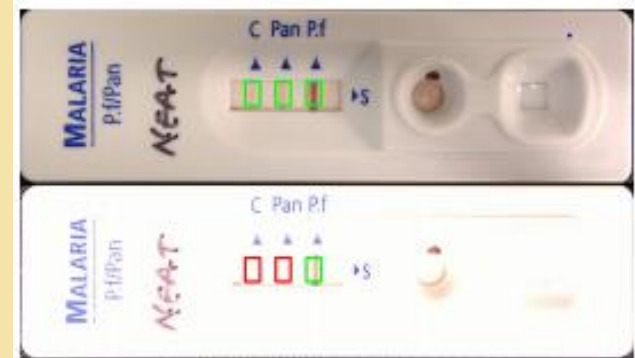
Hijack

- Sensor interface through audio jack

- EKG Interface

- Soil temperature monitor

- UBC Pulse Oximeter for iPhone

- HIV Diagnostic
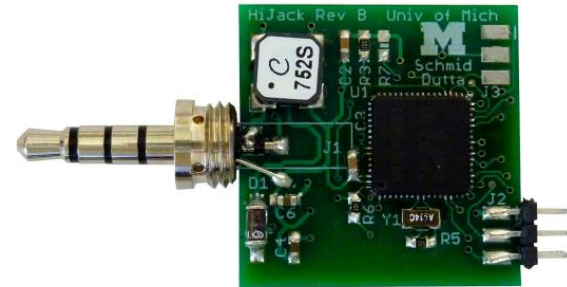
Figure 14: The HiJack base platform, with a 1" x 1" footprint, offers power (>5 mW), analog (2x 12-bit), digital (1x GPIO), and serial (1x I2C and 1x UART) interfaces, exported via connectors, and all multiplexed over the headset port. This board provides the functionality needed to build a variety of external sensor interfaces for the mobile phone.

Smartphone for point of care diagnosis

- Recent press attention on HIV/Syphilis diagnosis by Columbia University

- Laboratory quality immunoassay

- Ultra low power

- Power from cell phone
  - iPhone = Battery
  - Signal processing on cell phone to generate results
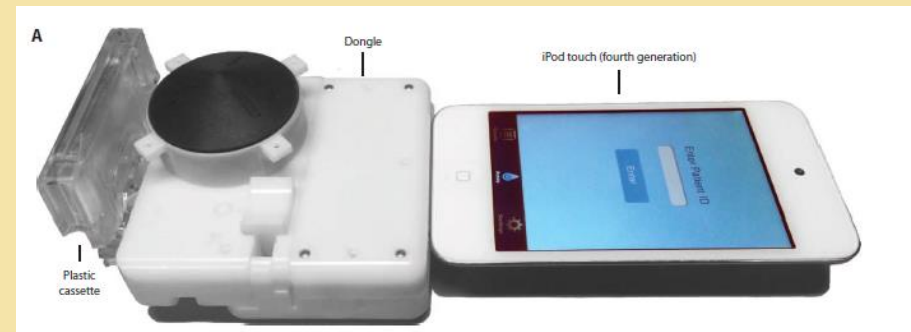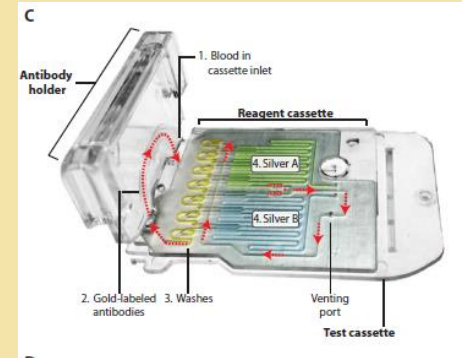
Cell Scope

- UC Berkeley project
  - Dan Fletcher, Bioengineering
  - Build a cheaper microscope for diagnostics
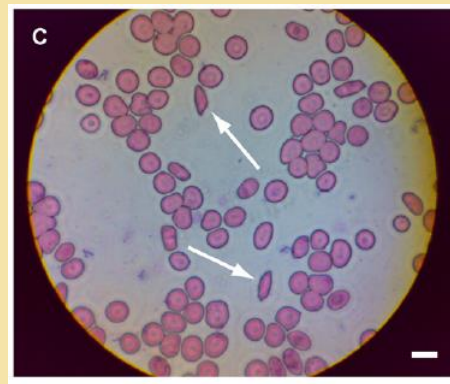
Mobile video for patient education: The midwives' perspective

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
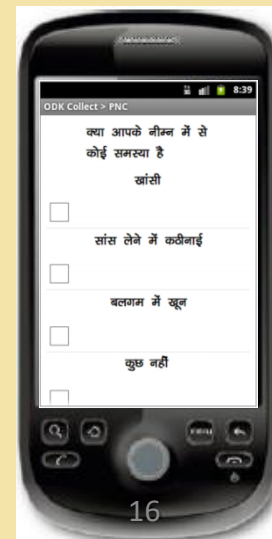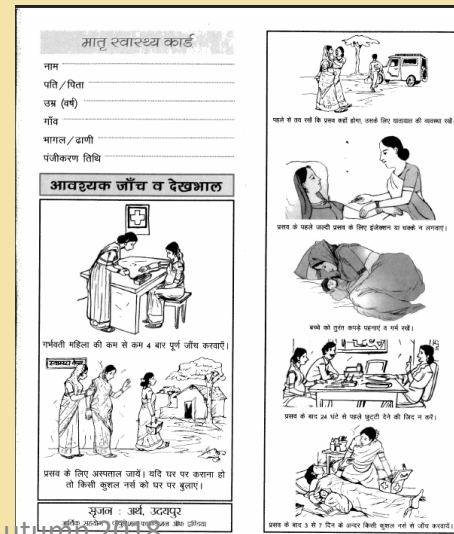
Health videos

- 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

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