The Problem

- Developing countries struggle with HIV, tuberculosis, and malaria
- Necessarily-strong pharmaceuticals can pose risk to patients’ lives
- Communities lack the diagnostic measures necessary to prevent liver failure

Objective

- Develop an inexpensive test kit that can perform liver function assays
- Research point-of-care diagnostics market opportunities for Hewlett-Packard
- Propose a business model for HP that enables diagnostics and informatics in developing countries

The Data Ecosystem

- Establishing health demographics
- Monitoring the spread of infectious disease
- Determining disease morbidity rates
- Epidemiological studies
- Assessing pharmacological priorities
- Planning medical humanitarian organizations’ campaigns

Informatics

- Uses of aggregate, non-identifying health data:
  - Organizes patient health information
  - Categorizes by patient demographics

Existing Technologies

- Digital blood tests
  - Connects remote areas with central labs
  - Lacking in sensitivity and specificity

Diagonstics For All

- “[+] Robust and inexpensive
- [-] Lacking in sensitivity and specificity

The PicolLeaders

Bill Bedell | Travis Heinze | Meghan Keck | Spencer Saunders
Manish Giri & James Stasiak

Printing Assays

Assays consist of reagent mixes in buffers that react with proteins or enzymes in biological samples to produce quantifiable colorimetric responses

ALT Assay

(Alamine Aminotransferase) Levels relate to liver damage

Bilirubin Assay

(Jaminet Bilirubin) Jaundice and possible liver damage

Image Analysis

Our MATLAB script identifies assay droplets and runs colorimetric analysis

Pyruvate Standard Concentration [nM]

Data Matrix

Unique ID on each µPAD, allowing information to be associated with it

Color Reference

For robust colorimetric analysis in different lighting conditions

Wicking Material

Draws blood to test point, covered in agglutination factor to separate plasma from red blood cells

Hydrophobic Barriers

Borders wicking channel, direct serum towards assay site

Small size requires microliters of blood and nanoliters of reagents, decreasing pain and costs.

Our Solution

A high-throughput paper-based medical test kit printed on-site

Prep

- Print assay function assay on “blank” test strip at point-of-care

Assay

- Distribute prepared test strips to patients

Analyze

- Collect tests; analyze responses with internet-connected scanner

Decide

- Compare results with electronic patient history; adjust drug regimen as necessary

Microfluidics

- Channel media needed: fast wicking & good colorimetric response
- Red and blue µPAD labels: biocompatible, color responses normally separated from plasma solution

Two Solutions

- Single-use blood filtration paper separates plasma from whole blood
- No need for bulky centrifuge

References

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