Diagnosing patients at point of care

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Motivation

• “A long and healthy life for all South African” (DOH Key Outcomes)

• “The equalising principles of primary health care is a decentralised, area-based, people-centred approach of the district system” (NDP Vision 2030)

• “Critical elements of primary health care include prevention and the use of appropriate technology” (NDP Vision 2030)
Point-of-care diagnostics

- Point-of-care diagnostic are medical tests conducted at or near the site of patient care

- Primarily aimed to provide same-day diagnosis to facilitate immediate decision-making

Image source: https://en.wikipedia.org/
Umbiflow: low-cost Doppler ultrasound for low-resource settings
Why antenatal care?

- Millennium Development Goals for Child (#4) & Maternal(#5) Health
  - South Africa & the majority of Sub-Saharan Africa will not meet 2015 deadline

- Perinatal Mortality Rate
  - Developed nations ~ 10 deaths per 1,000 pregnancies
  - South Africa = 37 (WHO)

- 50% of women in developing countries don’t receive adequate antenatal care (WHO: 4 visits)
Why antenatal care?

Clinic-Based Care

SGA

SF

No

Yes

Refer

Other Conditions

Doppler Ultrasound

Assess Blood Flow

Healthy

At Risk

Intervention

Caution

2 Weekly

9 / 10 SGA Referrals for Doppler

Primary Level: CLINIC

Secondary Level: HOSPITAL

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The approach

• A low-cost Doppler ultrasound system for assessment of blood flow in the umbilical cord
• Targeted at ante-natal clinics for use by nursing sisters
• Changes the paradigm of ultrasound being used only by specialists at the secondary level
Route to impact

- CSIR has implemented an ISO 13485 Medical Quality System
  - Permits commercialisation/technology transfer to happen

- CE Mark targeted for 2015
  - Will permit commercialisation

- Umbiflow validated through clinical testing
  - Reduced referral rates by up to 83% in small population study
  - 9% smaller babies detected in late bookers
Cellnostics: point-of-care device for full blood count analysis
Current environment

Geographical separation between community healthcare centres and centralized lab

Turnaround time (TAT) directly impacts the quality of patient care
The solution: Cellnostics

Clinic → Blood Samples → Centralized Laboratory

Blood Test Results
Cellnostics
Paper-based diagnostics
The ASSURED criteria

The World Health Organisation (WHO) states that diagnostics for the developing world should be ASSURED:

Affordable
Sensitive
Specific
User-friendly
Rapid and robust
Equipment free
Deliverable to end-users
Combining technologies

Different microsystems technologies each have pros and cons for effective point-of-care diagnostic implementations.

Cartridge-based microfluidics with readout systems

Aim to combine best of different microsystems from all platforms to provide optimal solution that encompasses all ASSURED criteria.

Lateral flow devices

ASSURED
Integrate all components found in more expensive equipment onto pieces of paper. This include:

- Design and printing
- Reagent introduction
- Adhesive layers
- Assembly and Reagent storage
- 3D fluid flow and control
- Electronics on paper
- Readout and Result
- Printed energy storage

A fully integrated, printable device
Impact

Sensors for medical and environmental diagnostics, also agriculture, drug detection, veterinary, and mining.
Conclusion

- Increase access to under-served communities

- Improve the quality of healthcare provision
  - Quicker diagnosis at initial point of care
  - Better patient outcomes

- Reduce cost
  - In the healthcare system due to reduced work load at secondary hospitals and laboratory
  - For patients who save money on transport costs
Thank you