Portable Ultrasound for Midwives

Waylon Brunette

working with
Wayne Gerard, Matthew Hicks, Alexis Hope, Pratik Prasad

with assistance from
Ruth Anderson, Gaetano Borriello, Beth Kolko, Rob Nathan
Recognized as a global problem
- In 2004, was second leading cause of death for women (15-44) worldwide (WHO Women & Health)
- UN Millennium Development Goal#5: Reduce the maternal mortality ratio by \( \frac{3}{4} \) of 1990 levels

In 2008, the World Health Organization (WHO) estimates lifetime risk of maternal death
- 1 in 4300 for developed regions
- 1 in 120 for developing regions
- 1 in 31 for developing regions in sub-Saharan Africa
WHO: Maternal Mortality Ratio

Maternal Mortality Ratio = Deaths per 100,000 live births
GapMinder.org: Maternal Mortality Ratio

Notice Africa

Logarithmic scale
Preventative Approach

- Identify women with high risk pregnancies
  - Increase diagnostic capabilities during antenatal visits
  - Enable referrals to appropriate medical facilities for delivery

- Utilize existing local healthcare resources to create a sustainable solution
Target Usage Scenario

- **TARGET COUNTRY:** Uganda
  - Existing partnership between UW Radiology & local partners
  - Birth Statistics
    - 89% of births happen in rural area
    - 58% of deliveries happen at home
    - Skilled Birth Attendant at Delivery
      - 80% in Urban area
      - 38% in Rural areas

- **TARGET LOCATION:** Rural
  - Travel time to health facilities can be large

- **TARGET USER:** Midwife with limited training
  - Midwives are often central medical figures in rural and low-income communities
Trained midwives using ultrasound to enhance routine antenatal care in rural health centers will decrease maternal and neonatal mortality

- By diagnosing high-risk pregnancies
- By encouraging use of the health care system
  - to attend the recommended 4 antenatal care visits
  - to deliver at a health facility by skilled birth attendants
Why Ultrasound?

- Ultrasound imaging is an effective tool for identifying maternal mortality risk factors.
- Cheaper than other forms of medical imaging.
  - Still expensive because of the high costs of both equipment and required training.
- Nearly absent in many rural healthcare facilities
- The following three common obstetrical complications can be reliably detected with ultrasound
  - Breech presentation
  - Multiple gestations
  - Placenta previa
Commercial Portable Ultrasound

Device includes UI elements and additional features to diagnose conditions in multiple types of domains

DOMAINS: Abdominal, OB, Vascular, Cardic, Thyroid, Breast, Etc
Design: New UIs for Old Technologies

- Utilizes older ultrasound sector scanning technology
  - Adequate quality image to spot potential problems
    - Do not need the highest resolution to identify possible problems
  - Lower cost

- Simplify user interface
  - Remove unnecessary ultrasound features
  - Reduce training time (standard ultrasound is 2 years in USA)

- Make device a learning tool
  - Integrated contextual help system to provide training/assistance “in the moment”
  - Avoid remote diagnosis to remove dependence on continuous foreign assistance.
Simplified User Interface
Sample Images

A) Midwife’s Ultrasound

B) >$100k Hospital Ultrasound Machine

B-Liver Lesion

A-Kidney

A-Liver Lesion
Five radiology MDs rated whether the prototype ultrasound system could diagnose:

- Breech presentation: Likely

- Multiple gestations: Likely

- Placenta previa: Likely

All MDs stated that the system needed to be tested on pregnant women to accurately determine abilities.
Image of 17-week fetal phantom obtained using our prototype and using SonoSite M turbo ultrasound machine.
Future Project Goals

- Perform scans on pregnant women to verify adequate image quality.
- Expand UI functionality
  - Contextual help system
  - Patient data record browsing system
  - Improved automated scanning functionality.
- Produce a System < $1000.
- Perform additional user testing with Ugandan midwives.
QUESTIONS?

Come see the system at the Demo & Poster Session