Portable Ultrasound for Midwives

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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

2008

Logarithmic scale

Notice Africa
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 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
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

Soft Buttons

Sliders

Keyboard & Track Ball

Extra Buttons

Scroll Wheel

Labels Added by Hospital Staff
Midwives Ultrasound
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:**
  - Responses:
    - Likely
    - Plausible
    - Not Likely

- **Multiple gestations:**

- **Placenta previa:**

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