Maternal and Neonatal Health

Opportunities and Challenges for mHealth in resource-limited settings

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MDG 4/5 – Defining the burden

Global Burden of Maternal Mortality

Global Burden of Neonatal Mortality

Source: http://www.worldmapper.org, 2010
When do maternal deaths occur?

Figure 4: Mortality during pregnancy and by time since end of pregnancy in Matlab, Bangladesh. Data from reference 3. Black lines show 95% CI.

Source: Ronsmans et al. Lancet 2006; 368:1189-1200
When do neonatal deaths occur?

- 1st Day – 50% of deaths
- 1st Week – 75% of deaths

Neonatal Mortality by Maternal Age at Pregnancy ($n=12,023$ live births)

Overall NMR: 57/1000 LB

Maternal Age

NMR (Deaths per 1000 Live Births)

- $\leq 14$ y
- 15-19
- 20-24
- 25-29
- 30-34
- 35-39
- $\geq 40$
Complex pathways to mortality...

Sikder et al., 2010, M/S in preparation
A 20-year-old woman who experienced obstructed labor explained:

“When I tried to give birth, the umbilical cord came out first. The dai who was helping me called 2 other trained dais. They were afraid to touch me because they said they had never seen anything like this before. Two hours later, my family called an ambulance, but the baby was already dead, probably from the cord being wrapped around its neck for a long time.”
Compounded Delays…

“During the home delivery, the child’s head became stuck. An untrained dai used her fingers to pull the child’s head to deliver the baby. The placenta would not come out even after much pulling. The woman had so much bleeding that it flowed over the floor. The family hurriedly took her to the government hospital, where attendants inserted their hands … to remove the placenta. The bleeding stopped immediately. The woman became very weak, and doctors were unable to get saline to enter her body. They suggested the woman be transferred to the district hospital. Before the family was able to arrange transportation, the woman died.”
A Continuum of Opportunity

Health Education / Improved Nutrition

- Delayed Marriage
- Improve Care-seeking / Service delivery
  - ANC
  - emNOC
  - ENC
  - Vaccination
  - IMCI

- Adolescence
- Marriage
- Pregnancy
- Delivery
- Early Infancy
- Childhood
“Simple” Strategies

- Increase access to information
  - Improve decision-making

- Improve routine preventive care
  - ANC
  - ENC

- Compress the time between crisis and care
  - Expedite appropriate decisions
  - Accelerate treatment-seeking
  - Accelerate care provision
mHealth “Opportunities” in MNCH

Immediate access to information → rapid, targeted response

**Identification of Pregnancy**
- Pregnancy registration
- ANC / ENC counseling
- Late pregnancy ANC

**Delivery**
- Immediate, exclusive BF
- Registration of outcome

**Postpartum Period**
- Windows of Opportunity
- ANC / ENC counseling
- Late pregnancy ANC

**Windows of Opportunity**
- High “risk” pregnancy identification
- Prolonged labor
- Obstructed delivery
- Intrapartum crisis events
- Early neonatal illness
- Neonatal illness

**Windows of Vulnerability**
- mHealth solutions?
- e-registration
- Risk profile algorithm use
- Push ENC/ANC messages
- e-Labor Notification
- Dispatch of Emergency Team or Facilitated Referral Systems
- Facilitate recognition of illness, improve referral behavior
Example: The Johns Hopkins “JiVitA” Maternal and Child Health Research Site (www.jivita.org)
The Johns Hopkins “JiVitA” Maternal and Child Health Research Site

- ~500 sq. km. of rural NW Bangladesh
- ~600 “villages”
- Population: 650,000
- 600 Community Health Workers
- Women of reproductive age listed: ~150,000
- Pregnancies enrolled and followed since 2001: ~98,000
- Newborns enrolled and followed since 2001: >80,000
Enrolled mothers are periodically interviewed for diet, morbidity, other exposures, pregnancy outcomes, and infant health.
Pregnancies are monitored weekly, and vital events reporting is ongoing using paper and digital systems.
Field-based study workers, on bicycles, reach newborns within 18 hrs of birth.
Data Entry, Processing and Management
Over 260,000 homes are GIS-mapped...

- Over 260,000 GPS Points
- Households updated
- Rural road network
- Health Center locations
- “Distance” to facility capable

Sugimoto J et al. JHPN 2008
Girls are married, on average, at age 16½

“Survival Curve” of Time to Pregnancy after Marriage
(Among Cohort of Newly Married Women 2001-2005)

13 Months = Median Time from Marriage to Pregnancy

Source: Labrique, JiVitA Data (Unpublished)
~50% of infants are low birth weight

N=12,342 Newborns
Mean wt= 2442 grams

Source: Klemm et al., Pediatrics 2007
~ 22% of neonates are preterm...

N = 12,342

Median: 39 weeks

22.3% Preterm

Source: Labrique, JiVitA Data (Unpublished)
Most pregnant women in this population experienced NO routine antenatal care
(2001-2007, n=41,285)

Source: Labrique, JiVitA Data (Unpublished)
Mobiles ?

Source: © Photographersdirect.com
Cellular Coverage and Household Ownership seems High
N=32,528 (2007-2010)

<table>
<thead>
<tr>
<th>Year</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>37 / 181</td>
<td>20.4</td>
</tr>
<tr>
<td>2008</td>
<td>3,996 / 18,016</td>
<td>22.2</td>
</tr>
<tr>
<td>2009</td>
<td>4,600 / 13,293</td>
<td>34.6</td>
</tr>
<tr>
<td>2010</td>
<td>3977 / 8,826</td>
<td>45.1</td>
</tr>
</tbody>
</table>

- 3G / EVDO networks
- High bandwidth capacity
- Wide network of traditional market phone support and charging systems

Source: Labrique, JiVitA Data (Unpublished)
Families who have phones use them during pregnancy Crises
N=11,451 (2007-2010)

<table>
<thead>
<tr>
<th>Mobile phone use</th>
<th>Count (Percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of “Near Miss” events</td>
<td>611 (5%)</td>
</tr>
<tr>
<td>Mobile phone use during crisis</td>
<td>337 (55%)</td>
</tr>
<tr>
<td>Mobile phone used to call provider</td>
<td>241 (72%)</td>
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<tr>
<td>Mobile phone used for medical advice</td>
<td>193 (57%)</td>
</tr>
<tr>
<td>Mobile phone used to arrange transport</td>
<td>110 (33%)</td>
</tr>
<tr>
<td>Mobile phone used to ask for financial aid</td>
<td>70 (21%)</td>
</tr>
</tbody>
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Source: Labrique, JiVitA Data (Unpublished)
Some examples...

• A 23-year-old woman who experienced obstructed labor:

“When the traditional birth attendants realized they could not handle the delivery, they phoned the family welfare assistant for advice. She told us to go straight to the government hospital, where I received an emergency C-section that saved me.”

• A 17-year-old girl who experienced postpartum hemorrhage:

“After delivery, I lost so much blood that the village doctor could not make it stop. He used his mobile phone to call an ambulance to immediately take me to the maternal and child welfare center.”

Source: Sikder, JiVitA Data (Unpublished)
What about the gap?

Source: Labrique, JiVitA Data (Unpublished)
Phone Ownership – Associations with SES

N=32,528 (2007-2010)

<table>
<thead>
<tr>
<th>Year</th>
<th>Overall (%)</th>
<th>Low SES (%)</th>
<th>High SES (%)</th>
</tr>
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<tbody>
<tr>
<td>2007</td>
<td>20.4</td>
<td>8.6</td>
<td>27.9</td>
</tr>
<tr>
<td>2008</td>
<td>22.2</td>
<td>8.0</td>
<td>29.7</td>
</tr>
<tr>
<td>2009</td>
<td>34.6</td>
<td>15.2</td>
<td>42.9</td>
</tr>
<tr>
<td>2010</td>
<td>45.1</td>
<td>26.6</td>
<td>51.4</td>
</tr>
</tbody>
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*SES proxied by household construction index. Source: Labrique, JiVitA Data (Unpublished)
Neonatal Mortality –
Associations with Socioeconomic Status

*SES proxied by household construction index. Source: Labrique, JiVitA Data (Unpublished)
Average Birth Notification Speed did not differ by Family Phone Ownership (2007-2010)

Source: Labrique, JiVitA Data (Unpublished)
So...
Potential Priorities

Test mHealth for what “we know works”:

- Antenatal and Infant Vaccines
- Improve safe / clean deliveries
- Emergency, facilitated referrals
- Provide essential newborn care
- Assure postpartum mother / newborn visit
- Improve immediate / exclusive breastfeeding
- Generate robust data streams (vital registries)
Potential Priorities

• Leverage mHealth / ICT opportunities to:
  – Track / monitor progress of pregnant women
  – Immediately notify / record births
  – Immediately recognize pre-term births
  – Provide location information to CHW / Provider
  – Standardize delivery of ENC/EOC
  – Automate algorithms for classifying severely ill newborns
Moving Forward…

• Common “mHealth” vocabulary
• Defined research agenda
  – Testing ideas
  – Demonstrating feasibility
  – Establishing cost-effectiveness
  – **Measuring EFFICACY**
• Defining mHealth “Success”
  – Standardized, defined process indicators
  – Standardized, defined outcome indicators
How to prioritize?

Identify, test and advocate for interventions that:
- Have measured public health impact
- Are cost-effective and sustainable
- Are locally appropriate and scalable
- Target MDG / MNCH Priorities
- Strengthen health systems
Selecting mHealth Strategies for MNCH: What is the target “space”? 

Other axes: health system infrastructure, burden of disease / mortality, etc…
Summary

- Continuum of opportunity
- Bridge the “Gap” between Problems and Solutions
- Develop and use robust measures of impact

*Future thoughts: Protection of patient confidentiality*
Thank you অনেক ধন্যবাদ