Validity of home-based sonographic diagnosis of obstetric risk factors by community health workers in rural Nepal

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Maternal, newborn, and fetal death

- 2.6 million stillbirths
- 2.7 million neonatal deaths
- 303,000 maternal deaths

2.3 million deaths averted with proper care at birth

References:
Lawn JE, Blencowe H, Oza S, et al. Every Newborn: progress, priorities, and potential beyond survival. Lancet 2014.
Risk factors diagnosable by ultrasound

• Non-cephalic presentation
  – Incidence: 2-3%

• Multiple gestation

Lack of human resource
In Nepal, 1 radiologist : 185,000 people
  – Incidence: <1%
How validly can community-level health workers diagnose basic obstetric risk factors using ultrasonography?
Methods

• Validation study
  – Test accuracy of diagnosis of basic obstetric risk factors by community-level health workers

- Two one-week trainings for three auxiliary nurse midwives
  – Non-cephalic presentation
  – Multiple gestation
  – Placenta previa
Methods

- Pregnant women identified by household surveillance (conducted by parent study, Nepal Oil Massage Study)
  - Eligibility: All women ≥32 weeks gestation
- ANM home visit in pairs
- Data collected Sep 2014 - Sep 2015 (n=805)
Methods

- Independent examinations
  - Diagnoses recorded
  - Images saved following protocol
- Images uploaded onto online server for remote gold standard review

- Analysis
  - Validity – ANM vs. gold standard reading
  - Inter-rater agreement - between ANMs

SonoSite Nanomaxx device
Donated by SonoSite Soundcaring Program
Results – Non-cephalic presentation

• Reported prevalence by the ANMs – 5.0% (n=40)
• Validity against gold standard reading:

<table>
<thead>
<tr>
<th></th>
<th>ANM 1 N=533</th>
<th>ANM 2 N=541</th>
<th>ANM 3 N=536</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>92.6</td>
<td>96.7</td>
<td>94.1</td>
</tr>
<tr>
<td>Specificity</td>
<td>99.6</td>
<td>100</td>
<td>99.8</td>
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<tr>
<td>Positive predictive value</td>
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<td>99.6</td>
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</tr>
</tbody>
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ANM 1 = 4 discrepant out of 533, ANM 2 = 1 discrepant out of 541, ANM 3 = 2 discrepant out of 536
## Results – Multiple gestation

- Reported prevalence by the ANMs – 0.8% (n=6)
- Validity against gold standard reading:

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## ANM inter-rater agreement

<table>
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<tr>
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<th>Non-cephalic presentation (kappa)</th>
<th>Multiple gestation (kappa)</th>
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<tbody>
<tr>
<td>ANM 1 &amp; 2 (n=268)</td>
<td>1.00</td>
<td>N/A*</td>
</tr>
<tr>
<td>ANM 2 &amp; 3 (n=271)</td>
<td>0.95</td>
<td>1.00</td>
</tr>
<tr>
<td>ANM 3 &amp; 1 (n=265)</td>
<td>1.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

*all diagnosed as singletons, cannot calculate kappa
Results – Placenta previa

• Two cases detected by ANMs
  – Gold standard reviewers agreed

• 34% of exams reported as “can’t determine” by gold standard reviewers
  – Most likely attributable to difficulty of imaging in third trimester
Conclusions

• Community-level health workers able to validly diagnose non-cephalic presentation and multiple gestation

• Potential benefit of task shifting
  – Among mothers who had a non-cephalic birth, 71% unaware prior to labor
  – Among mothers who had twins, 64% unaware prior to labor
Conclusions

• Study unique in
  – Providing quantitative data re: accuracy
  – Home visit protocol

• Considerations for ultrasound expansion
  – Robustness of the technology
  – Overuse / misuse
  – Impact on health outcomes?
Acknowledgments

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