Technology innovation in service of women

The case of antenatal care

Pascale Ondoa
African Society for Laboratory Medicine

ICASA- 2019
• 533 maternal deaths per 100,000 live births: >68% of all maternal deaths per year worldwide.

• 28 infant deaths per 1,000 live births: 10 times more risk to die during first month than in high-income countries
Maternal and child mortality in sub-Saharan Africa (2)

- 14% of maternal death from hypertension (eclampsia)
- 2.7 % of women infected with syphilis: >900,000 pregnancies at risk each year
- 57% of pregnant women are anemic
  - 23% of indirect cause of maternal death
  - Preterm birth
  - Low weight birth
- 386 Rhesus disease/100,000 live births
- 5%-16% of <5 years death due to Rhesus Disease
- 6% of infant deaths due to HIV
Access to diagnostic tests for antenatal care

Focused Antenatal care (ANC) services: 4 visits

In Senegal

<table>
<thead>
<tr>
<th>Minimal screening test package visit 1</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIV serology (Rapid Test – for free)</td>
<td>PMTC</td>
</tr>
<tr>
<td>Syphilis serology</td>
<td>Congenital syphilis</td>
</tr>
<tr>
<td>Proteinuria (rapid test)</td>
<td>(Pre-)eclampsia</td>
</tr>
<tr>
<td>Blood group/Rhesus factor</td>
<td>Rhesus disease, hyperbilirubinemia</td>
</tr>
<tr>
<td>Glycemia</td>
<td>Diabetes. Child overweight</td>
</tr>
<tr>
<td>Emmel test</td>
<td>Sickle cell anemia</td>
</tr>
<tr>
<td>Hemoglobin level</td>
<td>Anemia</td>
</tr>
</tbody>
</table>

- ANC screening package is part of the minimal testing package down to level 2 laboratories
- In Health Posts (level 1) only rapid tests (HIV and proteinuria) can be done
- When laboratory is available in the facility, rapid tests are done by the laboratory staff

$9 to $22
Pregnant woman visits the ANC clinic

Midwife requests test

Laboratory executes the test

Clinical management based on test results

Average number of back and forth: N=5
How are laboratory screening tests utilized in ANC services?

The example of Senegal

On 1694 women attending 16 ANC clinics across the country
Pregnant woman visits the ANC clinic

Midwife requests test

Laboratory executes the test

Clinical management based on test results

95% of pregnant women attend the 1st ANC visit

32% of women receive a complete test request

30% of test requests are executed

<30% of women with abnormal test results are adequately managed

Midwives anticipate the financial hardship, stock out of reagents, misconception.

Pregnant women admit that tests are too expensive, Multiple travels are a burden
ANC screening tests are severely underused in the context of available laboratory infrastructure and high attendance to ANC
Rapid test format (and gratuity?) associated with higher uptake

38 % of women have 0 to 2 tests available
Choice of technology contributes to lack of uptake

<table>
<thead>
<tr>
<th>TESTS</th>
<th>RESULT</th>
<th>FLAG</th>
<th>UNITS</th>
<th>REFERENCE INTERVAL</th>
<th>LAB</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBC With Differential/Platelet</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WBC</td>
<td>5.7</td>
<td>x10E3/uL</td>
<td>4.0-10.5</td>
<td>01</td>
<td></td>
</tr>
<tr>
<td>RBC</td>
<td>5.27</td>
<td>x10E6/uL</td>
<td>4.10-5.60</td>
<td>01</td>
<td></td>
</tr>
<tr>
<td>Hemoglobin</td>
<td>15.4</td>
<td>g/dL</td>
<td>12.5-17.0</td>
<td>01</td>
<td></td>
</tr>
<tr>
<td>Hematocrit</td>
<td>44.1</td>
<td>%</td>
<td>36.0-50.0</td>
<td>01</td>
<td></td>
</tr>
<tr>
<td>MCV</td>
<td>84</td>
<td>fL</td>
<td>80-98</td>
<td>01</td>
<td></td>
</tr>
<tr>
<td>MCH</td>
<td>29.2</td>
<td>pg</td>
<td>27.0-34.0</td>
<td>01</td>
<td></td>
</tr>
<tr>
<td>MCHC</td>
<td>34.9</td>
<td>g/dL</td>
<td>32.0-36.0</td>
<td>01</td>
<td></td>
</tr>
<tr>
<td>RDW</td>
<td>13.7</td>
<td>%</td>
<td>11.7-15.0</td>
<td>01</td>
<td></td>
</tr>
<tr>
<td>Platelets</td>
<td>268</td>
<td>x10E3/uL</td>
<td>140-415</td>
<td>01</td>
<td></td>
</tr>
<tr>
<td>Neutrophils</td>
<td>47</td>
<td>%</td>
<td>40-74</td>
<td>01</td>
<td></td>
</tr>
<tr>
<td>Lymphs</td>
<td>46</td>
<td>%</td>
<td>14-46</td>
<td>01</td>
<td></td>
</tr>
<tr>
<td>Monocytes</td>
<td>6</td>
<td>%</td>
<td>4-13</td>
<td>01</td>
<td></td>
</tr>
<tr>
<td>Eos</td>
<td>1</td>
<td>%</td>
<td>0-7</td>
<td>01</td>
<td></td>
</tr>
<tr>
<td>Basos</td>
<td>0</td>
<td>%</td>
<td>0-3</td>
<td>01</td>
<td></td>
</tr>
<tr>
<td>Neutrophils (Absolute)</td>
<td>2.6</td>
<td>x10E3/uL</td>
<td>1.8-7.8</td>
<td>01</td>
<td></td>
</tr>
<tr>
<td>Lymphs (Absolute)</td>
<td>2.6</td>
<td>x10E3/uL</td>
<td>0.7-4.5</td>
<td>01</td>
<td></td>
</tr>
<tr>
<td>Monocytes(Absolute)</td>
<td>0.4</td>
<td>x10E3/uL</td>
<td>0.1-1.0</td>
<td>01</td>
<td></td>
</tr>
<tr>
<td>Eos (Absolute)</td>
<td>0.1</td>
<td>x10E3/uL</td>
<td>0.0-0.4</td>
<td>01</td>
<td></td>
</tr>
<tr>
<td>Baso (Absolute)</td>
<td>0.0</td>
<td>x10E3/uL</td>
<td>0.0-0.2</td>
<td>01</td>
<td></td>
</tr>
<tr>
<td>Immature Granulocytes</td>
<td>0</td>
<td>%</td>
<td>0-1</td>
<td>01</td>
<td></td>
</tr>
<tr>
<td>Immature Grans (Abs)</td>
<td>0.0</td>
<td>x10E3/uL</td>
<td>0.0-0.1</td>
<td>01</td>
<td></td>
</tr>
</tbody>
</table>

Equipment breakdown/stock out of reagents/cost
Glycemia and Hemoglobin levels can be tested using rapid test technology

- Decreases the costs
- Avoids multiple trips of pregnant women
- Can be used in Health Posts
- Less opportunities for expensive equipment break down
All ANC care screening tests have the potential to be delivered in POC rapid test formats

Senegal introduced HIV/Syphilis Duo under PMTCT

[1 + 2] + 3 + 4 + 5 + 6 + 7

HIV/Syphilis proteinuria Glycemia Hemoglobin BG/Rh Emmel test

All these technologies are well established
What women need?: all-in-one ANC test kit including HIV rapid test

- 1st ANC visit
- 7 tests
- Lower price
- Done at community level
- Easy to QC-QA

94% of attendance to ANC 1 visit = 94% of complete ANC test screening done
Integrating diagnostics...
not only centered on the testing platform

Client centered

Community friendly
From ANC screening test to HIV care: The role of innovation in integrated testing

ANC → HIV programme → Integrated offer of HIV testing/care services for mothers and children
### Test area

<table>
<thead>
<tr>
<th>Test area</th>
<th>Near term diagnostic priorities</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIV viral load</td>
<td>Point-of-care testing for pregnant and breast-feeding women</td>
</tr>
<tr>
<td>HIV early infant diagnosis</td>
<td>Point-of-care tests for infants under 18 months of age</td>
</tr>
<tr>
<td>TB</td>
<td>Low-cost and easy to scale tests to screen for active and latent TB</td>
</tr>
<tr>
<td>Cervical cancer</td>
<td>Low-cost test to screen for persistent HPV infection in women 30 years of age and above + improved visual exam</td>
</tr>
<tr>
<td>Viral Hepatitis C</td>
<td>Easily accessible tests to confirm persistent HCV infection</td>
</tr>
<tr>
<td>STIs</td>
<td>Chlamydia, Gonorrhea, dual HIV-syphilis tests, HIV self tests</td>
</tr>
</tbody>
</table>

**Latest trends**

- **HIV care for mothers and children**
- **ANC**
Diagnostics is evolving towards (i) integrated use of both centralized laboratory and point-of-care platforms and (ii) integrated multiplex testing for TB, HIV, HCV, HBV, HPV, other tests

<table>
<thead>
<tr>
<th>Test Menu</th>
<th>Roche CAP/CTM 96</th>
<th>Roche 6800/8800</th>
<th>Abbott m2000sp</th>
<th>Hologic Panther</th>
<th>Molbio</th>
<th>Cepheid GeneXpert IV/16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max daily throughput</td>
<td>168 (8hrs); 312 (24hrs)</td>
<td></td>
<td></td>
<td></td>
<td>1,344/3,072 (24hrs)</td>
<td>1,220 (24hrs)</td>
</tr>
<tr>
<td>HCV VL</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>HBV VL</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>HIV EID</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>HIV VL</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>TB/M DRTB</td>
<td>✗</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>HPV</td>
<td>✗</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

- Programmatic relevance?
- Placement of instruments for maximal out reach and network performance?
- Affordability?
- Optimal demand and test result utilization?
Acknowledgements

Team SOCIALAB  
Senegal

Prof Iyane Sow  
Aicha Sarr  
Oulimata Diémé  
Khadija Datt-Fall  
Habib Seck  
Louis Delorme  
Gauthier Ndione

Team SOCIALAB  
Netherlands

Winny Koster  
Prof Robert Pool  
Constance Schultsz  
Stephan Rupert  
Anja van’t Hoog  
Julien Schrijver  
Robert Meester

Team SOCIALAB  
France

Christophe Longuet

Staff of Health facilities  
Study participants

Team SOCIALAB  
Mali

Prof Souleymane Diallo  
Lorène Fofana  
Ibrahima Guindo  
Prof Flabou Bougoudogo  
Bouréma Kouriba

Team SOCIALAB  
Burkina Faso

Prof Jean Sakandé  
Abdoulaye Nikiema  
Adama Morfou

NWO  
WOTRO

ASLM  
KTNET
Thank you