Innovations in Maternal/Infant Health Care

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DISCLOSURE: Michael J. Barber is a vice president & stockholder of the General Electric Company

DISCLAIMER: This presentation contains research and development concepts which have not been approved by any regulatory body (including the FDA). There is no intention to promote, market or sell any products.
Healthcare has reached a tipping point

✓ Healthcare industry in the U.S. has traditionally led innovation and exported globally

✓ Enormous pressure on the US to reduce costs – current model is unsustainable given “demographic” shifts

✓ Administrators looking to improve quality, lower cost, and reduce variation in care … patients want quality and coverage

✓ New healthcare models emerging on a global basis

*New solutions are required*
Healthcare innovation will be transformed

Old way (sequential)

1st
Impact outcomes

2nd
Lower Cost + Increase access

Distribution
Luminary → mainstream & U.S. → world

New way

Prevent/treat disease & Cost + quality + access

Two way innovation (U.S. ↔ World) & Broad-based and Simultaneous
For customers: 100+ innovations

1. Target
technology for lower-cost outcomes

2. Make
health IT faster and more productive

3. Create
innovation for all

4. Facilitate
consumer-driven health & prevention

What it means

+ More products and price points
+ Localize ...global ↔ U.S.
+ Expand services beyond installed base

+ Commercialize clinical decision support
+ Financing for IT
+ Automate productivity tools

+ Reduce screening cost
+ Broaden rural distribution/financing
+ Health essentials

+ Build out partnerships with IT
+ Awareness and motivation
+ Platforms for prevention/detection
Assessment process

**Cost savings**
1) Greater efficiency
   • Asset optimization
   • Maximize throughput
   • Reduce diagnosis & treatment variance
2) Therapy decision-support
3) Managing chronic diseases

**Access improvement**
1) Maternal & infant care
2) Water & sanitation
3) Screening for life-threatening conditions
4) Technology to extend reach (remote access and portability)

**Quality improvement**
1) Reducing medical errors
2) Improving diagnostic capability
3) Remote medicine/monitoring
4) Early disease detection

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Constant flow of innovation

Better, more affordable health for more people

Innovation pipeline

✓ Targeted, simplified innovations to lower cost
✓ HCIT financing for rural doctors and hospitals
✓ Cost out for customers healthcare delivery redesign
✓ Content, rural water & power for health benefit
✓ Expand maternal infant care offerings
✓ Strengthening of rural health initiatives
✓ Hand held ultrasound for ubiquitous imaging
✓ Pandemic flu preparedness
✓ Patient compliance from media with key healthcare institutions
✓ Health Advisory Board
healthymagination

✓ A new business strategy that reflects changing needs and emerging opportunities in healthcare

✓ A commitment to increase R&D investment in quality, access and cost and to bring the full focus of business on these issues

✓ A pledge to take on one of the world's toughest challenges and help people live healthier lives
Changing demographics

People of color ...

- Are ~50% of the U.S. population under the age of 30.
- Are >50% of the population in our 50 largest cities.
- Will reach 75% within the next ten years in our 25 largest cities.
- By 2010, 1 out of 6 people will be Hispanic.

To meet U.S. healthcare needs, we **MUST** address the disparity of healthcare.
Access and quality of care... an issue in healthcare

Care disparity measures below Whites

Quality of care by ethnicity (US)

- Ethnic disparities also exist in countries with ‘equalized’ access
- India has 40M diabetics—projected to be nearly 300M by 2025...less than 30% will have access to care
- 1M U.S. minorities have died prematurely in the last 10 years

Source: National Healthcare Disparities Report
SEER, USRDS, MEPS, CDC AIDS Surveillance System, NVSS-N, NIS< NHIS< NHDS

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Maternal/Infant Care

• High risk pregnancies are on the rise
• More than 500,000 mothers die of complications in delivery
• The premature birth rate is increasing …1 out of every 9 babies
• A premature baby, could be smaller than 400 grams, while full-term babies are about 3-4kg

Maternal mortality ratio, by country, 2005

Clinical Drivers – Global View

U.S. Vital Statistics
- Birth rate rose 2% from 2002 to 2003
- Birth rates rose for women aged:
  - 30-34 ↑ 4%; 35-39 ↑ 6%; 40-44 ↑ 5%
- Birth rates by cesarean delivery rose by 6% to represent 27.6% of all births
- Preterm birth rate @ 12.3% v goal of 7.6% ('10)
- LBW birth rate @ 7.9% v goal of 5% ('10)

Emerging Markets
- Goals for Maternal-Infant Health
- Not progressing as planned

Global Developed Markets
- Growing focus on fetal and neonatal brain
- Ongoing cost of neonatal morbidity is a growing concern

- Half million maternal deaths per year
- 4 million infants die per year during the neonatal period (first 4 weeks of life)
- 37% of neonatal deaths attributed to birth asphyxia and pre-term births

Reduce Morbidity
Reduce Mortality
## Opportunities in ultrasound diagnostics

<table>
<thead>
<tr>
<th>The public health consensus</th>
<th>Comprehensive obstetric care has 4 pillars: family planning, prenatal screening, skilled birth attendance, &amp; timely access to EmOC&lt;sup&gt;1&lt;/sup&gt;</th>
</tr>
</thead>
</table>

<sup>1</sup> *Emergency Obstetric Care* includes injectibles administration, skilled delivery, C-sections, & blood transfusion.

<table>
<thead>
<tr>
<th>Unique ultrasound opportunity</th>
<th>Identifying the 15% of pregnancies&lt;sup&gt;2&lt;/sup&gt; that have OB complications requires full screening coverage. Reaching rural mothers will demand innovation</th>
</tr>
</thead>
</table>

**Capabilities of Ultrasound**

- **Ectopic Pregnancy**
  Fetus develops outside the uterus.

- **Placenta Previa**
  Placental misplacement potentially causes fetal growth restriction, congenital deformities, & post partum hemorrhage.

- **Pregnancy Dating**
  Accurate determination of menstrual age thru gestational sac.

- **Multiple Gestation**
  Twins present risk during delivery (including higher likelihood of ectopic).

- **Breech**
  3-5% chance of single baby deliveries. Without manual repositioning, C-section may be needed.
Maternal/Fetal monitoring concept

- Fetal Heart Rate Monitoring
  - Automatically locate fetal heart
  - Monitor heart rate changes
  - Track heart with maternal & fetal motion.

- Uterine Activity Monitoring
  - Locate uterine lining
  - Identify contractions
  - Compare with fetal heart rate changes
Automated obstetrical measurement concept: Working with 3D data sets

Potential for estimation of fetal age
Concept for automated measurements

Automated searches for multiple gestation, breech, placenta

- Match 3D data to fetal template
- Locate placenta, birth canal, fetal head
- Identify risks to the birthing process

Automate femur length measurement.

FL-GA Table from Hadlock, F.P. et al, Radiology, 1984
The premature patient

Clinical Condition

- 130MM births annually, 8% are born premature
- Require continuous thermal & respiratory support
- Immature digestive track often necessitates IV feeding

Helping the tiniest patients survive
Questions to Ask About Touch…

Does physiological stability differ as a function of the type of microenvironment during procedural touch?

### Physiological Responses to Touch

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pre-Procedure Touch</th>
<th>Intra-Procedure Touch</th>
<th>Post Procedure Touch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Heart rate</td>
<td>138</td>
<td>161</td>
<td>140</td>
</tr>
<tr>
<td>Mean Respiratory rate</td>
<td>44</td>
<td>51</td>
<td>46</td>
</tr>
<tr>
<td>Mean SpO2</td>
<td>98</td>
<td>91</td>
<td>96</td>
</tr>
<tr>
<td>Mean Blood Pressure</td>
<td>38</td>
<td>44</td>
<td>39</td>
</tr>
</tbody>
</table>

### Decreasing touch in the NICU

<table>
<thead>
<tr>
<th>Variable</th>
<th>Traditional RW</th>
<th>Traditional Inc</th>
<th>Advanced RW</th>
<th>Advanced Inc</th>
</tr>
</thead>
<tbody>
<tr>
<td># of Touches (hourly)</td>
<td>6.9</td>
<td>4.4</td>
<td>3.1</td>
<td>1.6</td>
</tr>
<tr>
<td>Duration of Touches (min)</td>
<td>1.5</td>
<td>2.8</td>
<td>1.6</td>
<td>2.9</td>
</tr>
<tr>
<td>Total Touch Time (min/hr)</td>
<td>10.4</td>
<td>12.3</td>
<td>5.0</td>
<td>4.6</td>
</tr>
</tbody>
</table>

Average *duration* of microenvironment canopy openings:
- Hospital A: 14 minutes
- Hospital B: 10 minutes
- T-value = 4.34, p = .05

Average *number* of microenvironment canopy openings per day:
- Hospital A: 3.6 times/24 hours
- Hospital B: 2.1 times/24 hours
- T-value = 2.54, p = .01

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Microenvironment concepts…

Bed...from warmer to incubator & back:

– Open bed facilitates procedures but exposes baby to nuisance touch, light, and sound which impacts baby’s brain development

– Closed bed facilitates protection from light, sound, touch but makes life-saving procedures more difficult

– Closed bed can be a barrier to parent(s)
Vascular Access

- Used for nutrition, hydration, drugs, blood gas and pressure
- Types: Peripheral IV, Umbilical arterial & venous, Mid-line Catheter, PICC
Verify tip location with X-ray

FIG. 26-1
Anatomy of the umbilical and associated veins, with reference to external landmarks.
Vascular Access Workflow: PICC

Typical PICC Workflow

- Gather Tools: 5 min
- Prepare Patient Measure: 5
- Prepare Sterile Field: 10 min
- Prepare Catheter: 5 min
- Access Vein: 10-90 min
- Thread Catheter: 5-15 min
- X-ray: 10-120 min
- Adjust Catheter: 5 min
- Secure Catheter: 10 min

Typical PICC procedures last between 1-4 hours.
Potential Ultrasound based procedure could save up to 2 hours and eliminate the need to x-ray the babies!
Eco
magination ... for a better planet
+

healthymagination ... for a healthier population

= 

a better world ... for generations to come