Medical Devices and Diagnostics: Need
Preventive health care

1. Nutrition?
2. Water sanitation and hygiene?
3. Agricultural yield?

Diagnostics

1. Availability and accessibility?
2. Affordability?
3. Comfort of the patient?
4. Accuracy?

Curative health care

1. Penetration?
2. Ease of administration?
3. Effectiveness?

What do these innovations mean for the lower resource groups in our country?
Lakshmi, was brought to MAHAN when she was 23 months old and weighed 5.3 kgs (as against the recommended weight of 10 kg). She had severe pneumonia and her family had given up hope.

Upon intervention her pneumonia was cured and her weight increased from 5.3 kgs to 8.2 kgs within 90 days.

**Why the challenges are much bigger than they seem?**

Photo source: [melghatdiaries.mahantrust.in](melghatdiaries.mahantrust.in)
Dense communities

Pneumonia accounted for the death of 397,000 children under the age of 5 in year 2010.

- Assessing the burden of pneumococcal disease through routine surveillance remains a technical challenge in resource-poor settings.
- Vaccines which could reduce the disease burden have been available for twenty years, but they have not been incorporated into the Indian national immunization program.
- Current cost of the vaccine is prohibitively high: Rs. 1600/dose for 10-valent vaccine and Rs. 3200/dose for the 13-valent vaccine if no subsidies are offered.

Need: low cost and low skill screening devices.

Can we improve healthcare penetration?
The problem of Malnutrition


Common maternal problems hindering exclusive breastfeeding practice as documented in lactation management clinic

<table>
<thead>
<tr>
<th>Type of problem</th>
<th>Number of cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perception of reduced milk secretion</td>
<td>100</td>
<td>59</td>
</tr>
<tr>
<td>Nipple problems</td>
<td>31</td>
<td>18</td>
</tr>
<tr>
<td>Bottle-feeding</td>
<td>28</td>
<td>16.43</td>
</tr>
<tr>
<td>Breast abscess</td>
<td>6</td>
<td>3.57</td>
</tr>
<tr>
<td>Engorged breast</td>
<td>10</td>
<td>3.57</td>
</tr>
<tr>
<td>Adopted child</td>
<td>3</td>
<td>1.76</td>
</tr>
<tr>
<td>Mother not willing to breastfeed</td>
<td>2</td>
<td>1.17</td>
</tr>
<tr>
<td>No lactation related problem in mother</td>
<td>18</td>
<td>10.58</td>
</tr>
</tbody>
</table>

Source: Common Lactation Problems: Impact of Lactation Management Clinic and Telephone Support in their Management - A 5-Year Prospective Study in Davangere South India.

Are human milk banks the solution?
Infrastructural challenges: Communication

There are villages in Melghat located in inaccessible regions and at a distance of ~20 km from MAHAN and a distance of ~35 km from the nearest rural hospital.

There are 3 ambulances at the Dharni RH and 1 ambulance at Harisal PHC. These ambulances can be reached through 108, but there is no mobile network penetration.

How do we resolve emergency medical solutions?

Source: TRAI, Press Release No. 73/2014

**Need:** Devices that make use of but are not dependent on ICTs.
Infrastructural challenges: Power

Estimated Electricity Consumption in Hospitals (including Community Health Centers) and Nursing Homes in India, 2008

<table>
<thead>
<tr>
<th>Hospital</th>
<th>No. of Beds</th>
<th>Estimated kWh/Bed/year</th>
<th>Assumed Electricity Cost per kWh</th>
<th>Estimated Electricity Consumption (Million kWh)</th>
<th>Estimated Electricity Cost (Rs. Millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government Hospitals - Urban</td>
<td>328,491*</td>
<td>750 – 1500</td>
<td>Rs. 5</td>
<td>246 - 492</td>
<td>1232 - 2464</td>
</tr>
<tr>
<td>Government Hospital - Rural</td>
<td>154,031*</td>
<td>150 - 300</td>
<td>Rs. 4</td>
<td>23 - 46</td>
<td>92 - 184</td>
</tr>
<tr>
<td>Private/NGO Hospitals &amp; Nursing Homes</td>
<td>500,000**</td>
<td>1000 – 2000</td>
<td>Rs. 6</td>
<td>500 – 1000</td>
<td>3000 – 6000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>982,522</td>
<td><strong>-----</strong></td>
<td><strong>-----</strong></td>
<td>769 - 1538</td>
<td>4324 - 8748</td>
</tr>
</tbody>
</table>

Source: USAID ECO- III Project, 2009

*Central Bureau of Health Intelligence, National Health Profile, 2007

**Estimated for 2008: Based on number of beds as 262,256 in 2002 (11th Plan estimate) and an approx. 12% annual growth rate.

Basis and assumptions for arriving at the values in Table 3

- kWh/Bed/year in Urban Government Hospitals is based on sample studies conducted by DSCL under ECO-III Project
- kWh/Bed/year in Rural Government Hospitals is assumed to be 20% of that of Urban Government Hospitals
- kWh/Bed/year in Private/NGO Hospitals is from DSCL sample survey, and it takes into account Multi-speciality large hospitals in Metropolitan Cities, which may have kWh/Bed/year as high as ten times that of a normal Private/NGO Hospital

Energy requirement considering 8 hours of operation per day
- Medical refrigerator: 3120 Whr
- Outdoor lights (20W x 2 nos): 480 Whr
- 3 indoor lights and 1 wall mount fan: 677.65 Whr

**Need:** Devices that have lower power consumption or employ renewable sources of energy.
Infrastructural challenges: Medical eqp. repairs

Around 3 baby incubators were seen at Harisal PHC. None of them in working condition as no training was given on how the devices must be used and further no maintenance and repair budget was allocated for them.

Most of these baby warmers continue to be used as storage shelves.

**Need:** Devices that are more sturdy and frugal. Services that ensure maintenance and repair.
**Infrastructural challenges: Human Resources**

**Need:** Devices that are field friendly and can be used by the health workers in absence of a doctor.
Prevalence of avoidable blindness

India shoulders the largest burden of global blindness, about 3.5 million across the country with 30000 new cases being added each year.

Studies from India have reported ROP in 20% to 52% of screened neonates.

The disease burden for each individual with ROP is estimated to be around 30 lakhs INR (for a lifespan of 60 years). The average cost of screening and treatment for the same would be 15000 INR.

However, it is still not affordable.

Need: Affordable medical devices and diagnostics.
Healthcare access vs “culture of silence”

Rural women are too shy or nervous to discuss with doctors issues such as breast cancer, cervical cancer or reproductive tract diseases and don’t want to go to clinics in case of discomfort.

Per speculum examination and colposcopy are painful procedures and more often than not patient dissatisfaction is noted due to injuries caused during these tests.

This discourages gynaecological visits as well as follow-ups.

**Need:** Home based, discrete devices with product designs based on patient comfort and need.

**Source:** Self reported gynaecological problems from twenty three districts of India (an ICMR task force study), Indian Journal of Community Medicine Vol. XXVIII, No.2, Apr.-June, 2003
We have friends in other fields – in biology, for instance. We physicists often look at them and say, "You know the reason you fellows are making so little progress?" (Actually I don't know any field where they are making more rapid progress than they are in biology today.) "You should use more mathematics, like we do." They could answer us – but they're polite, so I'll answer for them: "What you should do in order for us to make more rapid progress is to make the electron microscope 100 times better."

- Richard Feynman
Thanks for Visit