Emerging Technologies/Emerging Economies: [Nano]technology for responsible, Equitable Development

HEALTH: The Global Health Initiative and Emerging technology
Jeff Spieler
Senior Advisor for Science and Technology
Office of Population and Reproductive Health
Bureau for Global Health
USAID
November 4, 2009
President Obama believes that it is in keeping with America’s values and our history of compassion to lead an effort to solve some of the most serious problems facing the world’s poorest people.

American leadership, sparked in large part by President George W. Bush and a bipartisan majority in Congress, has helped to save millions of lives from HIV/AIDS, malaria, and tuberculosis.

Yet, even with that monumental progress, 26,000 children around the world die every day from extreme poverty and preventable diseases.
In response, the President’s 2010 Budget begins to focus attention on broader global health challenges, including child and maternal health, family planning, and neglected tropical diseases, with cost effective intervention. It also provides robust funding for HIV/AIDS.

The initiative adopts a more integrated approach to fighting diseases, improving health, and strengthening health systems.
• The U.S. global health investment is an important component of the national security "smart power" strategy, where the power of America’s development tools -- especially proven, cost-effective health care initiatives -- can build the capacity of government institutions and reduce the risk of conflict before it gathers strength.

• In addition, the Administration’s funding plan can leverage support from other nations and multilateral partners so that the world can come closer to achieving the health Millennium Development Goals.
This comprehensive global health approach can yield significant returns by investing in efforts to:

- Prevent millions of new HIV infections;
- Reduce mortality of mothers and children under five, saving millions of lives;
- Avert millions of unintended pregnancies; and,
- Eliminate some neglected tropical diseases.

To reach these goals, the Budget invests $63 billion cumulatively over six years (2009-2014) for global health programs. PEPFAR will constitute more than 70 percent ($51 Billion) of global health funding.
We will devote more than 3 percent of our GDP to research and development. We will ... create new incentives for private innovation, promote breakthroughs in energy and medicine, and improve education in math and science. ... We also need to work with our friends around the world. ... my administration is ramping up participation in -- and our commitment to -- international science and technology cooperation across the many areas where it is clearly in our interest to do so. Remarks by President Obama on Science and Technology at the National Academy of Sciences, Washington, D.C. April, 27, 2009

When we fail to invest in research, we fail to invest in the future. Yet, since the peak of the space race in the 1960s, our national commitment to research and development has steadily fallen as a share of our national income. That's why I set a goal of putting a full 3 percent of our Gross Domestic Product, our national income, into research and development, surpassing the commitment we made when President Kennedy challenged this nation to send a man to the moon. Remarks by President Obama on Innovation and Sustainable Growth, Hudson Valley Community College, Troy, New York. September 21, 2009
The World’s Story
ON AIDS


People living with HIV/AIDS.........................33 million
Two-thirds of PLWHA are in Africa..............22 million
Women LWHA Globally..............................15.5 million
New HIV infections in 2007.......................2.7 million
Deaths due to HIV/AIDS in 2006...............2 million
New HIV Prevention Technologies Needed

While the Abstinence, Partner Reduction and male and female Condoms (ABC), male circumcision, ARVs and contraception have had significant impact in preventing HIV and MTCT, at least two new critical technologies are needed:

1. HIV vaccines
2. Microbicides- topical and oral (PrEP)
Maternal Health: Scope of Problem

• >200 million pregnancies per year
• Up to 50% of these are unplanned pregnancies
• 50 million induced abortions and 20 million have abortion complications
• 60 million give birth at home with no skilled attendant
• Over 529,000 maternal deaths/year (1 per minute), 99% occur in developing countries
• 1 maternal death = 30 maternal morbidities
Every minute around the world:

- **380** women become pregnant
- **190** women face unplanned or unwanted pregnancies
- **110** women experience pregnancy-related complications
- **40** women have abortion complications
- **1** woman dies
We have effective maternal health interventions, some at low cost

Other Indirect Causes
- Intermittent malaria treatment
- Bed nets
- Iron supplement
- ARVs for HIV

Anemia
- Iron Folic acid

Abortion complications
- Family Planning
- Post-abortion care/
  Management of complications

Hypertensive disorders
- Magnesium Sulfate

Obstructed Labor
- Partogram
- C-section

Hemorrhage
- AMTSL; oxytocin and oral uterotonics in the community;
  blood transfusion

Infection
- Clean delivery/
  Hand washing;
  Tetanus toxoid
  Antibiotics
  Immunization

Unclassified
We know the clinical interventions to prevent and treat maternal and newborn complications that lead to newborn death.

- Infection: 36%
- Sepsis/Pneumonia: 23%
- Asphyxia: 23%
- Complications of Prematurity: 27%
- Other: 7%
- Cong. Anom: 7%

Complications of Prematurity:
- Congenital Anomalies (Cong. Anom) 7%
- Malaria Control
- Antenatal Corticosteroid
- Treatment of bacteriuria
- Kangaroo Mother Care
- Birth Spacing
- Maternal Nutrition

Sepsis/Pneumonia:
- Tetanus Toxoid Immunization of Mother
- Clean Delivery
- Cord Care
- Early & Exclusive Breastfeeding
- Antibiotics for mother and baby

Asphyxia:
- Warming
- Resuscitation
- Skilled Birth Attendants

Other:
- Syphilis Control
- Folate Supplementation

Low birth weight is a significant contributor in 40–70% of neonatal deaths.

Adapted from Lancet 2005
• Roughly 9 million children under age five die every year

• Two-thirds of these deaths are from preventable causes
Lancet, 2003 – Key Messages

• Reducing under five mortality requires increased use of key high impact interventions

<table>
<thead>
<tr>
<th>Prevention Intervention</th>
<th>Number (thousands)</th>
<th>Deaths prevented as proportion of all child deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breastfeeding</td>
<td>1301</td>
<td>13%</td>
</tr>
<tr>
<td>Insecticide-treated materials</td>
<td>691</td>
<td>7%</td>
</tr>
<tr>
<td>Complementary feeding</td>
<td>587</td>
<td>6%</td>
</tr>
<tr>
<td>Zinc</td>
<td>459</td>
<td>5%</td>
</tr>
<tr>
<td>Hib vaccine</td>
<td>403</td>
<td>4%</td>
</tr>
<tr>
<td>Clean delivery</td>
<td>411</td>
<td>4%</td>
</tr>
<tr>
<td>Water, sanitation, hygiene</td>
<td>326</td>
<td>3%</td>
</tr>
<tr>
<td>Vitamin A</td>
<td>225</td>
<td>2%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Treatment Intervention</th>
<th>Number (thousands)</th>
<th>Deaths prevented as proportion of all child deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral rehydration therapy</td>
<td>1477</td>
<td>15%</td>
</tr>
<tr>
<td>Antibiotics for sepsis</td>
<td>583</td>
<td>6%</td>
</tr>
<tr>
<td>Antibiotics for pneumonia</td>
<td>577</td>
<td>6%</td>
</tr>
<tr>
<td>Antimalarials</td>
<td>467</td>
<td>5%</td>
</tr>
<tr>
<td>Zinc</td>
<td>394</td>
<td>4%</td>
</tr>
<tr>
<td>Newborn resuscitation</td>
<td>467</td>
<td>5%</td>
</tr>
<tr>
<td>Antibiotics for dysentery</td>
<td>310</td>
<td>3%</td>
</tr>
</tbody>
</table>
Reducing under five mortality further would benefit from some new technologies

- Less expensive pneumoccal vaccine
- Less expensive rotavirus vaccine
- More effective cholera vaccine
- Malaria vaccine and synthetic and low cost anti-malarial drugs
- Less expensive and simpler diagnostics, e.g. rapid point-of-care malaria and bacteria in urine diagnostic kits
Child Survival plus Reduced Fertility Create Demographic Transition: Indonesia - 1955 to 2010

Source: UN World Population Prospects

(> 2000 = projections)
New Contraceptive Methods Needed

While tremendous success can be achieved by expanding access to existing methods, some additional methods would have immediate application:

1. Non-hormonal or non-steroidal oral contraceptives
2. New long-acting injectables in novel delivery systems
3. Non-surgical methods of male and female sterilization
4. Novel dual protection methods
### Roadmap to the Neglected Diseases

#### Neglected Diseases

- HUNDREDS

#### Neglected Tropical Diseases

- Ascaris
- Trichuris
- Hookworm
- Lymphatic filariasis (LF)
- Onchocerciasis
- Guinea worm
- Schistosomiasis
- Leishmaniasis
- Chagas disease
- African trypanosomiasis
- Dengue
- Leprosy
- Trachoma

+ 20 MORE

#### Targeted NTDs

- Ascaris
- Trichuris
- Hookworm
- Lymphatic filariasis
- Onchocerciasis
- Schistosomiasis
- Chagas disease
- African trypanosomiasis
- Dengue
- Leprosy
- Trachoma
- Intestinal Helminths (STH)
These NTDs are Targeted because Mass Treatment are Available

<table>
<thead>
<tr>
<th>LF</th>
<th>Oncho</th>
<th>Schisto</th>
<th>STH</th>
<th>Trachoma</th>
</tr>
</thead>
<tbody>
<tr>
<td>120 Million</td>
<td>37 Million</td>
<td>200 Million</td>
<td>800 Million</td>
<td>84 Million</td>
</tr>
<tr>
<td>Infected</td>
<td>Infected</td>
<td>Infected</td>
<td>Infected</td>
<td>Infected</td>
</tr>
<tr>
<td>1.2 Billion</td>
<td>0.4 Billion</td>
<td>0.7 Billion</td>
<td>1.2 Billion</td>
<td>1.2 Billion</td>
</tr>
<tr>
<td>at risk</td>
<td>at risk</td>
<td>at risk</td>
<td>at risk</td>
<td>at risk</td>
</tr>
</tbody>
</table>
New Technologies Need for Treatment of NTDs

• For the targeted NTDs
  ✓ Second line drugs are needed as there will likely be resistance to first line drugs following national scale up of treatment
  ✓ Inexpensive POC diagnostic tests, e.g., for Trachoma

• For the other NTDs
  ✓ Inexpensive drugs suitable for mass treatment, e.g.
  ✓ For Guinea work, Chagas and Dengue
  ✓ Inexpensive POC diagnostics