June 15, 2013

DRIVING
INNOVATION

Aeras and the Global Effort for New TB Vaccines

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TB is a global epidemic with an urgent need for action

- Nearly 9 million new cases globally every year
- 11 countries in the Asia Pacific are among the 22 countries that carry 80% of the global TB disease burden
Failure to innovate has led to a man-made superbug

Underinvestment in new drugs, diagnostics and vaccines has led to growth of drug-resistant TB.

Over 120,000 cases of MDR-TB annually in the Western Pacific region, equaling 28% of the world’s MDR-TB burden.

TB evolving with some strains becoming virtually untreatable.

New, novel TB vaccines will aim to prevent all strains of TB.
TB has mutated and evolved

XDR diagnosed in 84 countries.

Total drug resistant disease reported in India, Iran and Italy.

MDR-TB prevalence will increase by 150% by 2036 without changes to DOTS or DOTS+

Source: Sze-chuan Suen, 2012. (SMDM)
## Multi-faceted Impact of the TB Epidemic

<table>
<thead>
<tr>
<th>Category</th>
<th>Impact</th>
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<tbody>
<tr>
<td><strong>TB-HIV Co-Infection</strong></td>
<td>• TB is the leading cause of death for people with HIV, accounting for 1 in 4 deaths</td>
</tr>
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</table>
| **Impact of TB on Women**      | • Half a million women died from TB in 2011  
• Every year over 3 million women fall ill with TB |
| **Impact of TB on Children**   | • At least half a million children become ill with TB every year  
• Over 10 million orphans in 2010 after parents died from TB |
| **Links between TB & Chronic Disease** | • People with diabetes at 2-3 times higher risk of TB  
• 10% of TB cases globally linked to diabetes |
| **TB & Socio-economic Development** | • TB severely impacts vulnerable populations - the poor, refugees, migrants, homeless, the elderly, prisoners  
• TB mainly impacts individuals during their most productive years, hampering their ability to provide for their families |

Source: WHO
The Economic Impacts of TB

Shortfall of $3 billion a year out of the $8 billion a year needed to fight TB in developing countries between 2013 and 2015

Source: WHO Stop TB Dept.

The estimated total costs of all planned TB control activities in the Western Pacific region from 2006 to 2015 is US $4.3 billion

Source: WHO Western Pacific Region

1.3 million M/XDR-TB cases will need to be treated between 2010 and 2015 at a cost of US $16 billion over six years, rising from US $1.3 billion in 2010 to US$4.4 billion in 2015

Source: WHO
The Economic Impacts of TB

Loss of productivity due to TB is 4-7% of some countries GDP
Source: World Bank

The average TB patient loses 3-4 months work-time, up to 30% of yearly household earnings.
Source: WHO

Economic cost of TB in Asia 2006 – 2015 is > US$1 trillion. Impact greater in China and India than any other country globally: rising incomes and high TB mortality compounds economic impact
Source: World Bank
THE NEED FOR A NEW VACCINE
World Health Organization declares TB a global epidemic in 1993

More absolute cases of TB a year now: 7.8 million (1990) and 8.7 million (2011)
Prevention trumps intervention

Elimination of TB will not be achieved through our current approach.

Projected incidence in 2050 >100x elimination threshold

Chris Dye, WHO; London 2009
Vaccine development approach – where to focus

- **Active Disease**
  - Infants
  - Adolescents
  - Adults
  - HIV+ All Ages

- **Latent**
  - Infants
  - Adolescents
  - Adults
  - HIV+ All Ages

- **Pre-Infection**
  - Infants (Covered by existing vaccine)
  - Adolescents
  - Adults
  - HIV+ All Ages (No coverage or impact from existing vaccine)

*Covered by existing vaccine*
*No coverage or impact from existing vaccine*
Our Approach

1. Complete clinical trials of current candidates

We work with partners to review and prioritize candidates with a goal of advancing at least two candidates to Phase III efficacy trials. With each advance, we collaborate to adjust site capacity, regimens, R&D, and regulatory approaches.

2. Build a robust and diverse pipeline

TB is complex and may require more than one vaccine to address geographic variations in the strains, stages of the disease, and populations. We continually invest in next-generation candidates, applying lessons learned and fostering novel partnerships and approaches.

3. Refine candidate selection and advancement

In collaboration with partners, we evolve and harmonize processes to focus on the most promising investigational vaccines. By using scientific approaches including challenge models, systems biology and innovative vaccine designs we accelerate advancement and cut costs.

4. Strengthen and diversify funding base

We mobilize resources across public and private entities to sustain the growing costs of TB vaccine R&D efforts as we advance toward the finish line. Only by expanding our network of support and forging new partnerships can we address the immense scientific challenges and global need.
Collaboration is key in an unprecedented effort

Aeras serves as a catalyst by investing in the world’s most promising TB vaccine candidates and coordinating a diverse community of global scientists, and researchers from industry, academia, civil society and governments on a single mission: the development of effective TB vaccines.
Fully Integrated R&D Capabilities

Translational Development

- Staff expertise in vaccine design, assay development, immunology, animal studies, antigen selection, platform development, patent and regulatory filings

Process Development & Manufacturing

- Fully integrated BSL-2 compliant biopharmaceutical manufacturing facility

Clinical Research

- Network of clinical trial partner sites in North America, Europe, Africa and Asia
- Diagnostic and mycobacteriology lab capacity at sites
- 25+ clinical trials conducted with multiple candidates and partners
- Highly trained and skilled clinical research infrastructure in Rockville, Maryland and South Africa
PDPs Facilitate Development Through “Valley of Death”
Global Clinical TB Vaccine Pipeline – 2012

Aeras has played an integral role in the facilitation and progression of half of all vaccines currently in human trials.
Aeras: Preclinical-Translation Portfolio

- Discovery
  - Evaluation
    - PIV
    - DNA
    - RNA
    - Novel BCG
  - Lead
    - CMV
    - Oral Ad
    - BCG enhancement
    - M. smeg IkePlus
  - Optimization
    - rBCG
    - Chimp Ad
    - Protein-adjuvant

- Preclinical Development
  - HBHA
  - Mycobacterial – whole cell or extract
  - Viral vector
  - rBCG
  - Protein/adjuvant
  - Nucleic acid

Alternate delivery
Portfolio Management: Achieving value for money

- Incorporates both preclinical and clinical portfolios to optimize diversity
- Prioritizes around a set of predefined targeted product profiles (TPPs) that seek to maximize the public health impact of new TB vaccines
- Decision-making predicated on a comprehensive, strategic and well-defined portfolio diversification approach to maximize success & minimize risk
- Uses stage-gating and milestone-based project management under independent external guidance of all critical activities to winnow out non-performers & advance candidates with the most promising data
- Utilizes innovative trial design and head-to-head comparisons to down select candidates with similar design and immunological profiles
- Accelerate the learning curve and establish competencies that create a comparative advantage within the scientific field
Regional Partnerships in Science & Innovation

**Australia**
- Partnership with Lipotek to undertake PoC studies combining their technology with an Aeras lead antigen selection strategy.

**New Zealand**
- Vaccine discovery collaboration with Dr. Frank Aldwell at University of Otago.
- Potential novel protein delivery technology: Bernd H. A. Rehm PolyBatics Ltd.

**China**
- Collaboration with China National Biotech Group to develop vaccine R&D capacity & advance recombinant protein/adjuvant combinations with MVA
- Partnership with China CDC & Fudan University to conduct epidemiology studies to prepare for TB vaccine trials in China
# Regional Partnerships in Science & Innovation

## Japan
- Partnership with Japan BCG Laboratory and Japan National Institute of Biomedical Innovation to develop rhuPIV2 as a platform for TB vaccine delivery.

## India
- In partnership with St. John’s Research Institute, India & University of Bergen, Norway built vaccine R&D capacity in Palamaner, India
- Conducted large epidemiology studies in thousands of adolescents and infants
- Conducted Phase I clinical trial of a new TB vaccine in India
- Assessed 16 potential sites in India to prepare for future TB vaccine trials

## Cambodia
- In partnership with the Cambodian Health Committee conducted TB prevalence study in 2,500 infants
Worldwide annual & cumulative TB incident cases averted over 25 years

50-60 million new cases of TB could be potentially averted over 25 years with a new adolescent and adult & improved infant vaccine
## Estimated TB vaccine Health Impact in the Region

<table>
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<tr>
<th>Market Segments</th>
<th>Health Impact Incident Cases Averted Over 30 Yrs. (millions)</th>
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<tbody>
<tr>
<td>WPRO</td>
<td>25.9 Million</td>
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<tr>
<td>SEARO</td>
<td>16.9 Million</td>
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<tr>
<td>Total</td>
<td>42.8 Million</td>
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</table>

Source: Applied Strategies modeling data
Thank you.

www.aeras.org

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