Antibiotic Resistance:
A Challenge to Global Health and
A Call for Concerted Action

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“A future free from the fear of untreatable infections”
Antibiotic Resistance is a Global Threat

Figure 17: Spread of Antibiotic-Resistance Bacteria (ARB)²

Costs

Europe
- EU: ARB costs society ~ €1.5 bn/yr & 600 million days of lost productivity.²⁹
- Russia: ARB a major concern²⁰ with 83.6% of families imprudently use antibiotics at home.²¹

North America
- USA: ARB causes majority of 99,000 deaths/yr from infections acquired in hospitals.²⁶
- USA: Health care costs of ARB are US$21-34 bn/yr.²⁶

Middle East & North Africa
- Egypt: 38% of blood infections contracted by young cancer patients are from ARB.²⁵
- Israel: ARB found fatal in ~ 50% cases when resistant to our strongest antibiotics.²³

South America
- Peru, Bolivia: >51% of hospital infections caused by ARB.²⁷
- Brazil: Rates of ARB are up >60%.²⁸

Sub-Saharan Africa
- Tanzania: Death rate of ARB infected children are double that of malaria.²⁵
- Nigeria: Rapid spread of ARB that came to Africa from Asia.²²

Asia
- Thailand: >140,000 ARB infections/yr and >30,000/yr patients die; 2 bn in productivity losses/yr.²³
- Japan: Extensive levels of ARB found in Tokyo’s urban watershed.²⁰
- China: Extreme over-prescription of antibiotics²¹ and rapid growth rate of ARB.²²
- India: Within 4 years (02-06) ARB went from being resistant to 7, to 21 drugs.²³
- Vietnam: Farming practices contributing to spread of ARB through environmental contamination.²⁴
- Pakistan: 71% of infections in newborns are from ARB.²⁵

Growing Resistance

Tackling Antibiotic Resistance as an Intersectoral Challenge

- **Conservation:** Promoting Rational Use of Antibiotics
- **Innovation**
- **Access**
- **Conservation:** Ecological Responsibility – Non Human Use of Antibiotics

Reimagining Resistance: Sustainability and Systems Thinking
Access, but not Excess

Pneumonia: Fewer than one in three children with suspected pneumonia received antibiotics when necessary.

Diarrhea: Fewer than four in ten children received appropriate treatment with oral rehydration therapy and continued feeding, yet many received unnecessary antibiotics.

Source: Pneumonia and diarrhoea: Tackling the deadliest disease for the world’s poorest children. UNICEF. 2012.
Maternal and child health

Basic health care

Modern medicine
R&D Pipeline Analyses Consistently Show Shortfall

- Spellberg, et al., 2004
- Freire-Moran, et al., 2011 (EMA-ECDC-ReAct)
- IDSA 10 X 20 Progress Report, June 2013
- Pew Charitable Trust, Sept 2014

# Bottlenecks in the Antibiotics R&D Pipeline

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<th>Time for Phase</th>
<th>2yr</th>
<th>5yr</th>
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*Hit to Phase 2 starts based on GSK data. Phase 2 and Phase 3 success based on Centers for Medicines Research (CMR) 2003 averages for antibacterials (likely based on agents from established classes).


Overcoming Scientific Bottlenecks

- Discovery of antibiotic with novel mechanism of action
- Development of iChip, a new approach to growing the 99% of all species in external environments that cannot be cultured under laboratory conditions
- Work funded by NIH and other public sector and philanthropic agencies

A new antibiotic kills pathogens without detectable resistance


Innovative Financing to Achieve Delinkage

WHO Consultative Expert Working Group on R&D Financing and Coordination

R&D Investment

Delinkage:
Divorcing R&D Funding from Product Pricing

Product Price

Revenue

Price X Quantity

Delinkage:
Divorcing ROI from volume-based sales

Antibiotic Innovation Policy Discussions
Reengineering the Value Chain for Antibiotic Innovation – The 3Rs

- **Discovery**
  - Access to Compound Libraries
- **Clinical Trials**
  - Crossing the Valley of Death
- **Development**
  - Regulatory Approval
- **Delivery**
  - Rational Use

Sharing RESOURCES

Sharing RISKS

Sharing REWARDS

Back to the Future

• 1929: Fleming’s discovery of penicillin
• 1940: Florey and Chain’s crucial experiment
• 1941 on: Committee on Medical Research assists to scale up penicillin production
• 1944: Twenty-one firms produce penicillin

Source: Penicillin mold, CC BY-SA 3.0, http://ahsbiology3.wikispaces.com/file/view/penicillin_g_sm.jpg/135823945/penicillin_g_sm.jpg