Indicators to measure progress towards sustainable investment in drugs, diagnostics, vaccines, other actions tackling AMR

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January 27, 2017

Expert Consultation on Monitoring and Evaluation for Antimicrobial Resistance (AMR) Intervention

Session # 8 – Strategic line 5

Objective	Impact indicator
Prepare economic arguments for sustainable investment that takes into account the needs of all countries, and increase investment in new drugs, diagnostic tools, vaccines, and other actions	*To be discussed globally*

Outcome	Outcome Indicator	Collection Methods	Comments
Systematized evidence to document the economic impact of antimicrobial resistance generated.	Data available that estimates the economic impact of antimicrobial resistance at national level in all sectors.		
Increased investment in R&D to address AMR and prevent MDR infections.	Proportion of national research funds invested in infections caused by multi-drug-resistant organisms.		
	Number of new public–private partnerships created to encourage research and development of new antimicrobial agents		
Promoted intersectoral collaboration for greater efficiency in the development, introduction, regulation, and use of new antimicrobial drugs, diagnoses, and vaccines	Number of agreements or new regulatory measures to evaluate new vaccines, diagnostic methods, and antimicrobial drugs, and that have included these in their national health agendas.		

Potential measures of effectiveness (WHO GAP Objective 5)

- **Assessment of investment needs for NAP implementation**

Assessment of Investment Needs for NAP implementation

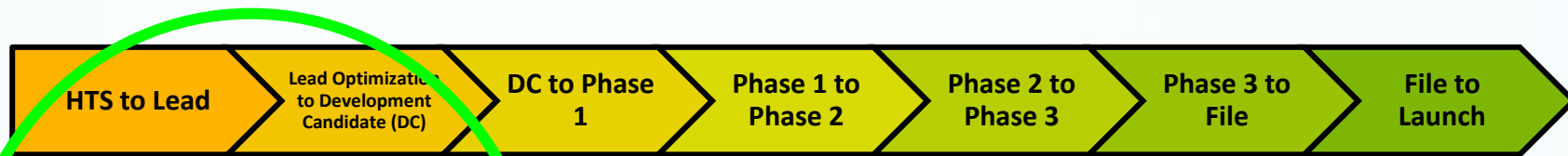# Other potential measures of effectiveness (WHO GAP Objective 5)

- **Prioritizing and supporting basic scientific research on infectious diseases**

- **Promoting partnerships between research institutions in developed and developing countries**

To / From	GLOBAL	COUNTRY B	LOCAL
GLOBAL	Global joint undertaking		
COUNTRY A	Multilateral aid to govts.	Bilateral aid	
LOCAL	Foundation funding	Domestic government	Community supported

Potential measures of effectiveness

- Prioritizing and supporting basic scientific research on infectious diseases

- Promoting partnerships between research institutions in developed and developing countries

- **Collaboration, based on fair and equitable benefit sharing as mutually agreed, in the investigation of natural sources of biodiversity and biorepositories as sources for the development of new antibiotics**

Bottlenecks in the Antibiotics R&D Pipeline

	HTS to Lead	Lead Optimization to Development Candidate (DC)	DC to Phase 1	Phase 1 to Phase 2	Phase 2 to Phase 3	Phase 3 to File	File to Launch
Time for Phase	2yr	5yr	1yr	2yr	2yr	0.5yr	1yr
*Novel Anti-bacterials	7%	50%	75%	25%	50%	67%	75%
#Industry average (all therapeutic areas)	**80%**	**85%**	69%	**54%**	34%	70%	91%

*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).

#Paul, et al (2010). Nature Reviews Drug Discovery 9: 203-214.

Source: Payne DJ, Gwynn MN, Holmes DJ, Pompliano DL. Drugs for bad bugs: confronting the challenges of antibacterial discovery. *Nature Reviews Drug Discovery* January 2007; 6: 29-40.

Scientific Bottleneck for Antibiotics: Lipinski Rule of Five
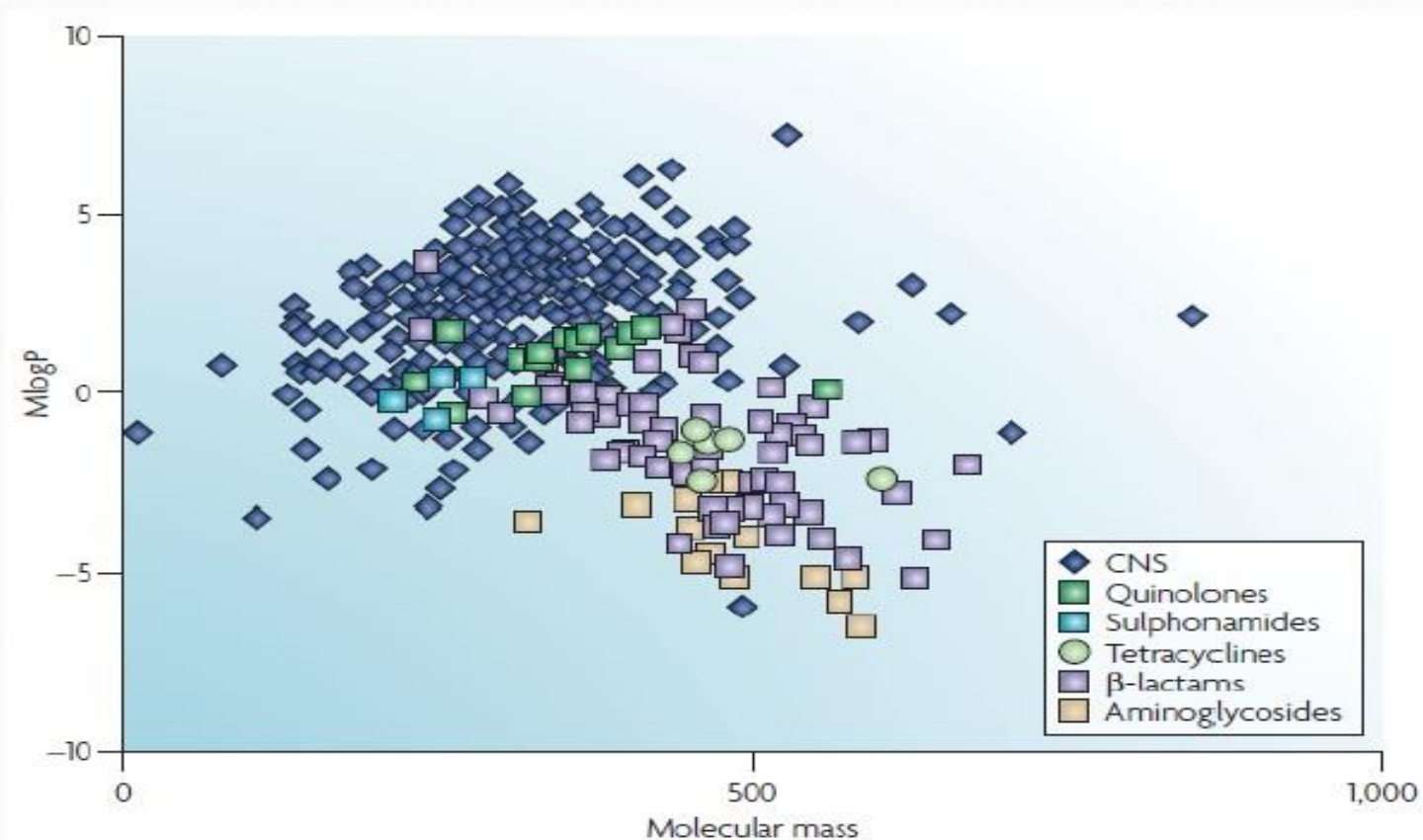
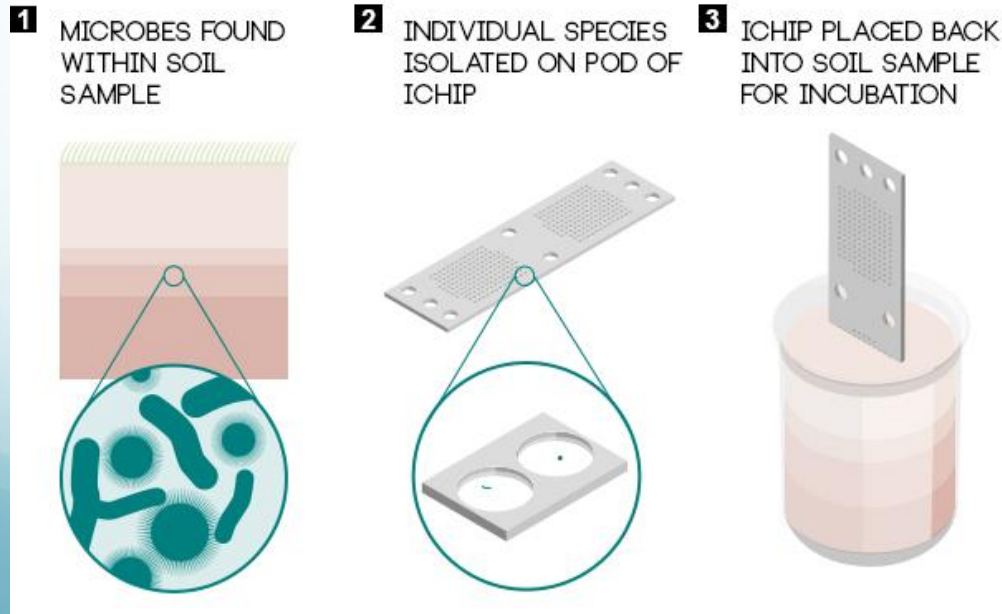Source: Payne DJ, Gwynn MN, Holmes DJ, Pompliano DL. Drugs for bad Bugs. *Nature Rev*. 2007.

Overcoming Scientific Bottlenecks

ARTICLE

A new antibiotic kills pathogens without detectable resistance

Losee L. Ling[1]*, Tanja Schneider[2,3]*, Aaron J. Peoples[1], Amy L. Spoering[1], Ina Engels[2,3], Brian P. Conlon[4], Anna Mueller[2,3], Till F. Schäberle[3,5], Dallas E. Hughes[1], Slava Epstein[6], Michael Jones[7], Linos Lazarides[7], Victoria A. Steadman[7], Douglas R. Cohen[1], Cintia R. Felix[1], K. Ashley Fetterman[1], William P. Millett[1], Anthony G. Nitti[1], Ashley M. Zullo[1], Chao Chen[4] & Kim Lewis[4]

1 MICROBES FOUND WITHIN SOIL SAMPLE

2 INDIVIDUAL SPECIES ISOLATED ON POD OF ICHIP

**3** ICHIP PLACED BACK INTO SOIL SAMPLE FOR INCUBATION

- **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**

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Potential measures of effectiveness

- Prioritizing and supporting basic scientific research on infectious diseases
- Promoting partnerships between research institutions in developed and developing countries
- Collaboration, based on fair and equitable benefit sharing as mutually agreed, in the investigation of natural sources of biodiversity and biorepositories as sources for the development of new antibiotics
- **Piloting of innovative ideas for financing research and development and for the adoption of new market models to encourage investment and ensure access to new antimicrobial products**

Measuring Antibiotic Innovation
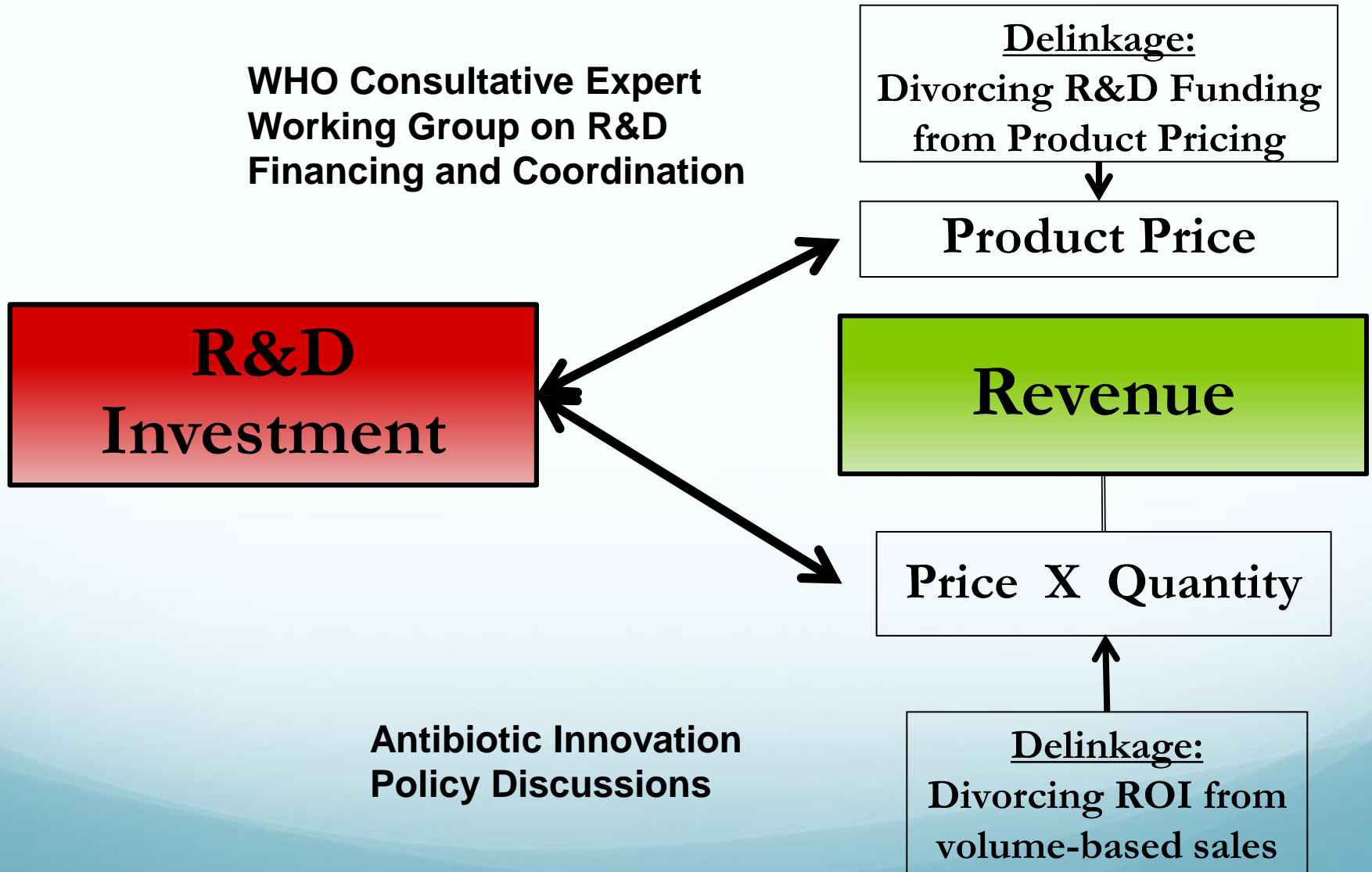
Innovation To Tackle AMR

Research need	Human Use	Animal Use
Innovation of Technology	Drugs, vaccines, diagnostics and other health technologies	Vaccines and diagnostics for animals
Innovation of Practice (Stewardship)	Practices that encourage access, but not excess in Healthcare Delivery	Practices that encourage Sustainable Agriculture, curbing non-therapeutic use of antibiotics

Defining the Indicator

- Is it most strategic for the indicator to focus on the magnitude of the problem or the progress made--the gap or the gain?

- How do we ensure that underuse is captured, not just overuse—ensuring access, but not excess?

- Is the indicator finding actionable? And at what interval would such a change in the indicator be meaningfully so?

- Is the indicator meant to diagnose a problem, set a floor for performance, allow comparison across countries or localities, motivate specific actions, or hold a specific stakeholder accountable?

Ensuring Antibiotic Stewardship: Industry vs. Healthcare Delivery

Stewardship Mechanisms

Accountability through drug companies

- **Limiting prescription to trained providers**
- **Dispensing by certified institutions**
- **Administration in specific healthcare settings**
- **Clinical algorithm and diagnostic test finding**

Accountability on healthcare providers and consumers

So AD, Bigdeli M, Tomson G, Woodhouse W, Ombaka E, Quizhpe Peralta A. "The access and excess dilemma." Part 5 of "Antibiotic resistance—the need for global solutions" by Cars O, et al. *The Lancet Infectious Diseases.* 2013.

Strategic Objective 5: Grounds for Indicators for Accountability

- Assessment of investment needs for NAP implementation

- *Return on investment*: Health burden of AMR per year in terms of AMR infections, additional length of hospitalization, deaths due to AMR infections, and the associated Economic costs

- *Resource commitments*:
  - Prioritizing and supporting basic scientific research on infectious diseases
  - Promoting partnerships between research institutions in developed and developing countries

- *Enabling environment:*
  - Collaboration, based on fair and equitable benefit sharing as mutually agreed, in the investigation of natural sources of biodiversity and biorepositories as sources for the development of new antibiotics
  - Piloting of innovative ideas for financing research and development and for the adoption of new market models to encourage investment and ensure access to new antimicrobial products [delinkage]

- "Other Actions":
  - Innovation of technology in agriculture
  - Innovation of practice in healthcare delivery system
  - Innovation of practice in animal husbandry and aquaculture