Community health perspective
on AMR and susceptibility measurements

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Antimicrobial resistance (AMR)

- Anti microbial resistance is now a global geometrically increasing threat

General causes

- It is natural process of adoption for their survival
- Its emergence is directly proportional to antimicrobial overuse in humans and food-producing animals;
- Globalization and suboptimal infection control facilitate its spread

Implications

- Morbidity and mortality due to communicable diseases is not coming down as desired
- In fact may increase
- Financial implications on personal as well community are at high stake
- It is feared that even it may affect GDP and development

Excess costs attributable to infections with resistant organisms vs. infections with susceptible organisms

Resistant organism	Control	Range of excess cost[a]
Methicillin-resistant *Staphylococcus aureus*	Methicillin-susceptible *S. aureus*	$695–$29 030
Vancomycin-resistant *Enterococcus*	Vancomycin-susceptible *Enterococcus*	$16 711–$60 988
Resistant *Pseudomonas aeruginosa*	Susceptible *P. aeruginosa*	$627–$45 256
Resistant *Acinetobacter baumannii*	Susceptible *A. baumannii*	$5336–$126 856
Multiple organisms	Susceptible	$9372–$18 990
ESBL-producing *Enterobacteriaceae*	Non-ESBL-producing *Enterobacteriaceae*	$3658–$4892

ESBL, extended-spectrum β-lactamase.
[a]Includes both adjusted and unadjusted estimates; includes only studies reporting cost in US dollars.

Excess cost of hospitalization per patient

The mortality may be higher in hospital acquired infections
But the magnitude of community acquired infections is higher

Solutions

1. Invest in development of newer effective molecules
2. Antibiotic use policy like rational use of antibiotics, surveillance
3. Non-pharmaceuticals non-specific measures to prevent spread

The need and reality contrast

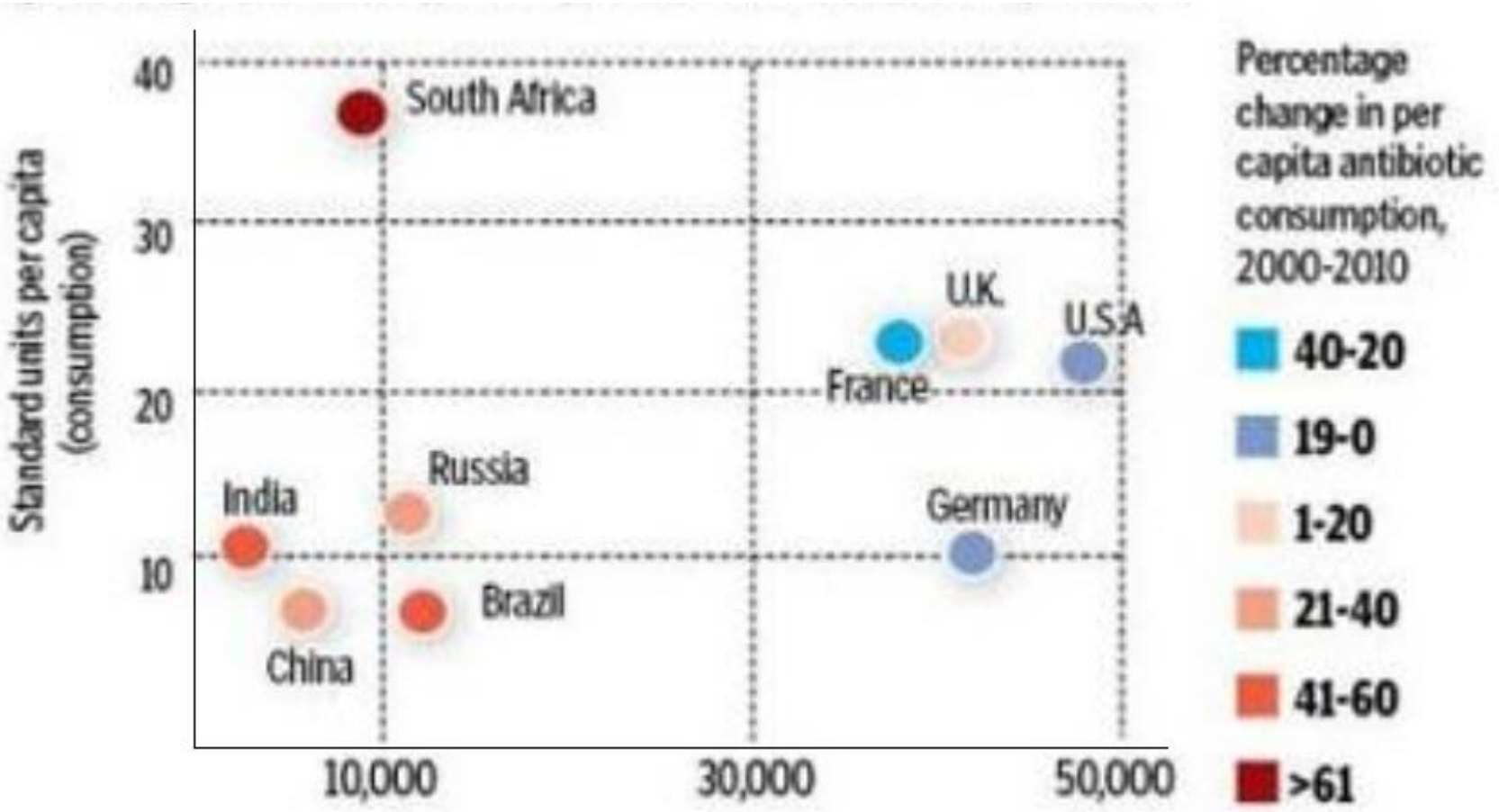
- Novel antimicrobials are urgently needed;

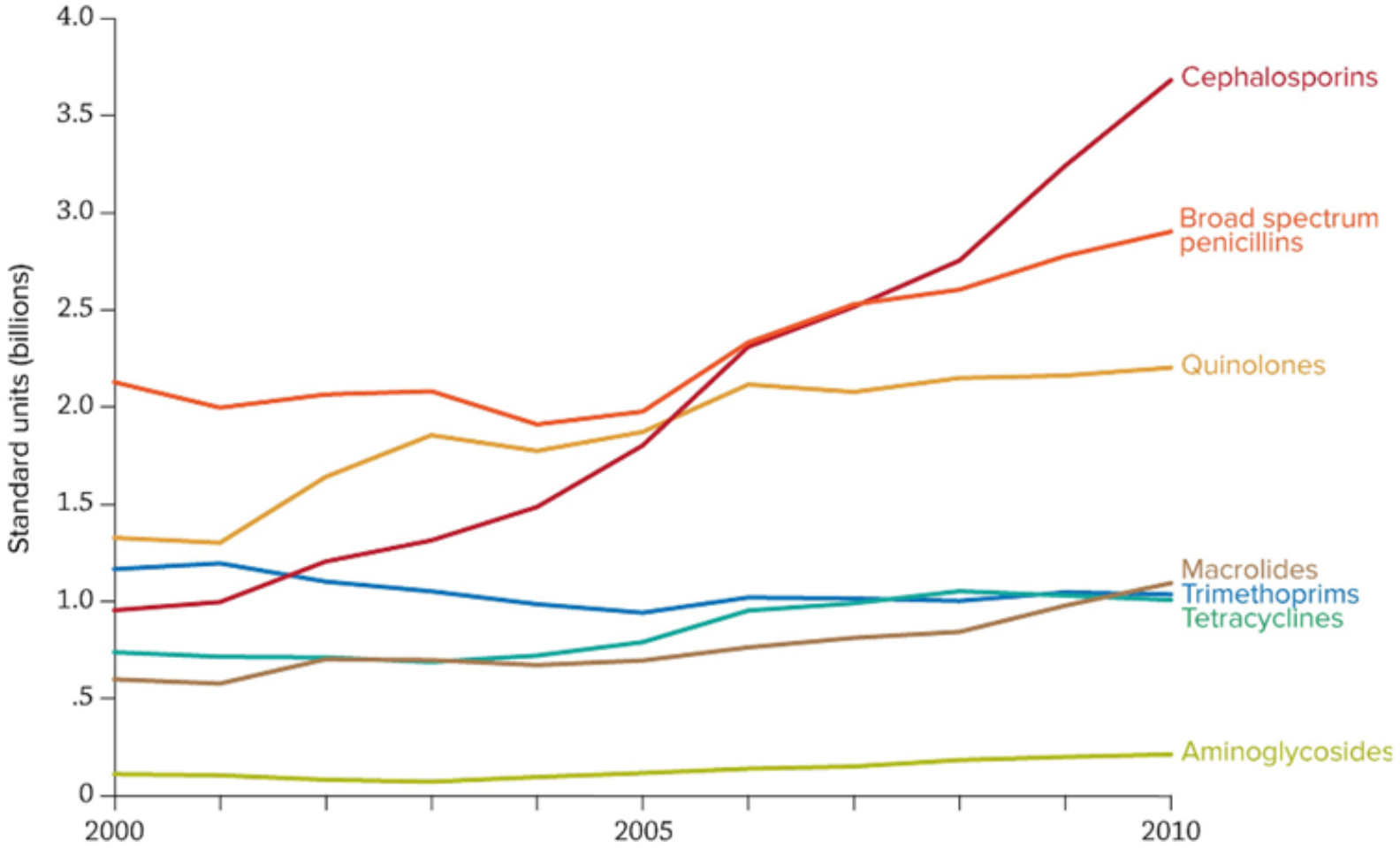
- *In recent decades pharmaceutical companies have largely abandoned research on antibiotic development due to their high costs and low yield*

Use of antibiotics

- The scale of the resistance and its impact on human beings is rapidly increasing
- In 1954, the USA produced just under 1 million kilograms of antimicrobials; annual production in this country alone now (2012-13) exceeds 16 million kg

Antibiotics use per capita by income in selected countries, 2010





Trends in antibiotic consumption in India, 2000-10

Causes

- Indiscriminate use of antibiotics by medical profession
- Use Growing antibiotic use in the animal sector is resulting in a greater selection of pathogens and is being driven by increased demand for meat and poultry
- Sub-therapeutic use results in AMR; This resistant microorganisms can be spread to humans
- Waste water treatment plants serving antibiotic manufacturing facilities have been implicated in the transfer of resistance genes into human microbiota

Cause and spread

- Weak surveillance systems contribute to the spread of drug resistance
- Improper use of Standard Operating Protocols
- Sub standard medicines

Community health perspective, India

- Per capita net national income during 2016-17 is estimated to be Rs. 1,03,007 at current prices
- The public expenditure on health is estimated to be around 1.2% of the Gross Domestic Product
- *There are1,55,069 Sub Centres; 25,354 Primary Health Centres; and 5,510 Community Health Centres*
- *ANM 2,19,980; MPW 53,442; allopathic doctors at PHCs 26,426*
- *9,637 PHCs without laboratory technici*an

Community health perspective
Top ten causes of mortality, India

1. Ischemic heart disease 12 %
2. Chronic obstructive pulmonary disease 11%
3. Stroke 9%
4. *Diarrheal disease 6%*
5. *Lower respiratory infections 5%*
6. Preterm birth complications 4%
7. *Tuberculosis 3%*
8. Self-inflicted injuries 3%
9. Falls 3%
10. Road injuries 2%

Community health perspective

- Public health impact depends up on
- The time required for confirmation of agent and resistance (first culture then sensitivity)
- Complexity ⟶ The cost
- Tracking difficulties
- The clinical and economic benefits of using diagnostic testing

Pathogens of high community concerns

- Tuberculosis
- Malaria
- HIV
- Influenza
- Acute respiratory tract infections
- Diarrheal agents
- Candidiasis

Strategies to reduce transmission

Horizontal measures are not pathogen-specific and include interventions such as improved hand hygiene and enhanced environmental cleaning, both of which have been shown to interrupt pathogen transmission effectively

Vertical measures are pathogen-specific and include targeted and universal screening upon hospital admission (e.g., MRSA, ESBL-producing gram-negatives) with or without presumptive isolation, often using novel molecular diagnostic techniques for rapid pathogen detection

General tendency

- Treatment without testing the agent and its susceptibility in following common diseases
- Urinary tract infection
- Dysentery
- Upper respiratory tract infection

General conflicts

- Tests are carried out for a group of common antibiotics
- Clinician expects some specific antibiotics

Need of the day

Excellent diagnostics

Point of care testing

Barriers and probable solutions

- Financial factors are the biggest barriers to bringing the next-generation AMR diagnostics to market
- Technological advances are barriers to developing next-generation diagnostics
- Viability and feasibility

(1) less expensive tests and more automated analysis of sequence data,

(2) increasing the concentration of infectious disease agents from a clinical specimen, and

(3) single cell diagnostic testing, like microfluidics

Solutions

- Avoiding Unnecessary Antibiotic Use and Optimizing Antibiotic Selection
- (1) ensuring that tests we have now, as well as future tests, are optimally implemented in clinical settings;
- (2) developing new diagnostics that improve patient care and antibiotic use; and
- (3) measuring the impact of diagnostics and antibiotic use

Solutions

- Culture independent tests are very useful which provide result faster, sensitive and capacity to detect several agents
- ***But important clinical or public health information, such as the susceptibility and resistance to antibiotics may not be available***

Solutions

- A. Incorporate antimicrobial resistance detection into culture-independent diagnostic tests;
- B. Collect a specimen for culture-independent tests that is suitable for reflexive testing if the test is positive for a relevant infectious agent; or
- C. Collect a second specimen for reflexive culture if strategy B is not possible

Best example

- Best example is GeneXpert in tuberculosis, in less than two hours diagnosis and resistance to most important drug Rifampicin confirmed
- *Community expects many more such diagnostics but cost is limiting factor*
- *The test must consider the qualifications , experience and working conditions of health manpower*

Thank you friends