From Knowledge to Action: Mobilizing Awareness for a Resilient Future Against AMR

November 19, 2024

9:00 GMT | 10:00 WAT

WORLD AMR AWARENESS WEEK
18-24 NOVEMBER

AMR Antimicrobial Resistance Knowledge Hub

THE GLOBAL HEALTH NETWORK
Enabling research by sharing knowledge

FOR ENLIGHTENMENT AND SELF-RELIANCE

Register.

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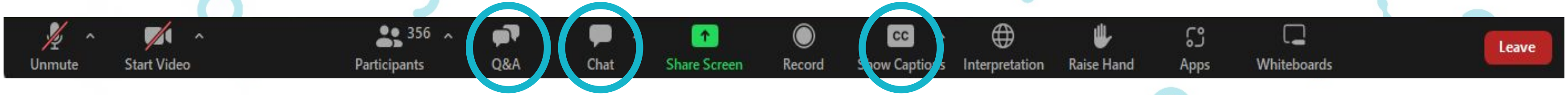

Panel & Agenda

Welcome address and opening remarks

Ohemu Godwin Pius

Brief Overview of the AMR Knowledge Hub of The Global Health Network

Adam Dale

Mobilizing Grassroots Movements: Engaging Communities to Tackle AMR

Dr. Alun Davies

Advocacy for Bold Commitments: The Role of Political Leadership in Strengthening AMR Resilience

Kome Otokunefor PhD

Data Driven Antibiotic Stewardship

Prof. Esmita Charani

Closing remarks

Joining us today

	Country	Count
1	Nigeria	51
2	Kenya	21
3	India	20
4	Uganda	19
5	Ethiopia	15
6	United Kingdom	12
7	Ghana	11
8	Tanzania	8
9	South Africa	7
10	Cameroon	7
11	Australia	7
12	Malawi	7
13	Bangladesh	5
14	Vietnam	5
15	Nepal	5
16	Rwanda	3
17	Pakistan	3
18	Greece	3
19	Philippines	3
20	Italy	3
	Total	
	72	289

Brief Overview of the AMR Knowledge Hub of The Global Health Network

Adam Dale

Knowledge Exchange/Project Coordinator,
The Global Health Network, University of Oxford

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Mobilizing Grassroots Movements: Engaging Communities to Tackle AMR

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Dr. Alun Davies

Senior Programmes Manager, Mesh community engagement network, The Global Health Network

Engaging communities to tackle AMR

Alun Davies

19th November 2024

THE GLOBAL HEALTH NETWORK
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mesh
community engagement network

The Global Health Network's hub and knowledge community for community engagement

Goals for community/public engagement with AMR?

- Raise public awareness
- Empower individuals
- To encourage Community-driven behaviour change
- AMR policy-change
- To foster collaborative action
  - Mitchel et al 2019, and 2020;

Responsive dialogues

- Deliberative discussions about AMR research evidence to develop solutions
  - Improve understanding, attitudes and behaviour
  - Empower the public – solutions
  - Contribute to policy-making

wellcome

Responsive Dialogues

Delivering Policies and Actions on AMR

Antimicrobial resistance (AMR) is one of the world's biggest health threats, affecting people everywhere. Drugs, such as antibiotics, which advanced medicine in the 20th Century are becoming less effective and new 'super-bugs' for which there are no treatments are emerging.

Across the globe, 28.3 million people could be pushed into extreme poverty by drug resistance by 2050, with particularly high impact on livelihoods and food security in low-income countries in Asia and Africa.

An estimated 700,000 people die a year because of AMR, many in low- and middle-income countries.

Covid-19 highlights this huge problem further: many patients are receiving antibiotics to help control secondary bacterial infections, potentially leading to increases in antimicrobial resistance.

Policy makers are working hard to tackle the immense problem of drug resistance in their countries. One approach that can help is Responsive Dialogues, which draws on the growing field of deliberative practices.

70% of bacteria are resistant to certain antibiotics in several LMICs[1]

28.3 million people globally could be pushed into extreme poverty by drug resistance by 2050

165% increase in specialist antibiotic use in LMICs in 15 years[2]

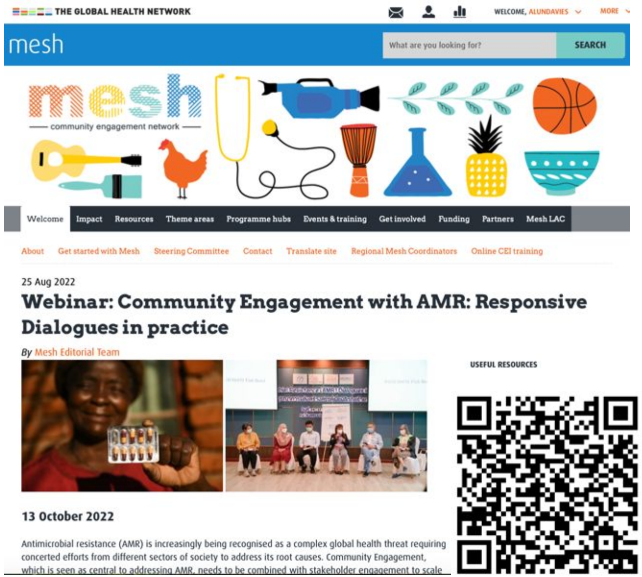
Photo credit: Steve Irel

This pamphlet summarises the Responsive Dialogue framework developed by Wellcome. It illustrates how Responsive Dialogues can be used to generate solutions that are grounded in local realities and embrace ideas and views from the public.

To get a free Drug Resistant Infectio
Responsive Dialogue Toolkit, ema
responsivedialogues@wellcome.c

Responsive Dialogues in Thailand and Malawi

- Thailand –
  - Regional and national conversations - 248 participants
  - Improved understanding and attitudes
  - Communication strategies, local action plans and educational materials
  - Policy contribution
- Malawi - Worked with Women's groups
  - Increased communication on daily hygiene
  - Installation of low-tech hygiene facilities in schools
  - MoH committed to scaling-up the interventions



Fishy Clouds – a puppet show to engage Thai communities

- Community drama
  - Scientists at the Mahidol Oxford Research Unit
  - Farmers
  - Theatre group
- 12 community shows – to 1500 people
- Increased interest in public health and science
- Enjoyable and engaging approach

Superheroes against superbugs – India Alliance

- Engaging school children
- Children developed plays, posters and comics to engage their peers
- Impact
  - AMR understanding
  - Installation of hygiene equipment
  - AMR in school programmes
  - Researcher workshops

CE4AMR - Handbook

- Community-centered approaches
- Step-by-step strategy planning process
- Real works case studies

Youth Against Antimicrobial Resistance

Kenya, Nepal, Vietnam & Thailand

Project objectives:

1. Understand AMR awareness
2. Develop a learning framework
3. Create engagement platforms for children and youth involvement
4. Co-create AMR messages and engagement activities

Involving children and youth

Youth advisory board:

- Representatives from 4 countries

Youth working groups:

- 5 groups of 10-12 young people

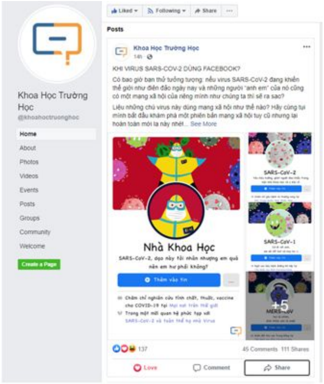
Wider young public:

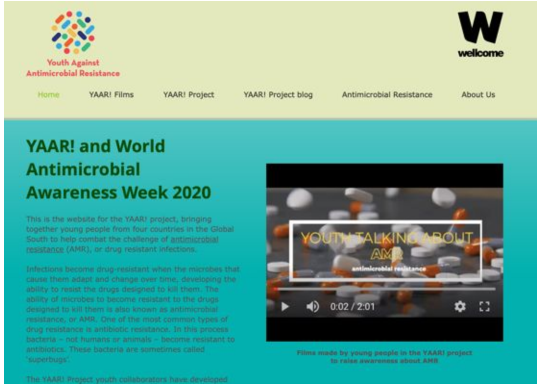
- Taking part in data collection
- Involved in engagement activities

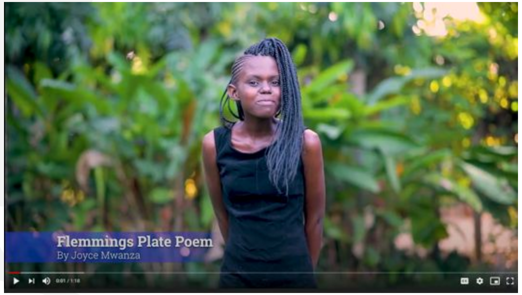
Youth Involvement in:

- Survey
- Designing engagement activities
- Interactive sessions with scientists
- Evaluation
- Messaging, web and social media materials

  - Reaching 523,955 people







Collaborative development of an AMR learning framework

- With science teachers, scientists and curriculum developers
  - Review of school curricula
  - Prioritised AMR content
  - Developed age-appropriate AMR learning outcomes
- All materials available through Mesh and TGHN

An Introduction and Practical Guide to Community Engagement and Involvement in Global Health Research

Authors

- Gill Black
- Rodrick Sambakunsi
- Robin Vincent
- Alun Davies
- Noni Mumba
- Helen Latchem

NIHR | National Institute for Health and Care Research

mesh — community engagement network —

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Q&A

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Advocacy for Bold Commitments: The Role of Political Leadership in Strengthening AMR Resilience

Dr. Kome Otokunefor

Associate Professor of Molecular and Medical Microbiology, University of Port Harcourt, Nigeria

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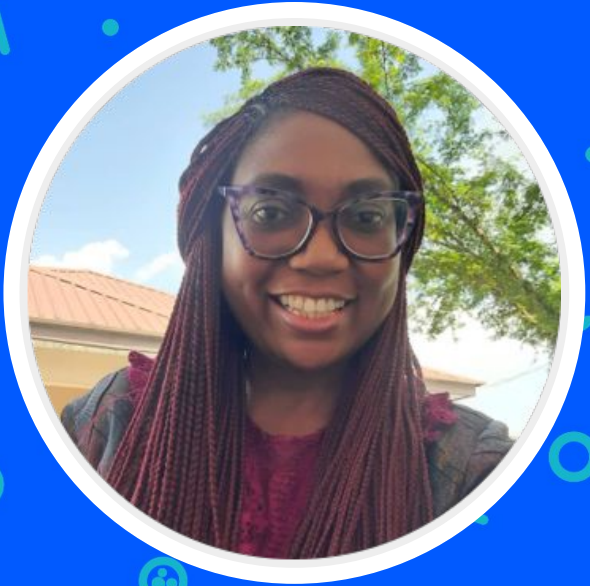


Dr. Kome Otokunefor

Associate Professor of Molecular and Medical Microbiology, University of Port Harcourt, Nigeria

The Role of Political Leadership in Strengthening AMR Resilience

Otokunefor, Kome PhD
Associate Professor of Molecular and Medical Microbiology
University of Port Harcourt

Outline

- Antimicrobial Agents
- Antimicrobial Resistance (AMR)
- AMR Consequences
- AMR Resilience
- One Health Approach
- Why Political Leadership?
- Advocacy

Antimicrobial Agents

- Chemical substances, synthetic or natural

- Act against bugs (kill or stop growth)

- Used in
  - Prophylaxis
  - Therapy
  - Growth promoters

Plate 1: Antimicrobial Agents

Antimicrobial Agents

Human

- Treatment
- Prophylaxis
- Control

Animal

- Treatment
- Prophylaxis
- Control
- Growth Promoters

Antimicrobial Resistance (AMR)

- Ability of bugs to withstand the action of antimicrobial agents
- Renders antibiotics ineffective
- Often develop rapidly following the introduction of the drug

Antimicrobial Resistance (AMR)

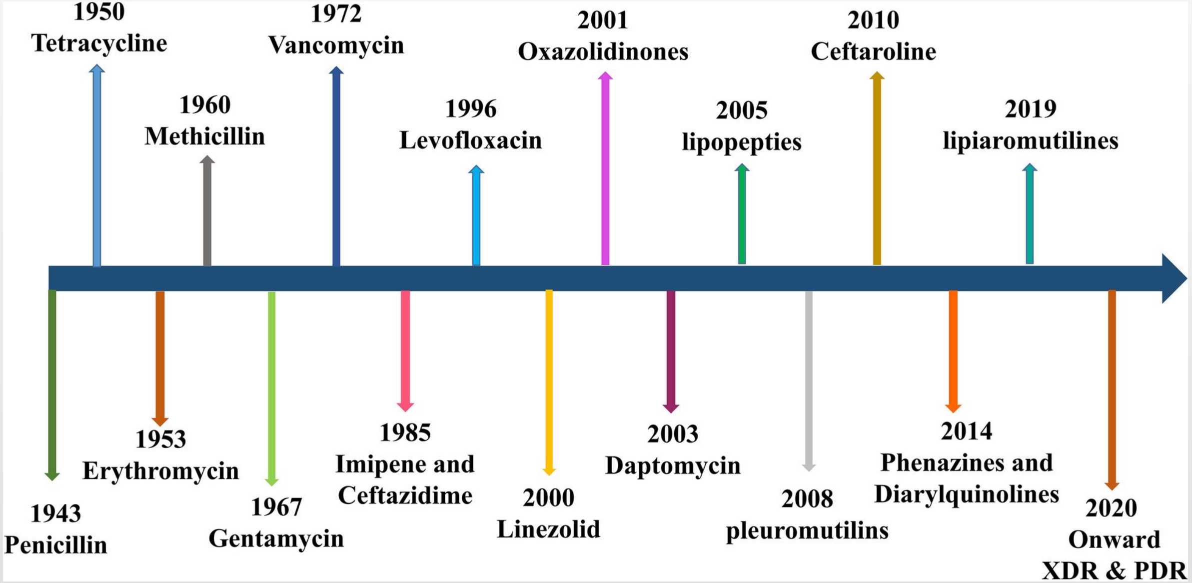
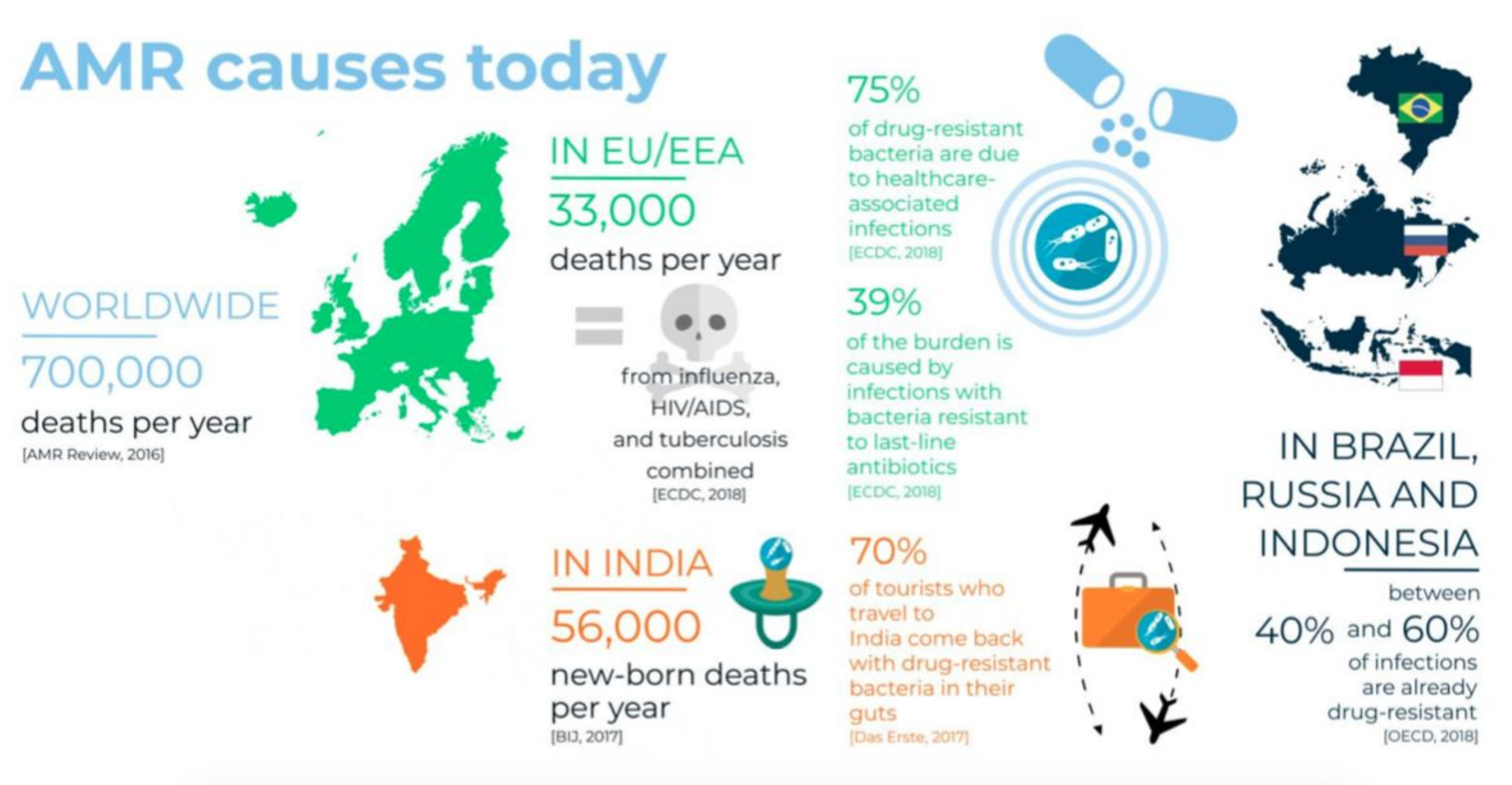


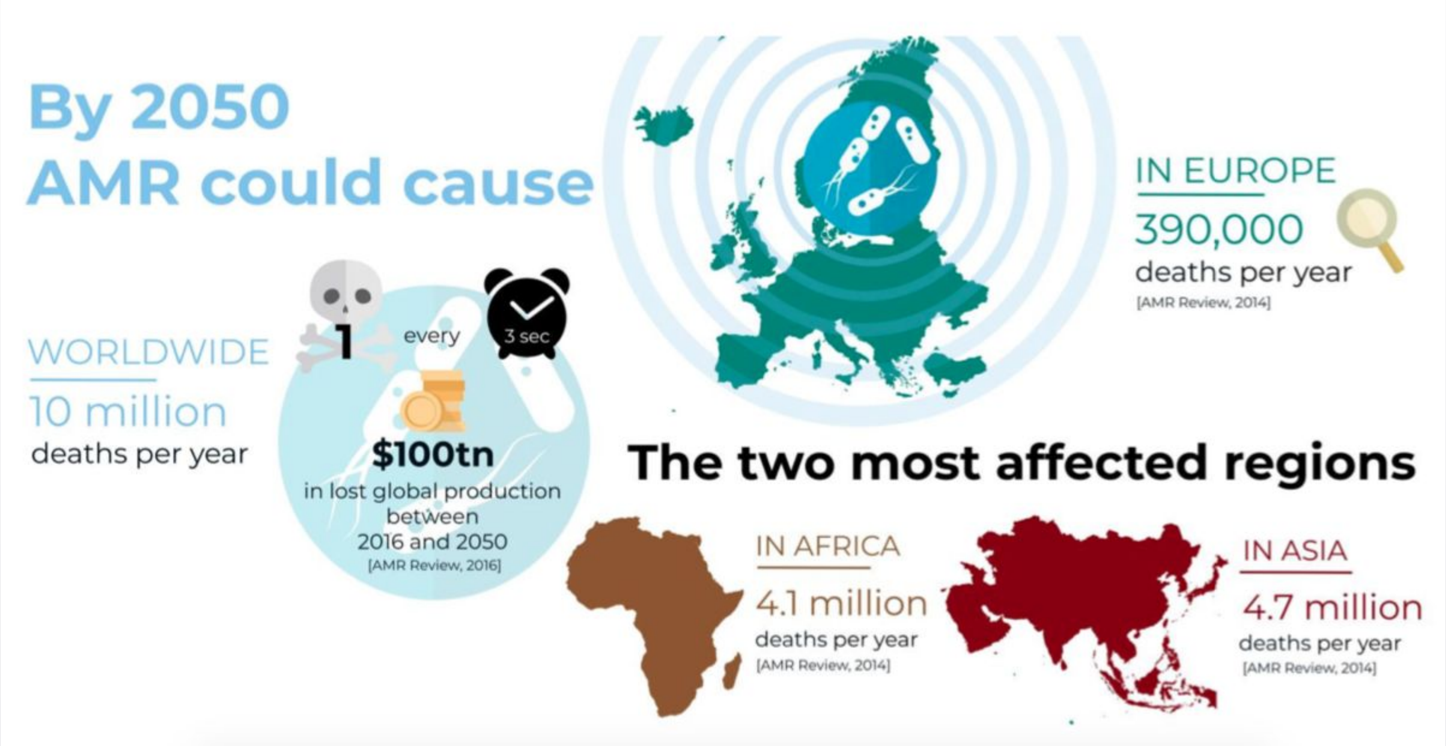
Figure 1: Timeline for the Development of Antimicrobial Resistance (Aslam et al., 2024)

Antimicrobial Resistance - Consequences



noharm-europe.org/infographic/increasing-impact-amr

Antimicrobial Resistance - Consequences



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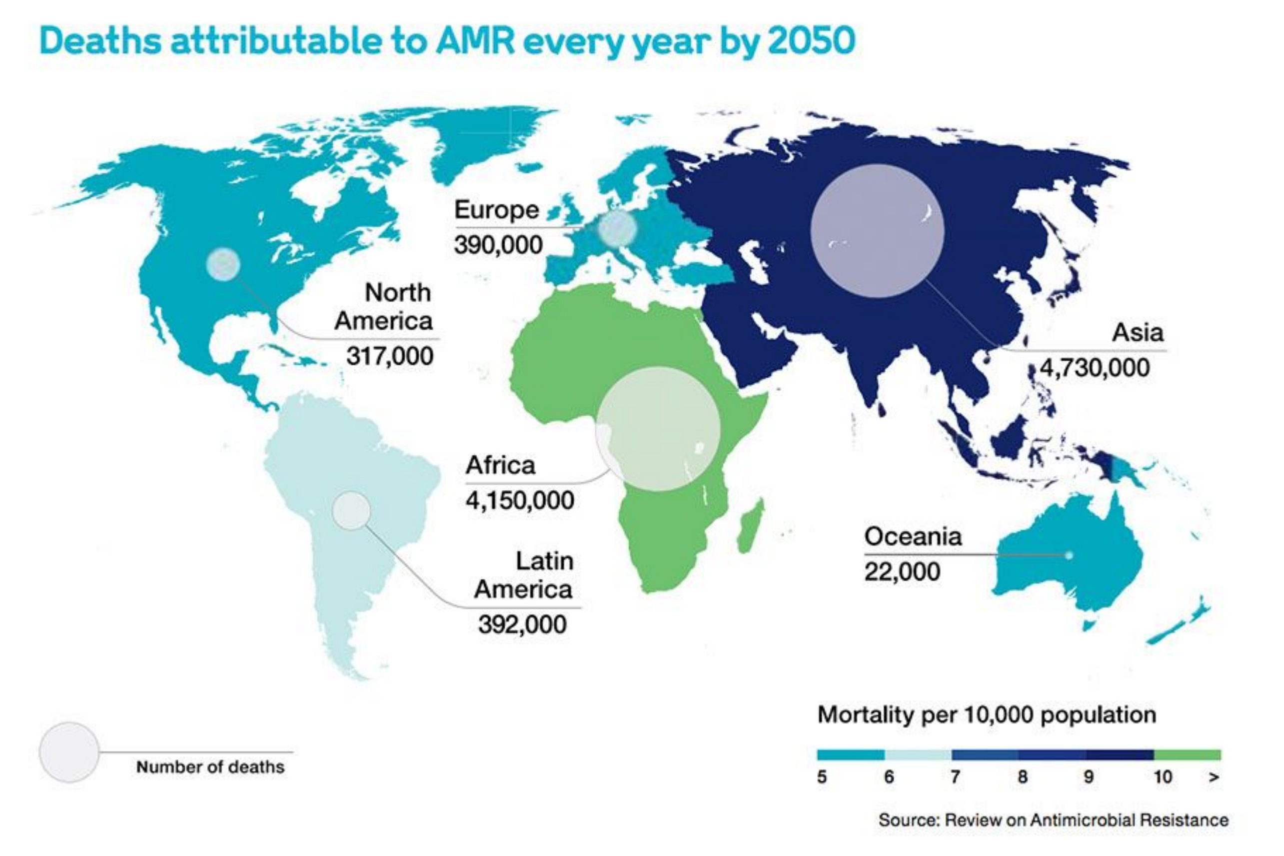
Antimicrobial Resistance - Consequences

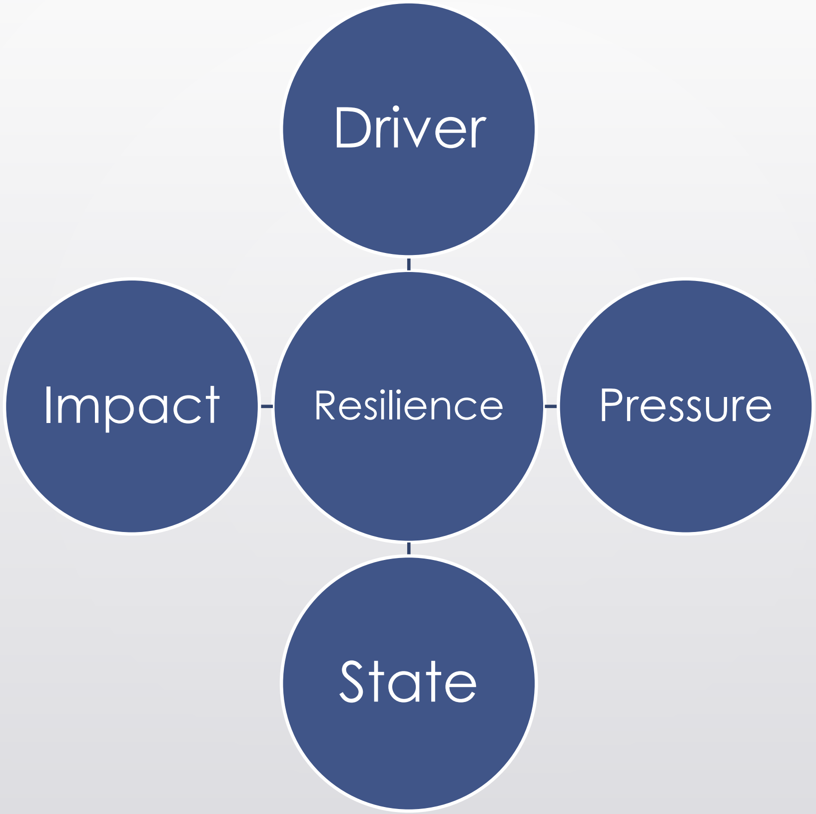


noharm-europe.org/infographic/increasing-impact-amr

Antimicrobial Resistance - Resilience

- Capacity of a system to respond to surprises AND maintain vital functions
- Responses could include
  - Cope
  - Adapt
  - Transform
- Aimed at managing disturbances
- Continue to ensure effective therapy
- Maintaining or improving economic, social, and environmental health and well-being

Resilience - Types



Resilience - Capacity

- Absorptive Capacity
  - Ability to absorb disruptions
- Adaptive Resilience
  - Capacity to adjust the system proactively or reactively to change
- Transformability
  - Ability to create a new system

Resilience – Absorptive Capacity

- Netherlands search and destroy policy targeting MRSA
- Implemented from the late 1980s
- Involved active screening, isolation and decolonisation
- Resulted in lower resistance rates compared to other countries

Resilience – Absorptive Capacity

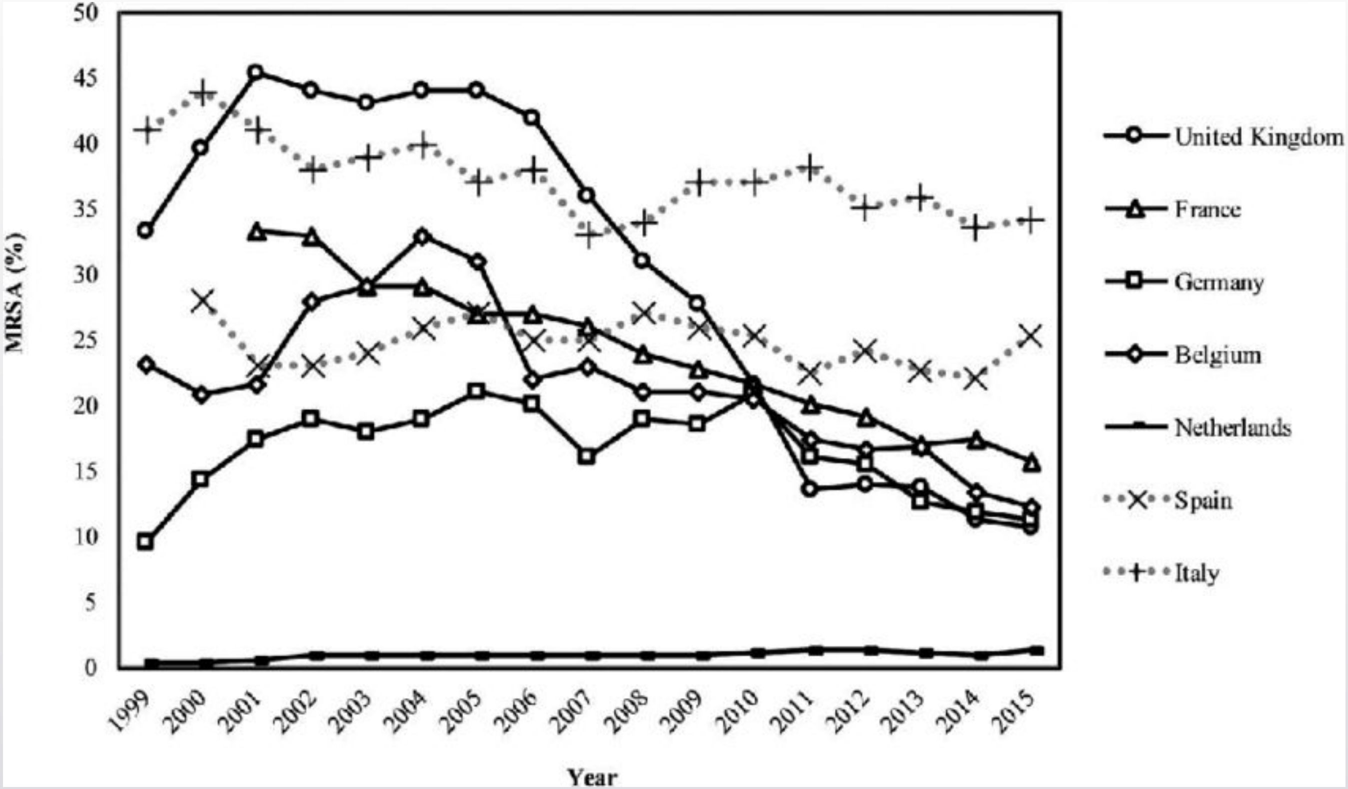
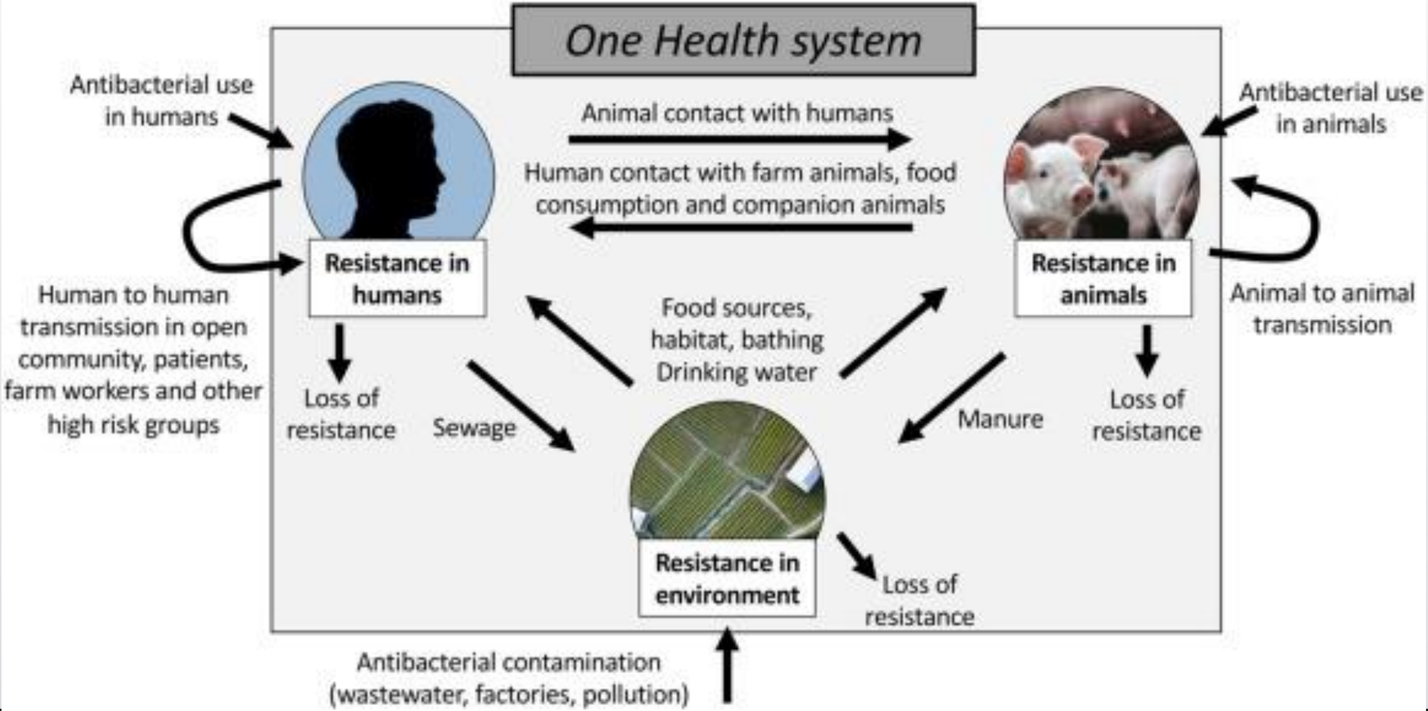


Figure 1: Trend in methicillin-resistant *Staphylococcus aureus* (MRSA) rates for seven countries, 1999–2015

Kinoshita et al., 2017

One Health Approach



Necessity for One Health Approach

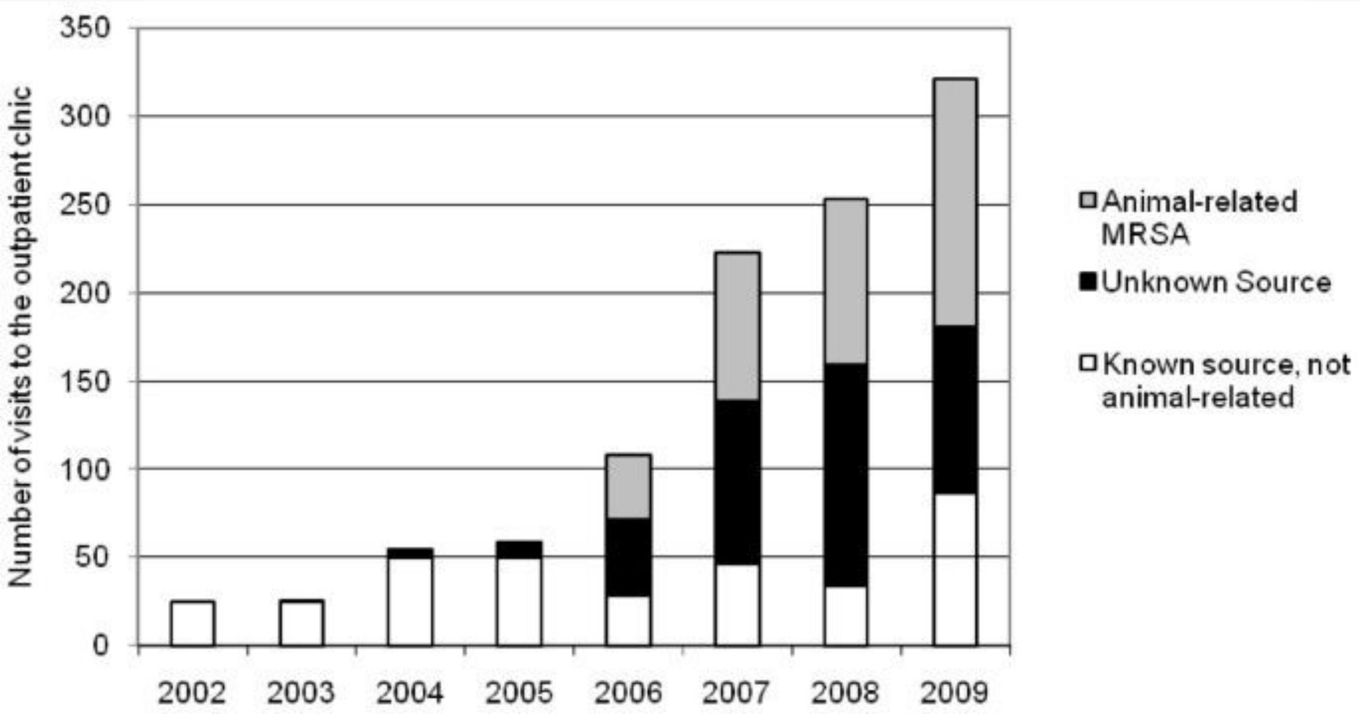


Figure 2: Visits of MRSA positive patients to the outpatient clinic.

van Rijen et al., 2014

Resilient System

Food Safety	Technology Transfer	Improved Surveillance and Monitoring	Outbreak Management Protocols
Enhanced Capacity Building	Reinforced Healthcare Systems	Proper Wastewater Management	Proper Follow up
Disease Prevention	Healthier Populations	Access to Clean Water	Zero Hunger
No Poverty	Quality/Rapid Diagnosis	Appropriate therapy Protocols	

Why Political Leadership?

- Response must be systemwide
- Silo's cannot holistically address the issues
- Globally coordinated governance
- Monitoring is crucial: - Local, National, International
- International Collaborations - Funding

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Guidance

UK 5 Year Antimicrobial Resistance Strategy 2013 to 2018

Sets out actions to slow the development and spread of antimicrobial resistance with a focus on antibiotics.

From: Department of Health and Social Care
Published 10 September 2013
Last updated 15 October 2024 — See all updates

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Policy paper

UK 20-year vision for antimicrobial resistance

How the UK will contribute to containing and controlling antimicrobial resistance (AMR) by 2040.

From: Department of Health and Social Care
Published 24 January 2019

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This was published under the 2016 to 2019 May Conservative

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Home > Health and social care > Public health > Health protection > Antimicrobial resistance (AMR)

Policy paper

UK 5-year action plan for antimicrobial resistance 2019 to 2024

Ambitions and actions for the next 5 years, supporting the 20-year vision for antimicrobial resistance (AMR).

From: Department of Health and Social Care
Published 24 January 2019

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This was published under the 2016 to 2019 May Conservative government

Focus of United Kingdom 2024-2029 NAP

Reducing the need for, and unintentional exposure to, antimicrobials	• IPC and IM • Public Engagement and education • Strengthened Surveillance
Optimising the use of antimicrobials	• Antimicrobial Stewardship and Disposal • AMR workforce
Investing in innovation, supply and access	• Innovation and influence • Using Information for Action • Health Disparities and Health Inequalities
Being a good global partner	• AMR Diplomacy

https://www.gov.uk/government/publications/uk-5-year-action-plan-for-antimicrobial-resistance-2024-to-2029/confronting-antimicrobial-resistance-2024-to-2029

Details of United Kingdom 2024-2029 NAP

https://assets.publishing.service.gov.uk/media/663357a61c82a7597d4f3022/figure-1-nap-2024-to-2029.sv

Fallouts of United Kingdom Political will on AMR

The Veterinary Medicines Regulations 2013 (VMR) set out the controls on the marketing, manufacture, distribution, possession, and administration of veterinary medicines and medicated feed. The Veterinary Medicines (Amendment etc.) Regulations 2024 make changes to the VMR to ensure continued availability of safe and effective veterinary medicines in the UK. These Regulations are now in force.

Public Health England

Protecting and improving the nation's health

Wellington House
133-155 Waterloo Road
London SE1 8UG
Tel: 020 7654 8090
www.gov.uk/phe

To: Local Authority Chief Executives
Directors of Public Health

23 October 2019
PHE Gateway Number: L2019-108

Dear colleagues

We are pleased to report that there has been a reduction in prescribing of antibiotics in primary care and a clear shift toward more targeted prescribing across England. Many Local Authorities and Health and Wellbeing Boards, have taken decisive action in this field and so can share in the credit for this achievement. Thank you very much for your efforts, this is a great outcome for all.

With World Antibiotic Awareness Week (18-24 November) and European Antibiotic Awareness Day (18 November) approaching, we would like to suggest some actions to build upon this success.

Good infection prevention and control in schools is key to reducing the spread of infectious diseases in the wider community. We therefore encourage you to make sure that local schools know where to find PHE's advice and resources on this matter. It would also be useful to draw schools' attention to PHE's e-Bug programme, which has a wealth of free resources linked to

2016 Davos Declaration

- Encourage greater investment in R&D
- Support and promote appropriate use
- Improve access to high quality products and manufacturing
- Reduce environmental pollution when manufacturing

https://www.gov.uk/government/news/new-veterinary-medicines-regulations-now-in-force

AMR Industry Alliance (2016)

A Global Picture

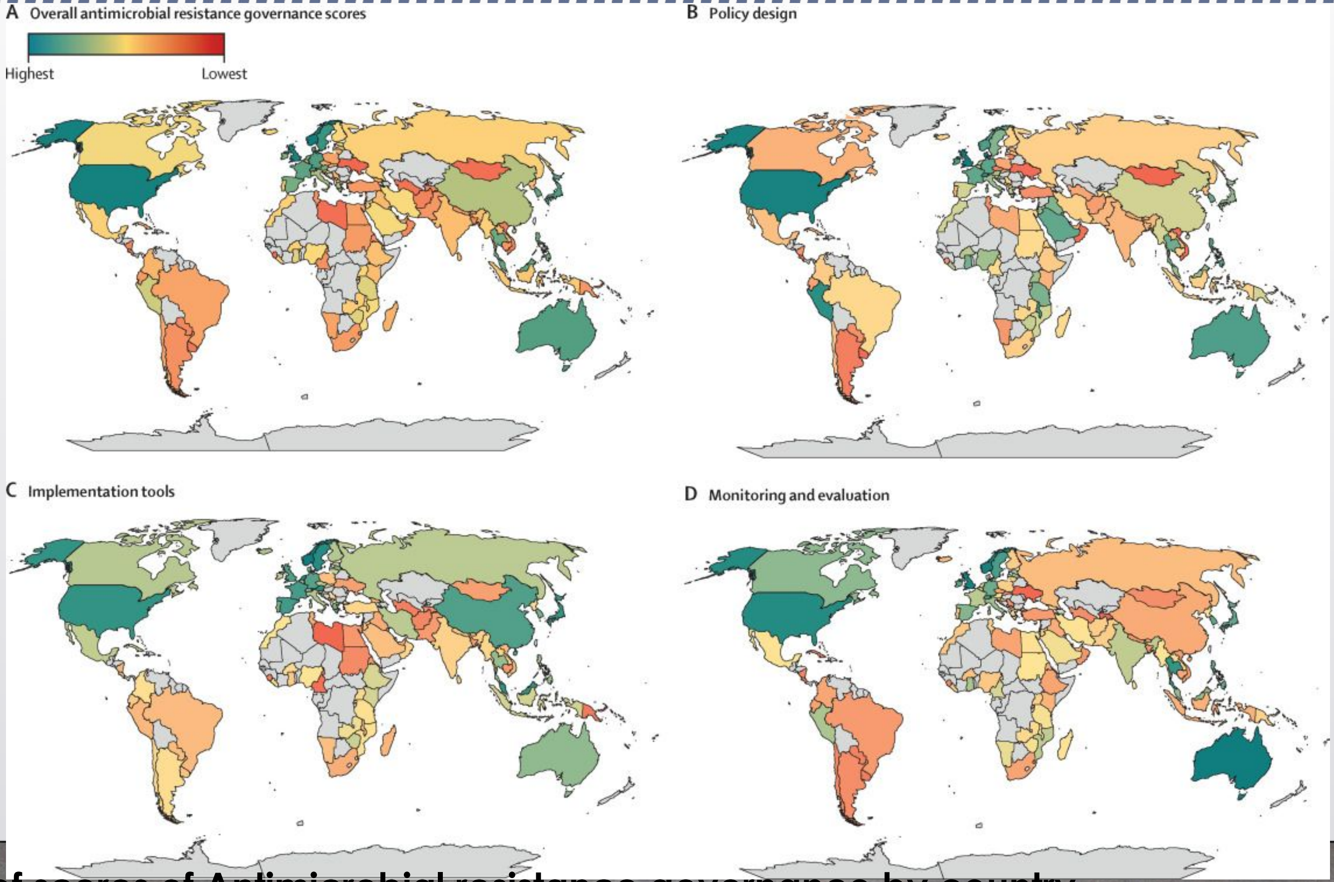


Figure 3: Map of scores of Antimicrobial resistance governance by country, 2020–21

Patel et al., 2023

78TH UNGA High Level Meeting on AMR

- 26th September 2024
- Borderless nature of drug-resistant infections
- Quadripartite Organisations
- Need for a political declaration on AMR
- Multisectoral engagement

FAO

UNEP

WHO

WOAH

Key Points of 2024 AMR Declaration

- Reduce estimated AMR deaths by 10% by 2030
- Set up sustainable national financing to help at least 60% of countries have funded national action plans (NAP).
- Develop global multisectoral action
- Encourage countries to report quality surveillance data
- Call for 95% of countries to annually report on implementation of NAPs

Advocacy

How will they hear?

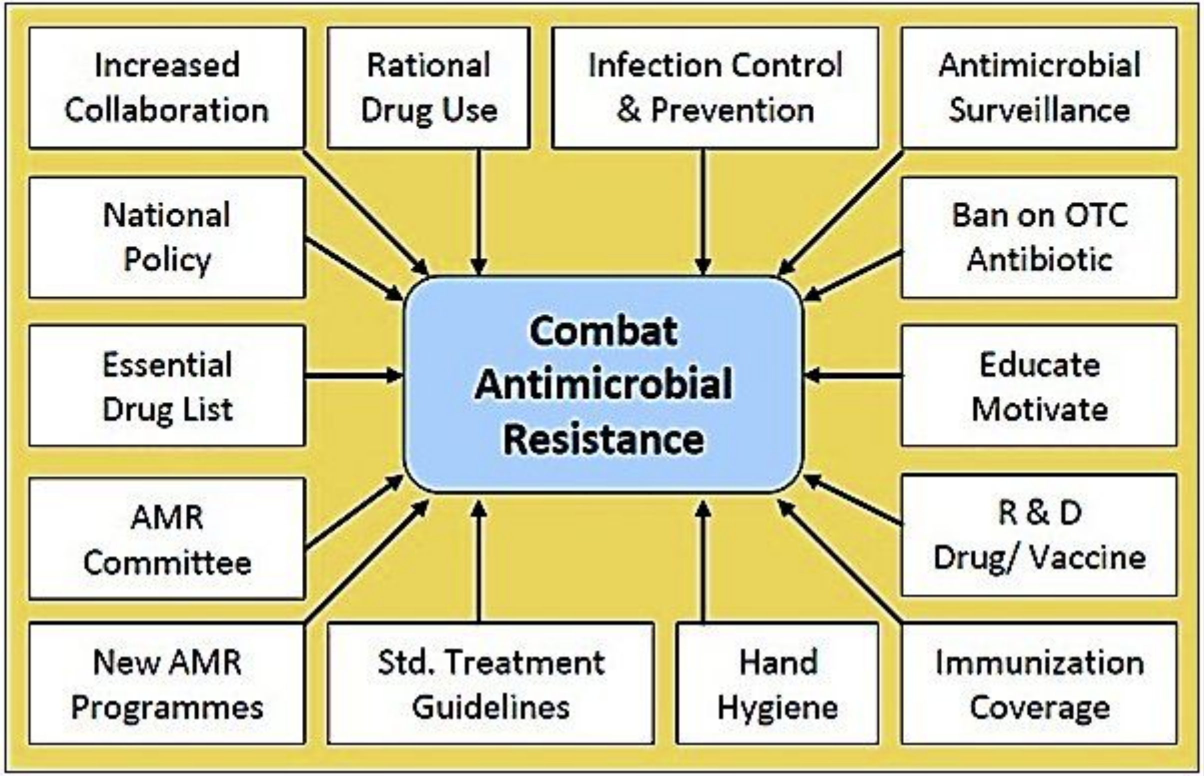
Who should be informed?

Who will do the informing?

How will the information be passed on?

A Collective Responsibility

FIND YOURSELF HERE



Ranjan, (2018). IAB ISS e-book cum compendium 2016.

In a Nutshell

- The current gains in AMR policies are not accidental
- These gains are a reflection of years of advocacy and "telling the AMR story"
- Small deliberate steps have culminated in the current state of things
- This momentum **MUST** be maintained
- All hands need to be on deck

References

- AMR Industry Alliance (2016). *Declaration by the Pharmaceutical, Biotechnology and Diagnostics Industries on Combating Antimicrobial Resistance*. Available at: https://www.amrindustryalliance.org/wp-content/uploads/2017/12/AMR-Industry-Declaration.pdf
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TOGETHER WE STOP AMR

Q&A

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Data Driven Antibiotic Stewardship

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Prof. Esmita Charani

Associate Professor, University of Cape Town

Data driven antibiotic stewardship

WAAW 2024

Esmita Charani, MPharm, MSc, PhD

FRPSGB, Associate Professor, University of Cape Town

Wellcome Trust Career Development Fellow

Research Landscape

Inequity in funding

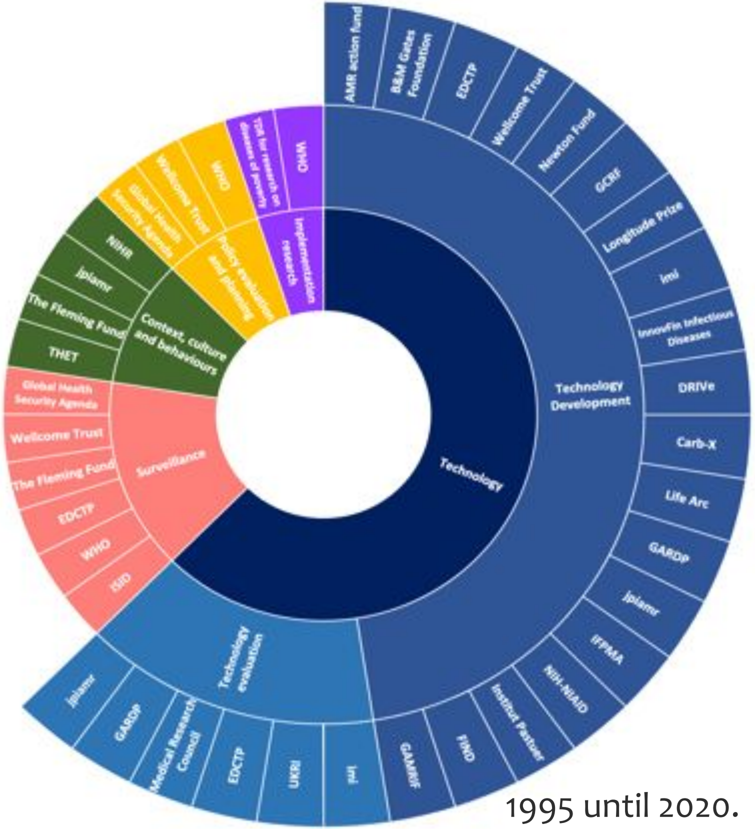
Inequity in AMR funding between R&D for new drugs and optimising existing ones

Skew towards tech development, not much on implementation

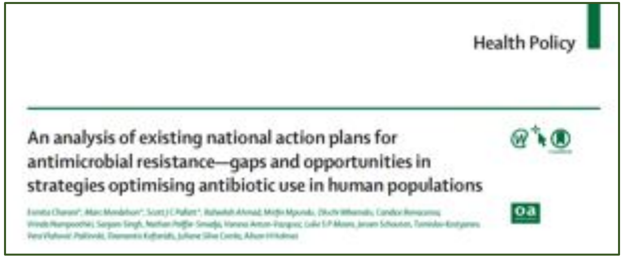
Policy, strategy not invested in – NAPs have big gaps in operationalisation

Contextual and culture and behavioural drivers under investigated

E. Charani et al., Optimising antimicrobial use in humans-review of current evidence and an interdisciplinary consensus on key priorities for research, The Lancet Regional Health - Europe (2021)



1995 until 2020.



Health Policy

An analysis of existing national action plans for antimicrobial resistance—gaps and opportunities in strategies optimising antibiotic use in human populations

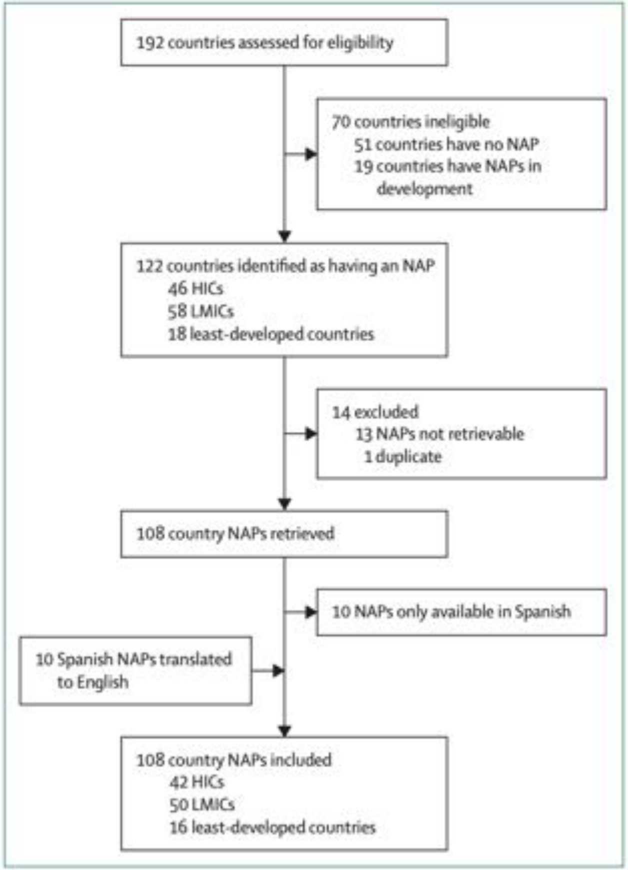
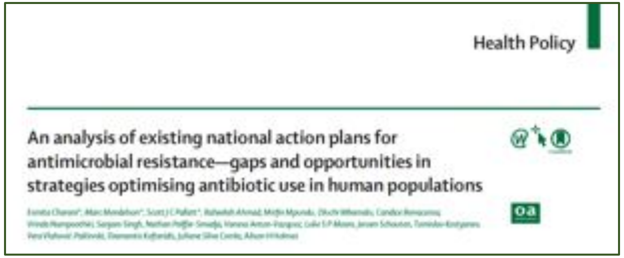


***Figure 1*: Flow diagram of search and retrieval of country NAPs for inclusion in the analysis**

NAP=national action plan. LMIC=low-income and middle-income country.

Lancet Global Health, 2023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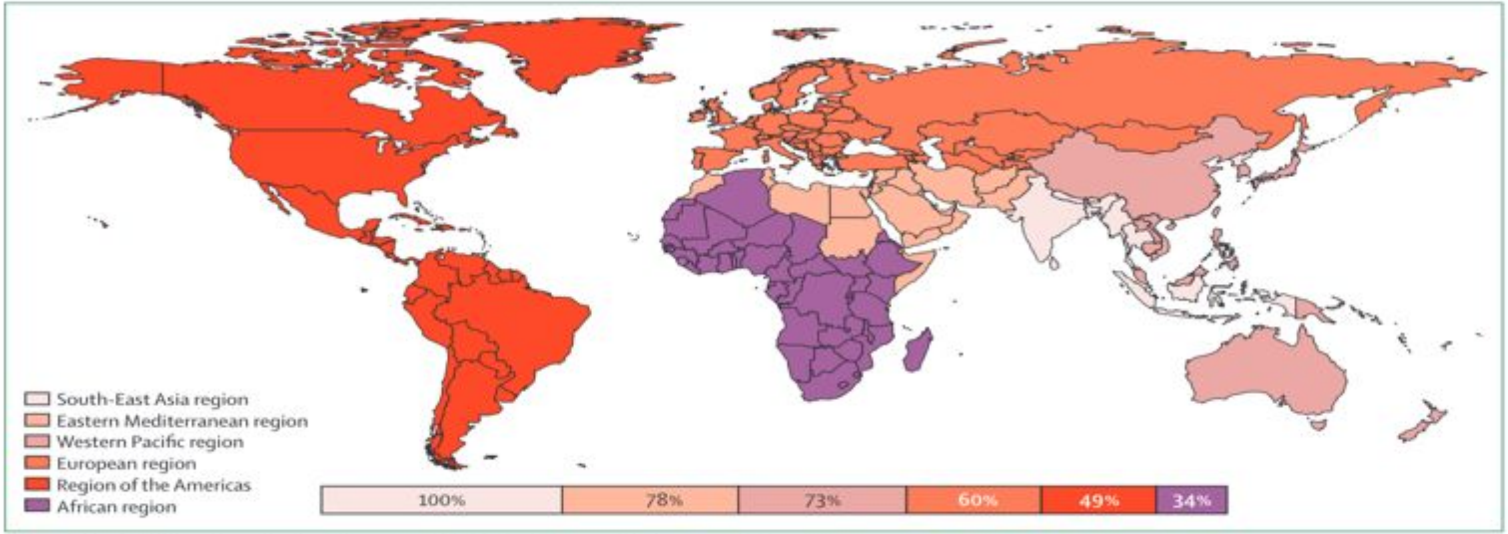


Figure 2: **Availability of national action plans by WHO region as of February, 2022**

Lancet Global Health, 2023

	NAP available and included in this review	NAPs that mentioned submission of AMR data to GLASS database*	AMR data available in GLASS database*	Antibiotic use or consumption data available in the NAPs*†	Antibiotic consumption data available in WHO report‡	Range; mean (median) antibiotic consumption reported as defined daily doses per 1000 population (p=0·061)‡
High-income countries (n=55)	42 (76%) of 55	12 (29%) of 42	29 (69%) of 42	16 (38%) of 42	32 (58%) of 55	9·78–33·85; 19·29 (17·91)
LMICs (n=95)	50 (53%) of 95	21 (42%) of 50	18 (36%) of 50	18 (36%) of 50	26 (27%) of 95	5·29–64·41; 19·86 (17·67)
Least-developed countries (n=42)	16 (38%) of 42	8 (50%) of 16	11 (69%) of 16	3 (19%) of 16	4 (10%) of 42	4·44–27·29; 16·44 (17·02)

Data are n/N(%). All 192 countries were categorised by OECD classification. AMR=antimicrobial resistance. GLASS=Global Antimicrobial Use and Surveillance System. LMIC=low-income and middle-income country. NAP=National action plan. OECD=Organisation for Economic Co-operation and Development. *Data reviewed from the 108 countries with NAPs included in this review. †The antibiotic use or consumption data in the NAPs were not consistent in their representation, often drawing data from small populations or a single study, and, therefore, could not be evaluated. ‡Antibiotic consumption data were retrieved for secondary analysis from an existing WHO AMR report published in 2019, with data available for 63 countries.[14] The consumption data in this report were presented as defined daily doses per 1000 population.

***Table 2:* Antibiotic consumption data and AMR surveillance data and their submission to GLASS database for the countries with an NAP that were included in this review**

Lancet Global Health, 2023


APROVEL 150mg
COAPROVEL
COVERSYL
Micardis Plus
40/12.5 mg
Micardis
40 mg
Augmentin
2 Blisters of 7 tablets
Augmentin
2 Blisters of 7 tablets
Clamoxyl
250
SaVi Roxim 250
Cotrimstada
Cotrimstada
SaVi Roxim 500
SaVi Cefim 200
Cotrimstada forte


I DON'T CURE THE COLD
I'M NO HELP WITH A COUGH


Stop!

Current state of IPC

Global survey on implementation of IPC using WHO IPC assessment framework (IPCAF)
Tomczyk et al., Lancet ID 2022

Weighted IPCAF median score from total 81 countries (4440 health-care facilities) was 605 (IQR 450·4–705·0) indicating an advanced level of implementation

Significantly lower score for low-income (385, 279·7–442·9) and lower-middle-income countries (500·4, 345·0–657·5)

Zero % facilities from low-income countries met all indicators that are considered as minimum requirements for IPC

Figure 1: Country participation in the Infection Prevention and Control Assessment Framework global survey 2019, after application of the minimal response threshold
Total number of countries=81. Total number with nationally coordinated data collection=37. The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of WHO concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement. Published with permission of the WHO GIS Centre for Health,

Main challenges reported

HAI surveillance and monitoring and feedback of IPC practices scored lowest among low-income countries.

IPC implementation in LMICs hampered by multiple factors:

Overcrowding, understaffing, lack of sufficient resources including PPE, inadequate environmental cleaning, insufficient hand washing stations, low compliance with recommended hand hygiene practices, poor ventilation, lack of IPC training, and lack of management support on IPC

Resulting in high rates of HAIs, and AMR

IPCAF study from Bangladesh

Majority of sampled tertiary care hospitals demonstrate inadequate IPC level with overall median IPCAF score 355.0 (IQR: 252.5–397.5) out of 800.

Most hospitals had IPC guidelines as well as environmental interventions, material and equipment.

Only 30% of hospitals had regular IPC training program. Around 90% of hospitals did not have an active IPC monitoring and audit system.

73% of hospitals had functional hand hygiene stations, but sufficient toilets were available in only 37% of hospitals. **Half of the hospitals had inadequate staffing.**

Harun et al., ARIC 2022

Economic evaluations of interventions to prevent and control health-care-associated infections: a systematic review

Define IPC interventions

Panel: Eligible interventions suitable for inclusion

- Hand hygiene interventions targeting prevention and control of health-care-associated infections (HAIs)
- Screening followed by contact precautions, isolation, decolonisation, or a combination of these targeting prevention and control of HAIs
- Personal protective equipment targeting prevention and control of HAIs
- Infection prevention and control programmes involving an infection preventionist at the national level or at a facility
- Education and training programmes
- Environmental cleaning
- Surveillance

Rice et al., Lancet ID 2023

Economic evaluations of interventions to prevent and control health-care-associated infections: a systematic review

Panel: Eligible interventions suitable for inclusion

- Hand hygiene interventions targeting prevention and control of health-care-associated infections (HAIs)
- Screening followed by contact precautions, isolation, decolonisation, or a combination of these targeting prevention and control of HAIs
- Personal protective equipment targeting prevention and control of HAIs
- Infection prevention and control programmes involving an infection preventionist at the national level or at a facility
- Education and training programmes
- Environmental cleaning
- Surveillance

Broader range of interventions than previous reviews.

Among the studies meeting minimum quality criteria, there was evidence **of cost-effectiveness for screening high-risk individuals, screening with decolonisation, universal decolonisation in intensive care units, hand hygiene, environmental cleaning, surveillance, and multimodal interventions**.

There were no quality studies that evaluated education and training, or specifically monitored and evaluated infection prevention and control interventions.

73 studies, 10 from LMICs, including China, Ghana, Cambodia Thailand, Vietnam

Rice et al., Lancet ID 2023

Contextual variability a limiting factor
Current practice, design of interventions, effectiveness of interventions, cost of interventions, and treatment of infections all vary between countries and affect the generalisability of the results to a specific setting.

Focus on one microorganism e.g., MRSA
The implementation or improvement of IPC motivated by the prevalence of one microorganism - underestimating the benefits of an intervention.

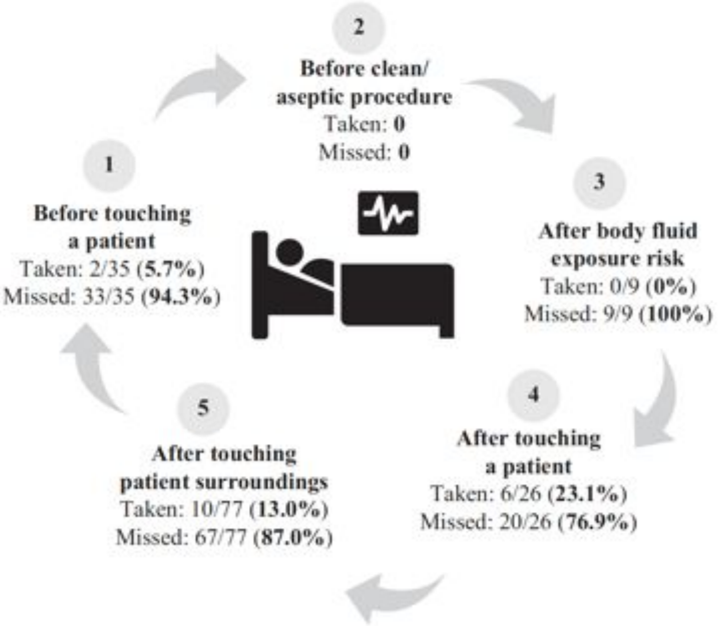
Flaws in modelling
'Studies that used complex models where patients could become colonised, infected, or decolonised sometimes made use of inadequate evidence for colonisation rates, infection rates for colonised or not colonised, or for the probability of being decolonised.'

Rice et al., Lancet ID 2023

Available online at www.sciencedirect.com

Journal of Hospital Infection

journal homepage: www.elsevier.com/locate/jhin

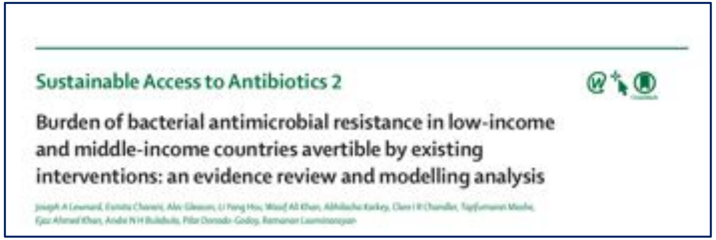


	HH opportunities		
	Taken	Missed	Total
Tech staff	1	2	3
Carer	3	10	13
Nurse	3	59	62
Physio	6	5	11
X-ray staff	4	9	13
Doctor	1	36	37
Patient	0	3	3
Cleaner	0	0	0
Dietitian	0	2	2
Kitchen staff	0	2	2
Pharmacist	0	0	0
Ward clerk	0	1	1
Visitor	0	0	0
Total	18	129	147

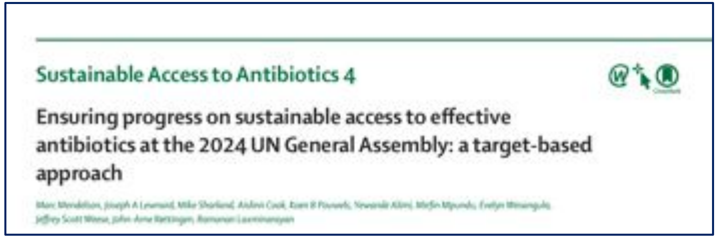
Figure 1. Proportion of hand hygiene (HH) opportunities (by HH moment) taken or missed during observations and staff involvement.

What interventions have most robust evidence for mitigation of AMR?

Evidence:


Sustainable Access to Antibiotics 2

Burden of bacterial antimicrobial resistance in low-income and middle-income countries avertible by existing interventions: an evidence review and modelling analysis


Sustainable Access to Antibiotics 4

Ensuring progress on sustainable access to effective antibiotics at the 2024 UN General Assembly: a target-based approach

Policy:

WHO Gender and AMR

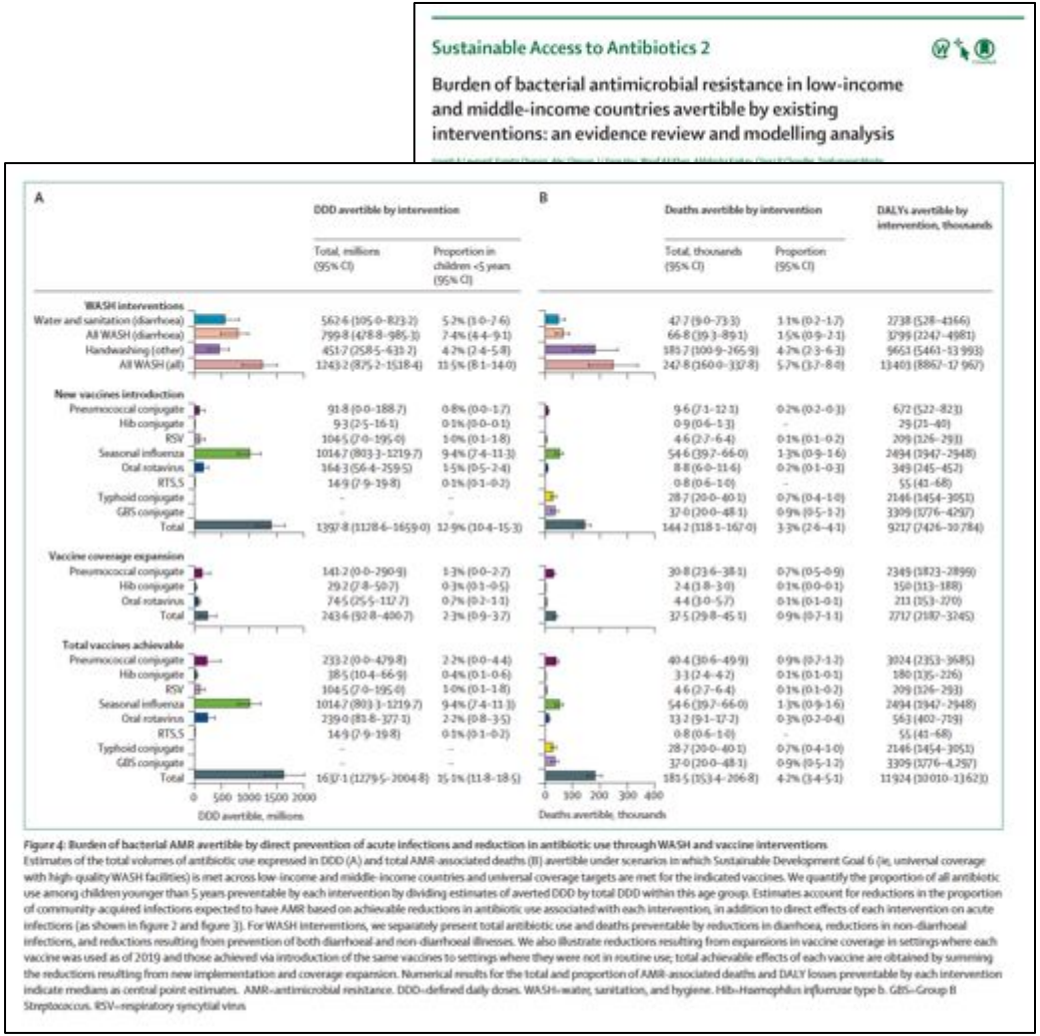
WHO AMR and Equity

WASH

Vaccines

Infection Prevention

Lewnard et al., The Lancet 2024



Sustainable Access to Antibiotics 2

Burden of bacterial antimicrobial resistance in low-income and middle-income countries avertible by existing interventions: an evidence review and modelling analysis

A — DDD avertible by intervention; B — Deaths avertible by intervention; DALYs avertible by intervention, thousands

	DDD: Total, millions (95% CI)	DDD: Proportion in children <5 years (95% CI)	Deaths: Total, thousands (95% CI)	Deaths: Proportion (95% CI)	DALYs averted by intervention, thousands
WASH interventions					
Water and sanitation (diarrhoea)	562·6 (105·0–823·2)	5·2% (1·0–7·6)	47·7 (9·0–73·3)	1·1% (0·2–1·7)	2738 (528–4366)
All WASH (diarrhoea)	799·8 (478·8–985·1)	7·4% (4·4–9·1)	66·8 (39·3–89·1)	1·5% (0·9–2·1)	3799 (2247–4981)
Handwashing (other)	451·7 (258·5–631·2)	4·2% (2·4–5·8)	185·7 (100·9–265·9)	4·2% (2·3–6·3)	9653 (5461–13 993)
All WASH (all)	1243·2 (875·2–1518·4)	11·5% (8·1–14·0)	247·8 (160·0–337·8)	5·7% (3·7–8·0)	13 401 (8867–17 967)
New vaccines introduction					
Pneumococcal conjugate	91·8 (0·0–188·7)	0·8% (0·0–1·7)	9·6 (7·1–12·1)	0·2% (0·2–0·3)	672 (522–823)
Hib conjugate	9·3 (2·5–16·1)	0·1% (0·0–0·1)	0·9 (0·6–1·3)	–	29 (21–40)
RSV	104·5 (7·0–195·0)	1·0% (0·1–1·8)	4·6 (2·7–6·4)	0·1% (0·1–0·2)	209 (126–293)
Seasonal influenza	1014·7 (803·3–1219·7)	9·4% (7·4–11·3)	54·6 (39·7–66·0)	1·3% (0·9–1·6)	2494 (1947–2948)
Oral rotavirus	164·3 (56·4–259·5)	1·5% (0·5–2·4)	8·8 (6·0–11·6)	0·2% (0·1–0·3)	349 (245–452)
RTS,S	14·9 (7·9–19·8)	0·1% (0·1–0·2)	0·8 (0·6–1·0)	–	55 (41–68)
Typhoid conjugate	–	–	28·7 (20·0–40·1)	0·7% (0·4–1·0)	2146 (1454–3051)
GBS conjugate	–	–	37·0 (20·0–48·1)	0·9% (0·5–1·2)	3309 (3776–4297)
Total	1397·8 (1128·6–1659·0)	12·9% (10·4–15·3)	144·2 (118·1–167·0)	3·3% (2·6–4·1)	9217 (7426–10 784)
Vaccine coverage expansion					
Pneumococcal conjugate	141·2 (0·0–290·9)	1·3% (0·0–2·7)	30·8 (23·6–38·1)	0·7% (0·5–0·9)	2349 (1823–2899)
Hib conjugate	29·2 (7·8–50·7)	0·3% (0·1–0·5)	2·4 (1·8–3·0)	0·1% (0·0–0·1)	150 (113–188)
Oral rotavirus	74·5 (25·5–117·7)	0·7% (0·2–1·1)	4·4 (3·0–5·7)	0·1% (0·1–0·1)	211 (153–270)
Total	243·6 (92·8–400·7)	2·3% (0·9–3·7)	37·5 (29·8–45·1)	0·9% (0·7–1·1)	2717 (2187–3245)
Total vaccines achievable					
Pneumococcal conjugate	233·2 (0·0–479·8)	2·2% (0·0–4·4)	40·4 (30·6–49·9)	0·9% (0·7–1·2)	3024 (2353–3685)
Hib conjugate	38·5 (10·4–66·9)	0·4% (0·1–0·6)	3·3 (2·4–4·2)	0·1% (0·1–0·1)	180 (135–226)
RSV	104·5 (7·0–195·0)	1·0% (0·1–1·8)	4·6 (2·7–6·4)	0·1% (0·1–0·2)	209 (126–293)
Seasonal influenza	1014·7 (803·3–1219·7)	9·4% (7·4–11·3)	54·6 (39·7–66·0)	1·3% (0·9–1·6)	2494 (1947–2948)
Oral rotavirus	239·0 (81·8–377·1)	2·2% (0·8–3·5)	13·2 (9·1–17·2)	0·3% (0·2–0·4)	563 (402–719)
RTS,S	14·9 (7·9–19·8)	0·1% (0·1–0·2)	0·8 (0·6–1·0)	–	55 (41–68)
Typhoid conjugate	–	–	28·7 (20·0–40·1)	0·7% (0·4–1·0)	2146 (1454–3051)
GBS conjugate	–	–	37·0 (20·0–48·1)	0·9% (0·5–1·2)	3309 (3776–4,297)
Total	1637·1 (1279·5–2004·8)	15·1% (11·8–18·5)	181·5 (153·4–206·8)	4·2% (3·4–5·1)	11 924 (10 010–13 621)

DDD avertible, millions: 0, 500, 1000, 1500, 2000. Deaths avertible, thousands: 0, 100, 200, 300, 400.

Figure 4: Burden of bacterial AMR avertible by direct prevention of acute infections and reduction in antibiotic use through WASH and vaccine interventions
Estimates of the total volumes of antibiotic use expressed in DDD (A) and total AMR-associated deaths (B) avertible under scenarios in which Sustainable Development Goal 6 (ie, universal coverage with high-quality WASH facilities) is met across low-income and middle-income countries and universal coverage targets are met for the indicated vaccines. We quantify the proportion of all antibiotic use among children younger than 5 years preventable by each intervention by dividing estimates of averted DDD by total DDD within this age group. Estimates account for reductions in the proportion of community-acquired infections expected to have AMR based on achievable reductions in antibiotic use associated with each intervention, in addition to direct effects of each intervention on acute infections (as shown in figure 2 and figure 3). For WASH interventions, we separately present total antibiotic use and deaths preventable by reductions in diarrhoea, reductions in non-diarrhoeal infections, and reductions resulting from prevention of both diarrhoeal and non-diarrhoeal illnesses. We also illustrate reductions resulting from expansions in vaccine coverage in settings where each vaccine was used as of 2019 and those achieved via introduction of the same vaccines to settings where they were not in routine use; total achievable effects of each vaccine are obtained by summing the reductions resulting from new implementation and coverage expansion. Numerical results for the total and proportion of AMR-associated deaths and DALY losses preventable by each intervention indicate medians as central point estimates. AMR=antimicrobial resistance. DDD=defined daily doses. WASH=water, sanitation, and hygiene. Hib=Haemophilus influenzae type b. GBS=Group B Streptococcus. RSV=respiratory syncytial virus

10% reduction in AMR mortality

20% reduction in human use

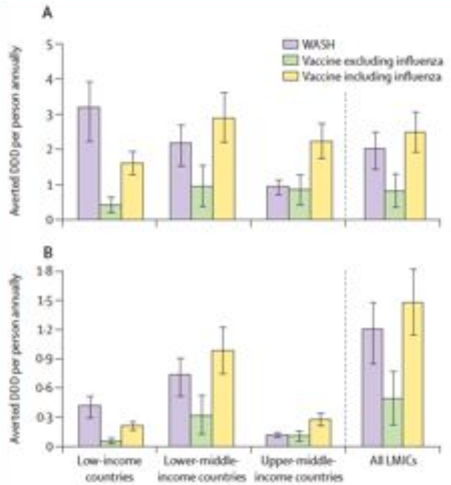
30% reduction in animal use

Mendelson et al., The Lancet 2024

Sustainable Access to Antibiotics 4

Ensuring progress on sustainable access to effective antibiotics at the 2024 UN General Assembly: a target-based approach

Marc Mendelson, Joseph A Lewnard, Mike Sharland, Aislinn Cook, Koen B Pouwels, Yewande Alimi, Mirfin Mpundu, Evelyn Wesangula, Jeffrey Scott Weese, John-Arne Røttingen, Ramanan Laxminarayan

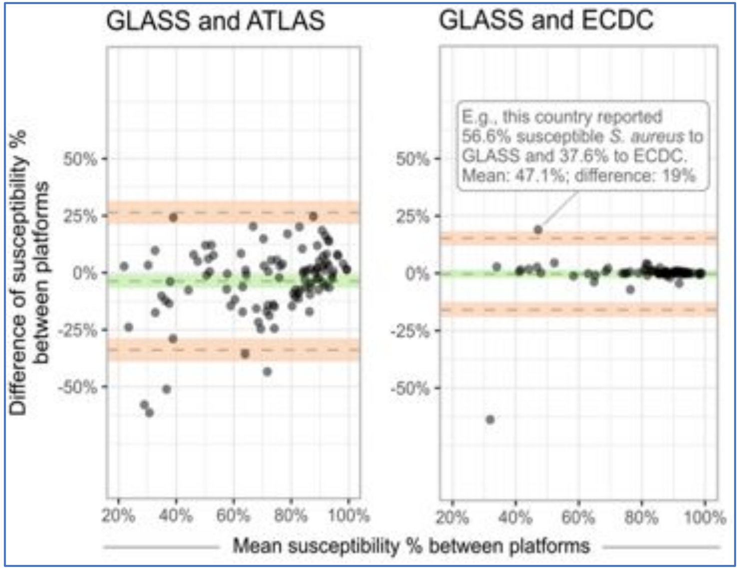


	DDD averted (millions)	Proportion of antibiotic use averted (%)
Achieving universal WASH access		
Low-income	417·1 (290·1–511·6)	24·6 (17·1–29·9)
Lower-middle-income	738·1 (514·5–907·4)	11·4 (7·9–13·9)
Upper-middle-income	117·9 (89·5–141·4)	5·3 (4·0–6·4)
All LMICs	1207·9 (850·4–1475·4)	11·5 (8·1–14·0)
Achieving universal coverage of select paediatric vaccines		
Low-income	209·9 (167·1–254·3)	12·4 (9·9–14·9)
Lower-middle-income	980·1 (746·9–1221·3)	15·1 (11·5–18·8)
Upper-middle-income	278·1 (215·7–340·0)	12·5 (9·7–15·3)
All LMICs	1476·1 (1140·4–1819·4)	14·1 (10·8–17·3)
Achieving universal coverage of select vaccines (excluding influenza)		
Low-income	55·8 (27·2–85·0)	3·3 (1·6–5·0)
Lower-middle-income	319·6 (127·6–521·8)	4·9 (2·0–8·0)
Upper-middle-income	107·0 (53·5–158·4)	4·8 (2·4–7·1)
All LMICs	492·5 (218·3–771·9)	4·7 (2·1–7·4)
WASH and vaccine interventions (combined impact)		
Low-income	627·8 (494·4–734·3)	37·0 (29·1–42·9)
Lower-middle-income	1714·5 (1396·8–2014·2)	26·4 (21·6–31·0)
Upper-middle-income	395·6 (327·3–463·5)	17·8 (14·7–20·8)
All LMICs	2680·5 (2197·1–3122·9)	25·5 (20·9–29·7)
WASH and vaccine interventions (combined impact, excluding influenza)		
Low-income	473·2 (342·4–572·4)	27·9 (20·2–33·4)
Lower-middle-income	1054·2 (755·3–1319·0)	16·2 (11·7–20·3)
Upper-middle-income	224·7 (163·9–282·3)	10·1 (7·4–12·7)
All LMICs	1695·8 (1247·8–2083·3)	16·1 (11·9–19·8)

Figure 3: Human antibiotic use averted by scaling up WASH and vaccine interventions
(A) Annual per capita antibiotic use rates. (B) Annual projected antibiotic use (as of 2030) avertible by implementation of WASH and vaccine interventions. See the second paper in this Series for details.[31] Scenarios: countries achieve universal access to WASH infrastructure and countries achieve universal coverage with paediatric vaccines. Effects with and without universal coverage with seasonal influenza vaccines are shown in yellow and green, respectively. We present stratified estimates for countries by low-income, lower-middle-income and upper-middle-income groupings (left) and for all LMICs (centre). Estimated volumes of antibiotic use as of 2030 apply age-specific estimates of use rates to projected changes in population size for each country.[31] Bars indicate median estimates, with accompanying lines denoting 95% CIs. Numerical estimates (right) convey median estimates, with accompanying 95% CIs. DDD=defined daily doses. LMICs=low-income and middle-income countries. WASH=water and sanitation.

In healthcare facilities in LMICs, at least **one in 10 patients** acquire health care associated infections (HCAIs) WHO Global Strategy for IPC

Lack of national surveillance systems for reporting HCAIs in many LMICs – As of 2022, **70 countries actively report data to WHO** Pallett et al., WHO Bulletin 2023



Pallett et al., WHO Bulletin 2023

Antibiotic Prescription Chart

Ward

Patient Label | Weight | eGFR | Allergies

Infection Episode 1 — Diagnosis: ☐ Pneumonia ☐ UTI ☐ Meningitis ☐ Line infection ☐ Cellulitis ☐ Intra-abdominal infection ☐ Other

Source*: ☐ Community acquired ☐ Hospital acquired — Indication: P = Prophylactic E = Empirical D = Definitive

SEND APPROPRIATE CULTURES BEFORE PRESCRIBING ANTIBIOTICS

Cultures: ☐ Sent before antibiotics ☐ Sent after antibiotics ☐ Not Sent

Antibiotic Day 1 2 3 4 5 6 7 8 9 10 — Date / Time

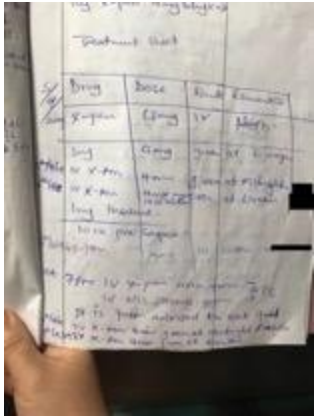
Indication ☐ P ☐ E ☐ D — Medicine Approved Name or GE — Dose — Route — Start Date — Stop Date — Frequency — Time — Drs Signature & Name — Contact — Pharmacy

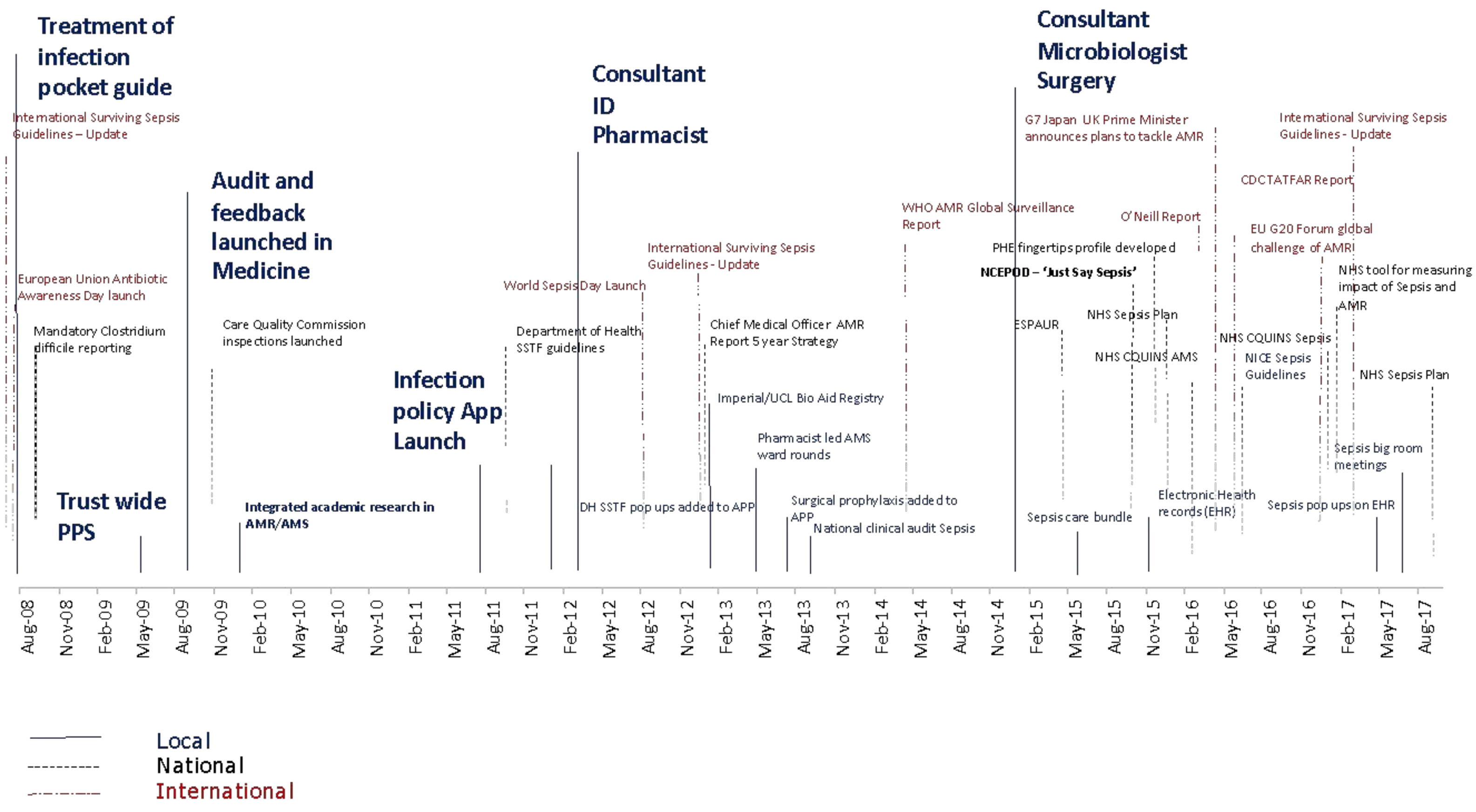
Nursing Codes 1. Patient away from Ward 2. Nil by Mouth 3. Patient refused drug 4. Drug not yet obtained 5. Patient Could not receive drug e.g. vomiting

Antibiotic Stewardship Team Alerts

Figure 1. Antibiotic Prescription Chart [25].

doi: 10.1371/journal.pone.0079747.g001





Treatment of infection pocket guide
International Surviving Sepsis Guidelines – Update
European Union Antibiotic Awareness Day launch
Mandatory Clostridium difficile reporting
Trust wide PPS
Audit and feedback launched in Medicine
Care Quality Commission inspections launched
Integrated academic research in AMR/AMS
Infection policy App Launch
World Sepsis Day Launch
Department of Health SSTF guidelines
Consultant ID Pharmacist
DH SSTF pop ups added to APP
International Surviving Sepsis Guidelines - Update
Chief Medical Officer AMR Report 5 year Strategy
Imperial/UCL Bio Aid Registry
Pharmacist led AMS ward rounds
Surgical prophylaxis added to APP
National clinical audit Sepsis
WHO AMR Global Surveillance Report
PHE fingertips profile developed
NCEPOD – 'Just Say Sepsis'
Consultant Microbiologist Surgery
G7 Japan UK Prime Minister announces plans to tackle AMR
ESPAUR
Sepsis care bundle
NHS Sepsis Plan
NHS CQUINS AMS
O'Neill Report
Electronic Health records (EHR)
International Surviving Sepsis Guidelines - Update
CDCTATFAR Report
EU G20 Forum global challenge of AMR
NHS CQUINS Sepsis
NICE Sepsis Guidelines
NHS tool for measuring impact of Sepsis and AMR
NHS Sepsis Plan
Sepsis big room meetings
Sepsis pop ups on EHR
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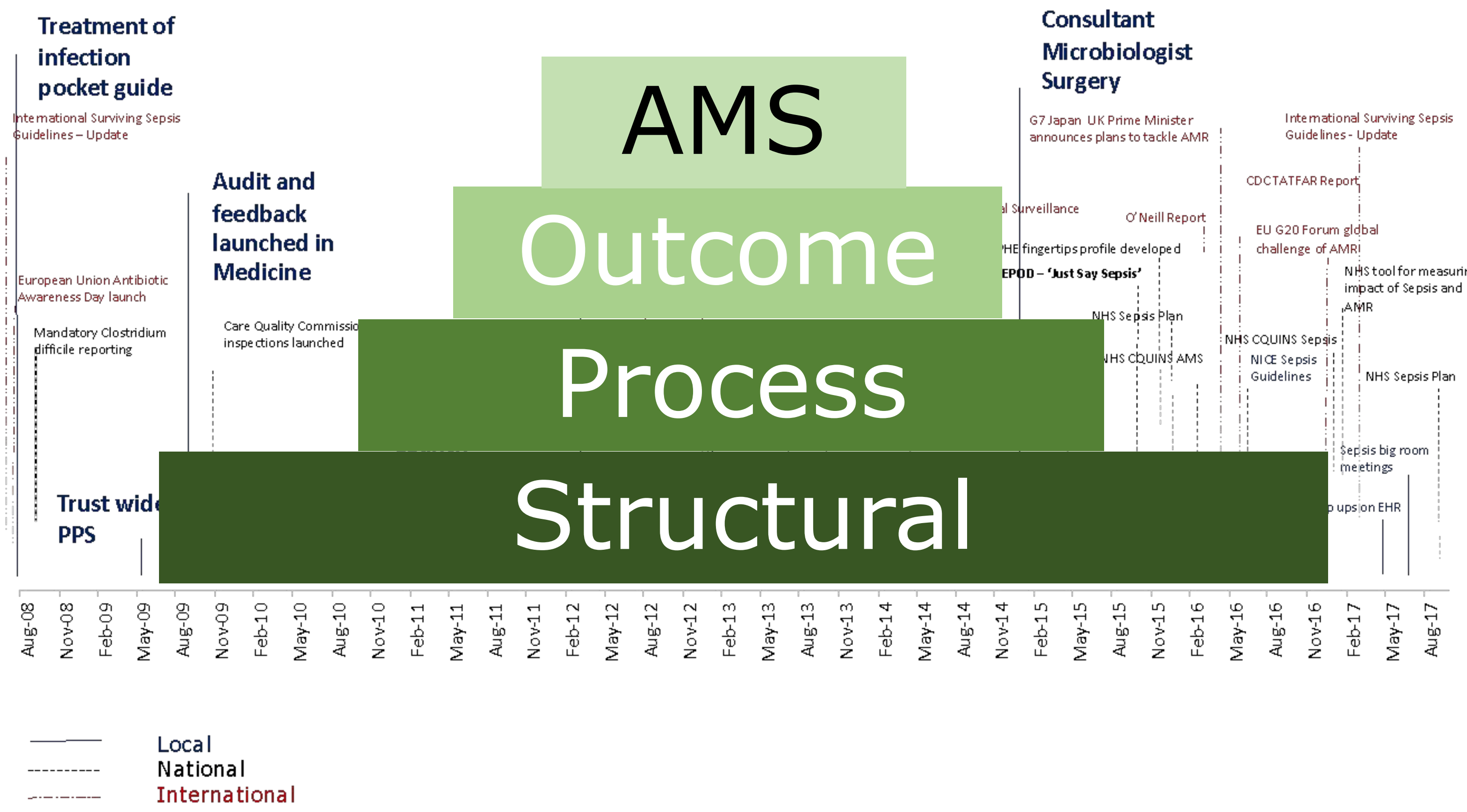
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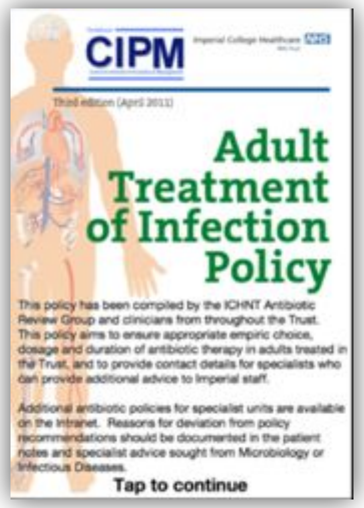
..from paper pocket guide[1]



… to smartphone app[1]

… to boundary object[2,3]

..to incentives and gaming[3]

..to AI and CDSS[3]


Journal of Antimicrobial Chemotherapy

Effect of adding a mobile health intervention to a multimodal antimicrobial stewardship programme across three teaching hospitals: an interrupted time series study


Clinical Microbiology and Infection


A Real-world Evaluation of a Case-based Reasoning Algorithm to Support Antimicrobial Prescribing Decisions in Acute Care


scientific reports

Point-of-care SARS-CoV-2 serological assays for enhanced case finding in a UK inpatient population


Comparison of deep learning with regression analysis in creating predictive models for SARS-CoV-2 outcomes

AI, artificial intelligence; CDSS, clinical decision support systems; IV, intravenous; NHS, National Health Service.
1. Imperial Antibiotic Prescribing Policy (IAPP). Available at: https://www.imperial.ac.uk/medicine/hpru-amr/applications-and-tools/imperial-antibiotic-prescribing-policy-iapp/ Accessed June 2021; 2. Photo by National Cancer Institute. Available at: https://unsplash.com/s/photos Accessed June 2021; 3. Speaker's personal image; 4. Charani E, et al. *J Antimicrob Chemother* 2017;72:1825–31; 5. Rawson TM, et al. *Clin Microbiol Infect* 2017;23:524–32; 6. Rawson TM, et al. *Clin Infect Dis* 2020; doi: 10.1093/cid/ciaa383; 7. Pallett SJC, et al. *Sci Repl* 2021;11:5680; 8. Abdulaal A, et al. *BMC Med Inform Decis Mak* 2020;20:299.

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doi:10.1093/jac/dks492 Advance Access publication 19 December 2012

Journal of Antimicrobial Chemotherapy

An analysis of the development and implementation of a smartphone application for the delivery of antimicrobial prescribing policy: lessons learnt

E. Charani[1]*, Y. Kyratsis[1], W. Lawson[2], H. Wickens[2], E. T. Brannigan[2], L. S. P. Moore[1] and A. H. Holmes[1]

J Antimicrob Chemother 2017; **72**: 1825–1831
doi:10.1093/jac/dkx040 Advance Access publication 28 February 2017

Journal of Antimicrobial Chemotherapy

Effect of adding a mobile health intervention to a multimodal antimicrobial stewardship programme across three teaching hospitals: an interrupted time series study

E. Charani[1]*, M. Gharbi[1], L. S. P. Moore[1], E. Castro-Sanchéz[1], W. Lawson[2], M. Gilchrist[2] and A. H. Holmes[1]

[1]NIHR Health Protection Research Unit in Healthcare Associated Infection and Antimicrobial Resistance at Imperial College London, Du Cane Road, London W12 0NN, UK; [2]Imperial College Healthcare National Health Service Trust, St Mary's Hospital, Praed Street, London W2 1NY, UK

Charani et al. BMC Medicine 2014, 12:29
http://www.biomedcentral.com/1741-7015/12/29

BMC Medicine

COMMENTARY — Open Access

Do smartphone applications in healthcare require a governance and legal framework? It depends on the application!

Esmita Charani*, Enrique Castro-Sánchez, Luke SP Moore and Alison Holmes

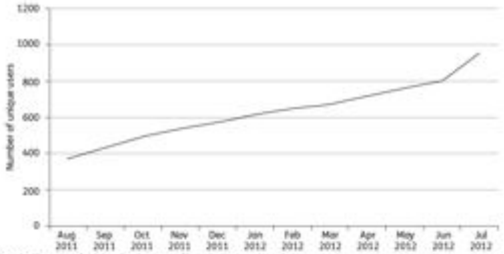

Figure 2. Monthly adoption rate of the application by staff over a 12 month period.

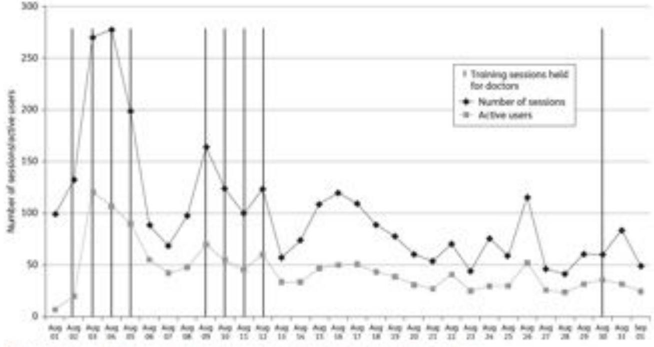

Figure 3. Using smartphone technology to track the use of policy in real time over its first month of release.

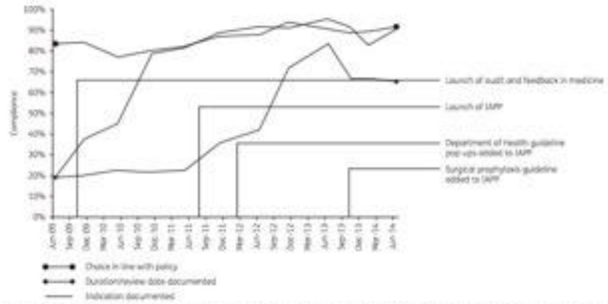

Figure 2. Timeline of PPS data for the three indicators; the launch of the Department of Health's 'Start Smart Then Focus' guidelines and the addition of the surgical prophylaxis policy to the IAPP are indicated.

Access to antibiotics

E. Charani et al. / The Lancet Regional Health - Europe 7 (2021) 100161 5

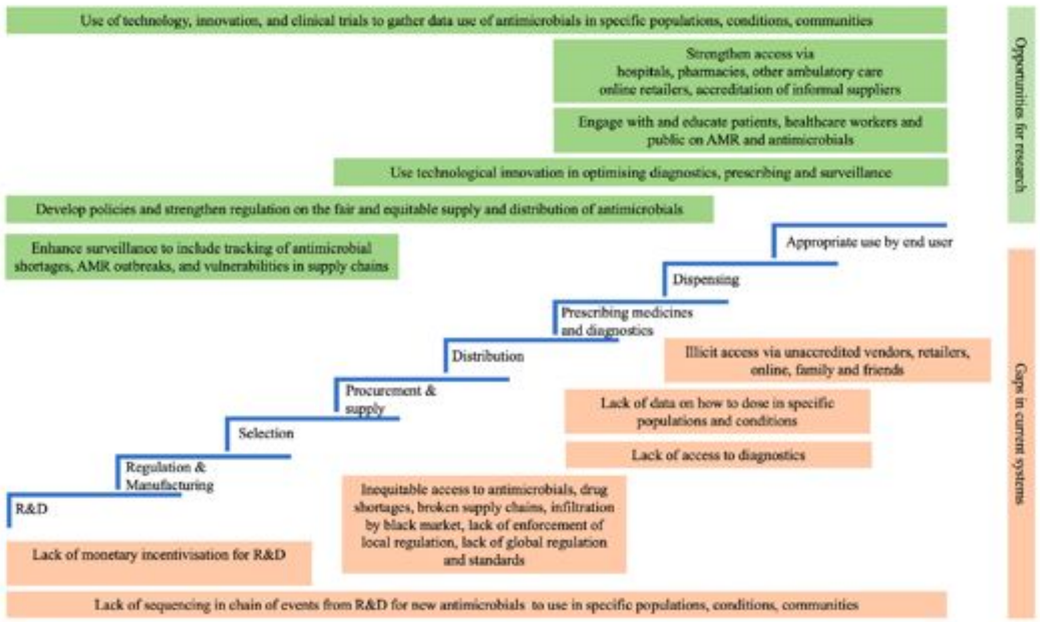

Figure 2. The antimicrobial drug supply chain indicating gaps in current systems and opportunities for research, adapted from the WHO framework for development and stewardship to combat antimicrobial resistance (AMR)[60]
R&D: research and development

Charani et al., Lancet Regional Health Europe (2021)

Sustained access to antibiotics

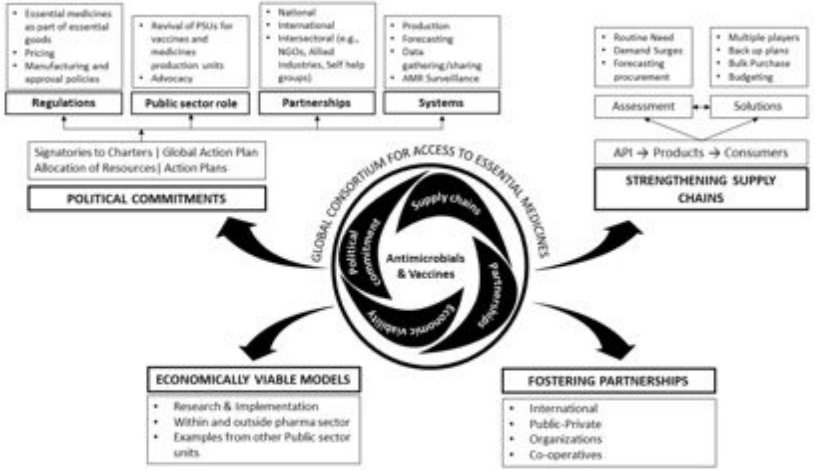

Figure 2 A proposed consortium for assuring access to antimicrobials and vaccines. API, active pharmaceutical ingredients; NGOs, non-governmental organisations; PSU, Public Sector Undertakings.

Current research on shortages and mitigation strategies

Shafiq et al., 2020

Clinical Microbiology and Infection xxx (xxxx) xxx

Contents lists available at ScienceDirect

Clinical Microbiology and Infection

journal homepage: www.clinicalmicrobiologyandinfection.com

Systematic review

A systematic review of antibiotic drug shortages and the strategies employed for managing these shortages

Avaneesh Kumar Pandey [1], Jennifer Cohn [2], Vrinda Nampoothiri [3], Uttara Gadde [4], Amrita Ghataure [5], Ashish Kumar Kakkar [1], Yogendra Kumar Gupta [6,7], Samir Malhotra [1], Oluchi Mbamalu [8], Marc Mendelson [8], Anne-Grete Märtson [9], Sanjeev Singh [3], Thomas Tängdén [10], Nusrat Shafiq [1], Esmita Charani [8,11,*]

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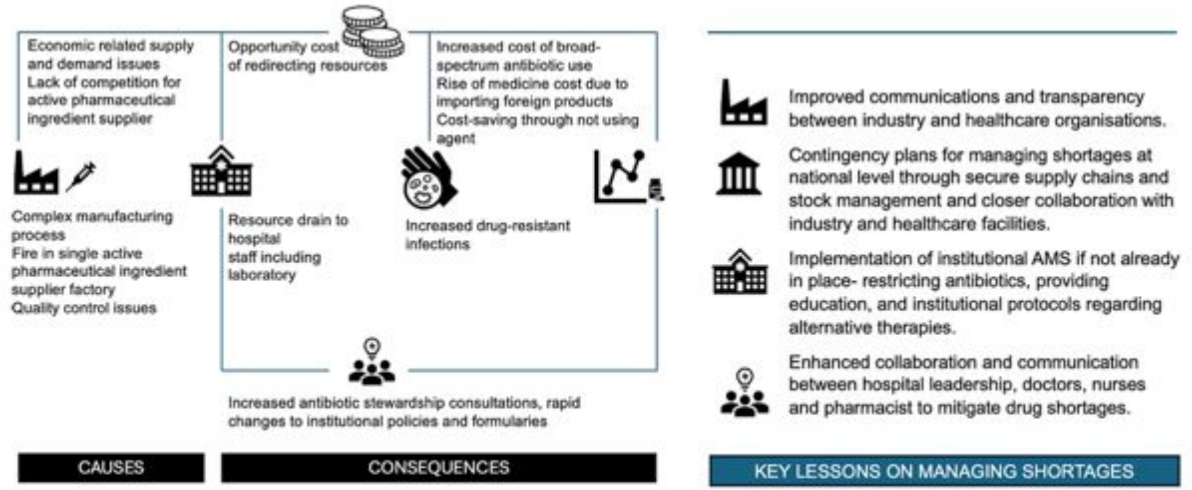

Fig. 2. Piperacillin-tazobactam shortages: a case study of causes, consequences, and recommendations for managing shortages. AMS, antimicrobial stewardship programmes.

GARDP Global Antibiotic Research & Development Partnership

wellcome

Singh et al. Antimicrob Resist Infect Control (2021) 10:32
https://doi.org/10.1186/s13756-020-00873-9

Antimicrobial Resistance and Infection Control

REVIEW — Open Access

A road-map for addressing antimicrobial resistance in low- and middle-income countries: lessons learnt from the public private participation and co-designed antimicrobial stewardship programme in the State of Kerala, India

Sanjeev Singh[1*], Esmita Charani[2], Sarada Devi[3], Anuj Sharma[4], Fabia E
Anup Warrier[5], P. S. Shareek[6], A. V. Jaykrishnan[7] and K. Ellangovan[8]

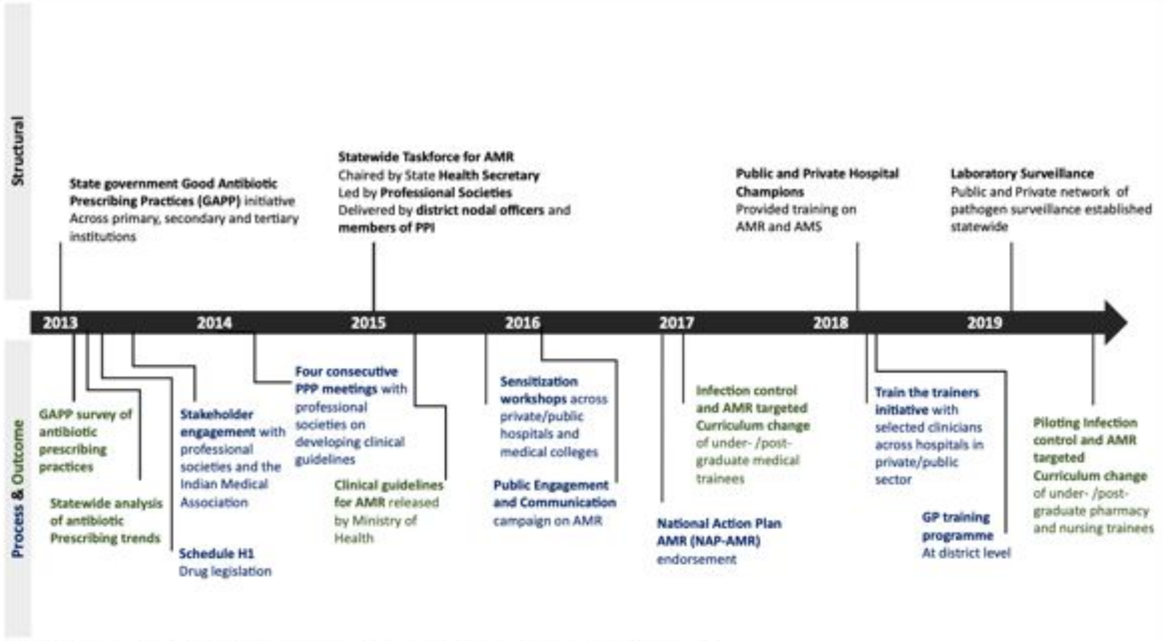

Fig. 1 A road map of the state-wide antimicrobial stewardship plan to tackle AMR in Kerala

Singh et al. Antimicrob Resist Infect Control (2021) 10:32
https://doi.org/10.1186/s13756-020-00873-9

Antimicrobial Resistance
and Infection Control

REVIEW

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Sanjeev Singh
Anup Warrier, P.

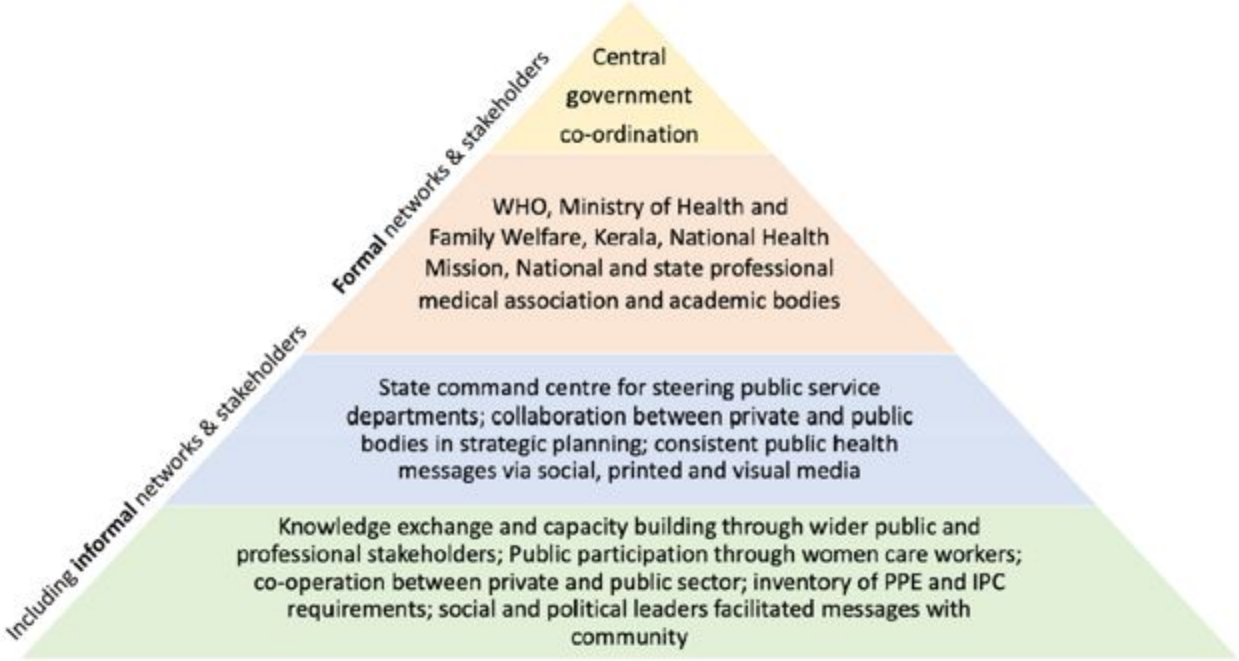


Fig. 2 Lessons learnt from PPP and co-designed AMS initiatives at Kerala

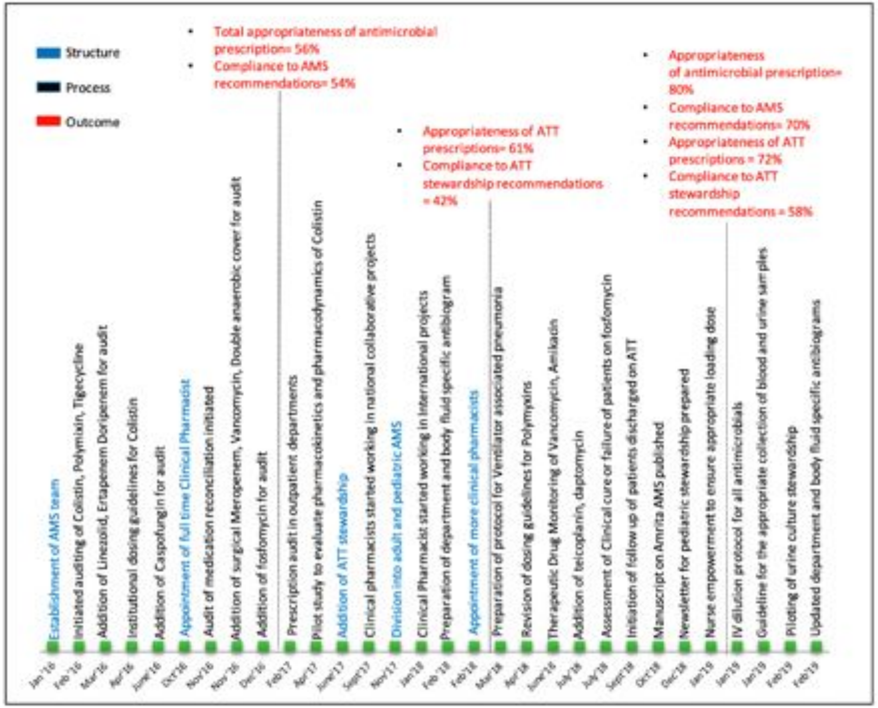
Workforce engagement

antibiotics MDPI

Article

Mapping the Implementation of a Clinical Pharmacist-Driven Antimicrobial Stewardship Programme at a Tertiary Care Centre in South India

Vrinda Nampoothiri [1], Akkulath Sangita Sudhir [1], Mariam Varsha Joseph [1], Zubair Mohamed [2], Vidya Menon [3], Esmita Charani [4] and Sanjeev Singh [1,*]



PhD registered at Amrita: The role of the clinical pharmacist in antimicrobial stewardship programmes

JAC Antimicrob Resist
https://doi.org/10.1093/jacamr/dlae047

JAC-Antimicrobial Resistance

Pharmacist roles in antimicrobial stewardship: a qualitative study from India, South Africa and the United Kingdom

Vrinda Nampoothiri[1]*, Oluchi Mbamalu[2], Marc Mendelson[2], Sanjeev Singh[3] and Esmita Charani[2,4,5]

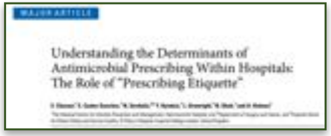
[1]Department of Health Sciences Research, Amrita Institute of Medical Sciences, Amrita Vishwa Vidyapeetham, Kochi, Kerala, India; [2]Division of Infectious Diseases & HIV Medicine, Department of Medicine, Groote Schuur Hospital, University of Cape Town, Cape Town, South Africa; [3]Department of Medical Administration, Amrita Institute of Medical Sciences, Amrita Vishwa Vidyapeetham, Faridabad, Haryana, India; [4]Department of Infection Control and Epidemiology, Amrita Institute of Medical Science, Amrita Vishwa Vidyapeetham, Kochi, Kerala, India; [5]Faculty of Health and Life Sciences, University of Liverpool, Liverpool, UK

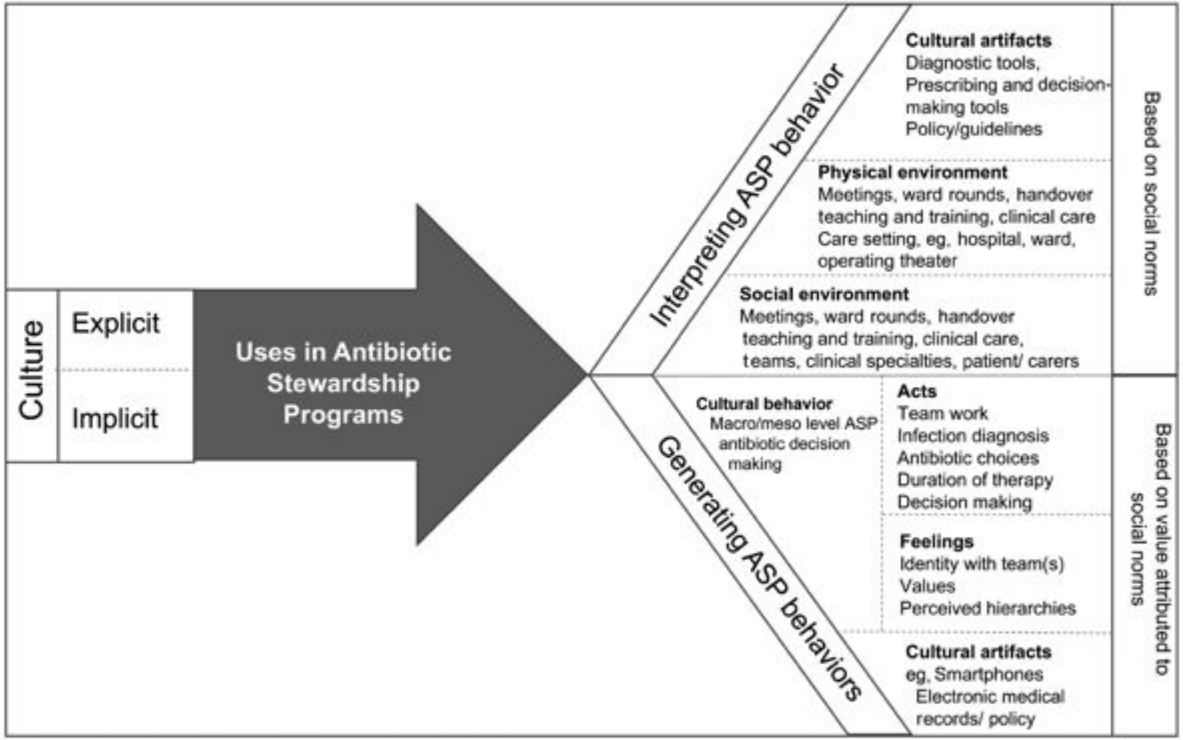
*Corresponding author. E-mail: vrindanampoothiri@yahoo.com

Table 1. Key responsibilities delivered by pharmacists in AMS in the different countries included in this study

Key responsibilities handled by pharmacist	India	SA		UK
		Public	Private	
Review of antimicrobials	x	x	x	x
Communication of recommendations to clinicians	x	x	x	x
Making changes to prescriptions directly				x
Responsibilities within pharmacy		x	x	x
Ward based clinical pharmacy responsibilities				x
Outpatient AMS				x
Policy level work		x		x
Training of pharmacy interns and other healthcare professionals	x	x	x	x
In hospital quality improvement projects	x			x
Research projects in collaboration with other universities	x	x		x
Answering drug related queries	x	x	x	x
Development of antimicrobial guidelines	x	x		x
Diagnostic stewardship	x			
Therapeutic drug monitoring	x			x
Members of hospital level committees such as pharmacy and therapeutic committee, antimicrobial committee etc.		x	x	x
Academic role		x		

Antibiotic prescribing is a complex social process





Antibiotic prescribing as a **'behaviour'** - a complex, dynamic social process, influenced by many determinants.

'Unwritten rules' influence antibiotic prescribing behaviours.

Clinical autonomy and hierarchies overrule policies, guidelines and expert input.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Original article

Understanding antibiotic decision making in surgery—a qualitative analysis

E. Charani[1,*], C. Tarrant[2], K. Moorthy[3], N. Sevdalis[4], L. Brennan[5], A.H. Holmes[1]
[1] NIHR Health Protection Research Unit in Antimicrobial Resistance and Healthcare Associated Infection, Department of Medicine, Imperial College, London, UK
[2] Department of Health Sciences, University of Leicester, Leicester, UK
[3] Department of Surgery and Cancer, Imperial College Healthcare NHS Trust, London, UK
[4] Centre for Implementation Science, Health Service and Population Research Department, King's College London, London, UK
[5] Department of Anaesthesia, Cambridge University Teaching Hospitals, Cambridge, UK

Use of blood culture and culture and sensitivity
Data to aid diagnosis
Clinical markers inappropriately used to diagnose infection
ICD- 9 Coding
Definition of infections e.g. Sepsis
Who is actually practicing 'stewardship'?


Charani et al. Antimicrobial Resistance and Infection Control (2019) 8:151
https://doi.org/10.1186/s13756-019-0603-6
Antimicrobial Resistance and Infection Control

RESEARCH Open Access

Antibiotic prescribing in general medical and surgical specialties: a prospective cohort study

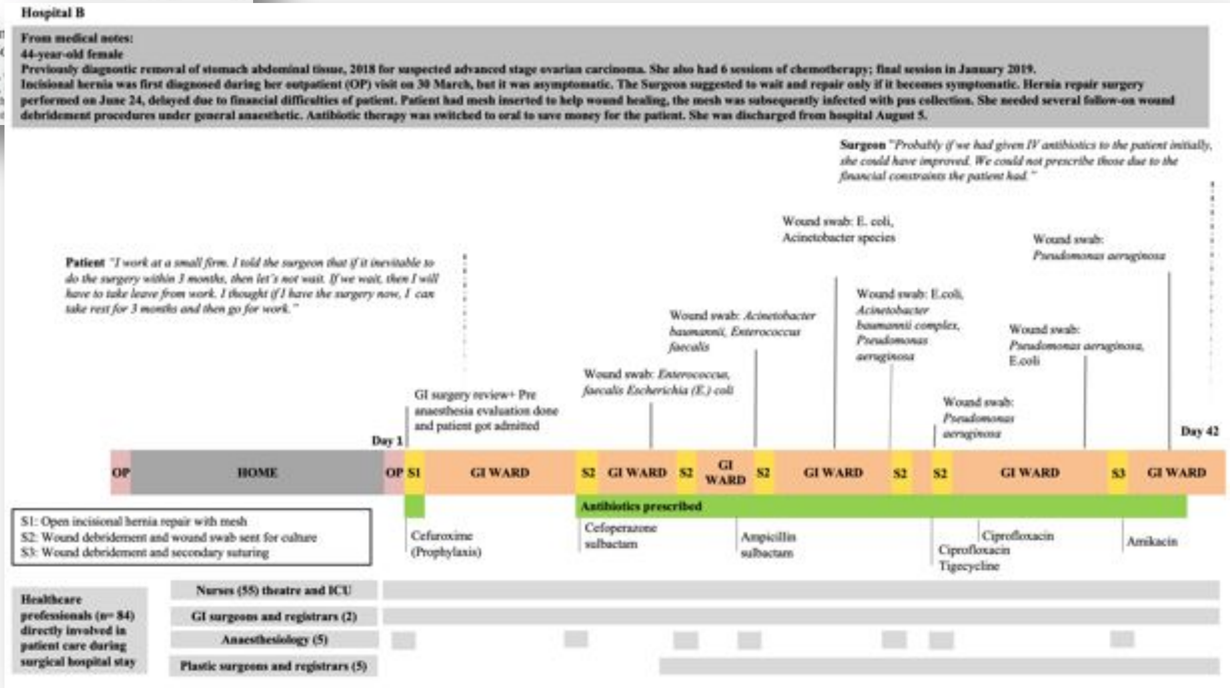
E. Charani[1*], E. de Barra[2], T. M. Rawson[1], D. Gill[3], M. Gilchrist[4], N. R. Naylor[1] and A. H. Holmes[1]

Antibiotics in surgery are

1) prescribed more frequently (p=0.001);
2) for longer (p=0.016);
3) more likely to be escalated (p=0.004);
4) less likely to be compliant with local policy (p<0.001) than medicine


Attention

Contextual factors influencing behaviours



Rationalising irrational prescribing, a study from paediatric surgical population


JAC Antimicrob Resist
https://doi.org/10.1093/jacamr/dlae105

JAC-Antimicrobial Resistance

Rationalizing irrational prescribing—infection-related attitudes and practices across paediatric surgery specialties in a hospital in South India

Surya Surendran, Vrinda Nampoothiri, Puneet Dhar, Alison Holmes, Sanjeev Singh and Esmita Charani

Mixed method approach with ethnography and review of antibiotic prescribing at tertiary care hospital in Kerala

Empirical broad spectrum antibiotic prescribing in 83% (n= 98) surgical patients

Limited influence of well-established stewardship team

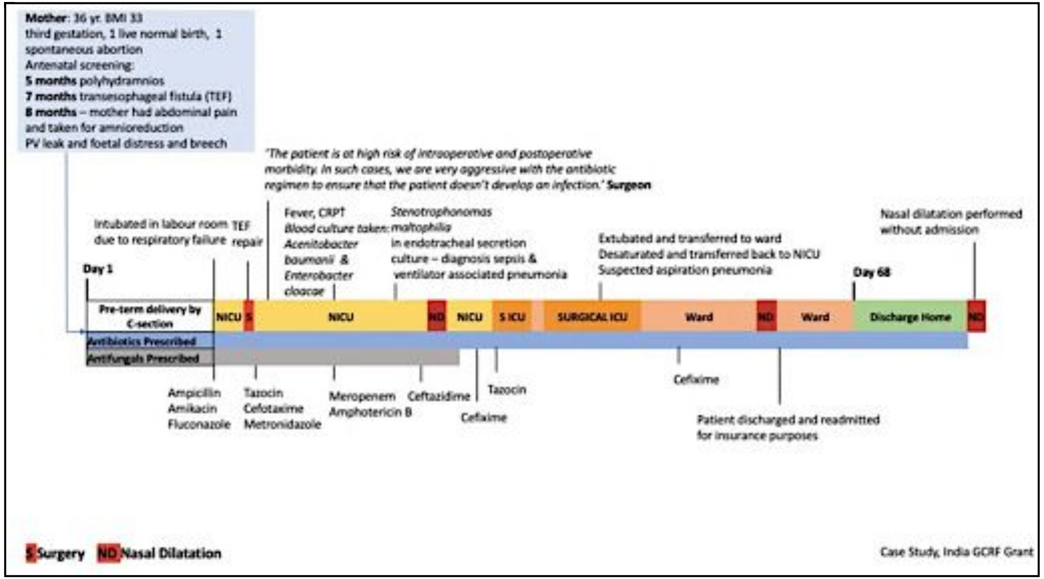
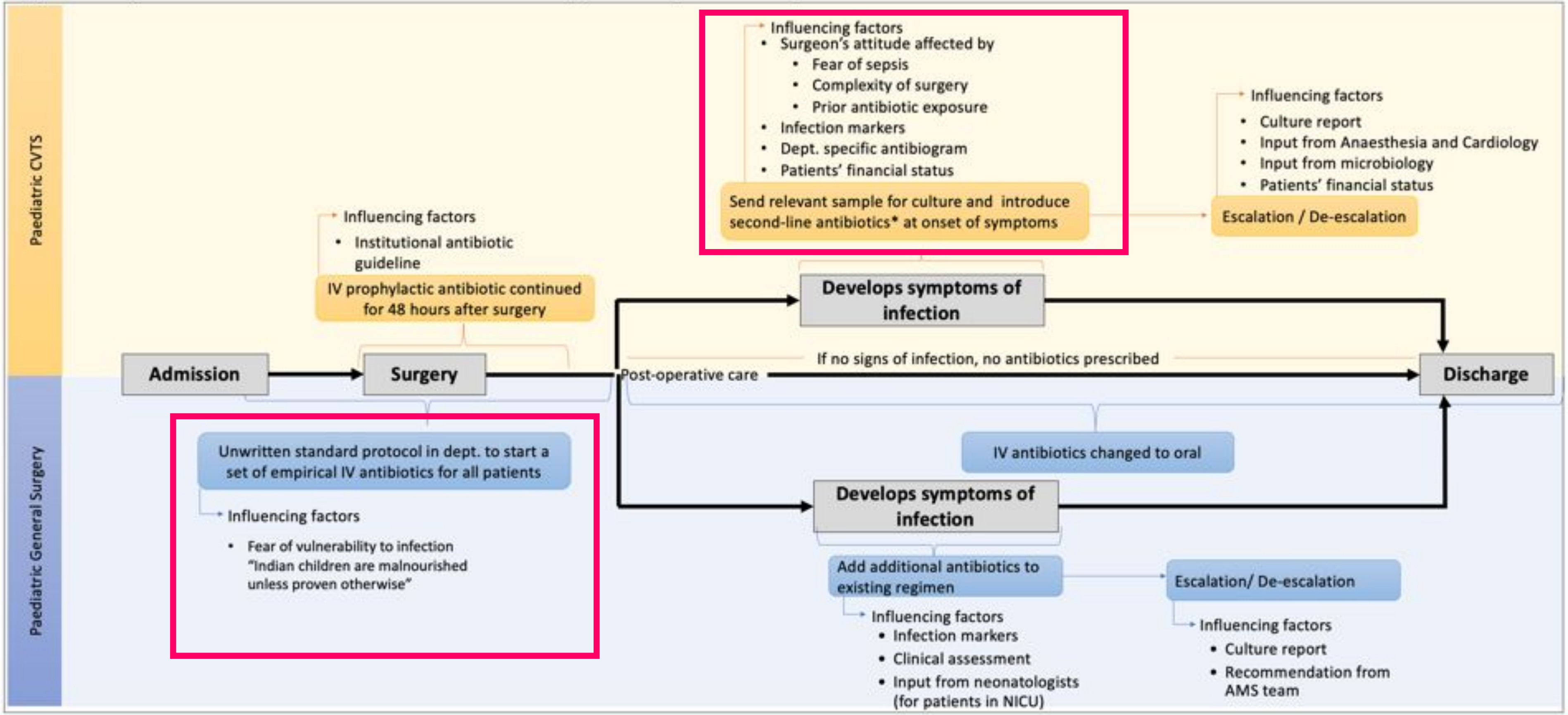


Figure 2: Key factors which influence the infection management in pediatric departments



Surendran et al 2024 IJID

International Journal of Infectious Diseases

Prospective antimicrobial stewardship interventions by multidisciplinary teams to reduce neonatal antibiotic use in South Africa: The Neonatal Antimicrobial Stewardship (NeoAMS) study

Angela Dramowski, Pavel Prusakov, Debra A. Goff, Adrian Brink, Nelesh P. Govender, Ama Sakoa Annor, Liezl Balfour, Adrie Bekker, Azraa Cassim, Michelle Gijzelaar, Sandi L. Holgate, Sonya Kolman, Angeliki Messina, Hafsah Tootla, Natalie Schellack, Andriette van Jaarsveld, ...a Conradie, Anika M. van Niekerk, ...ette Andrews, Magdel Dippenaar, ...ky Chirwa, Hannelie Erasmus, ...Teresa Kriel, Dini Mawela, Masego Moncho, ...Charani, Pablo J. Sánchez, ...NeoAMS Study Team

A. Dramowski, P. Prusakov, D.A. Goff et al. International Journal of Infectious Diseases 146 (2024) 107158

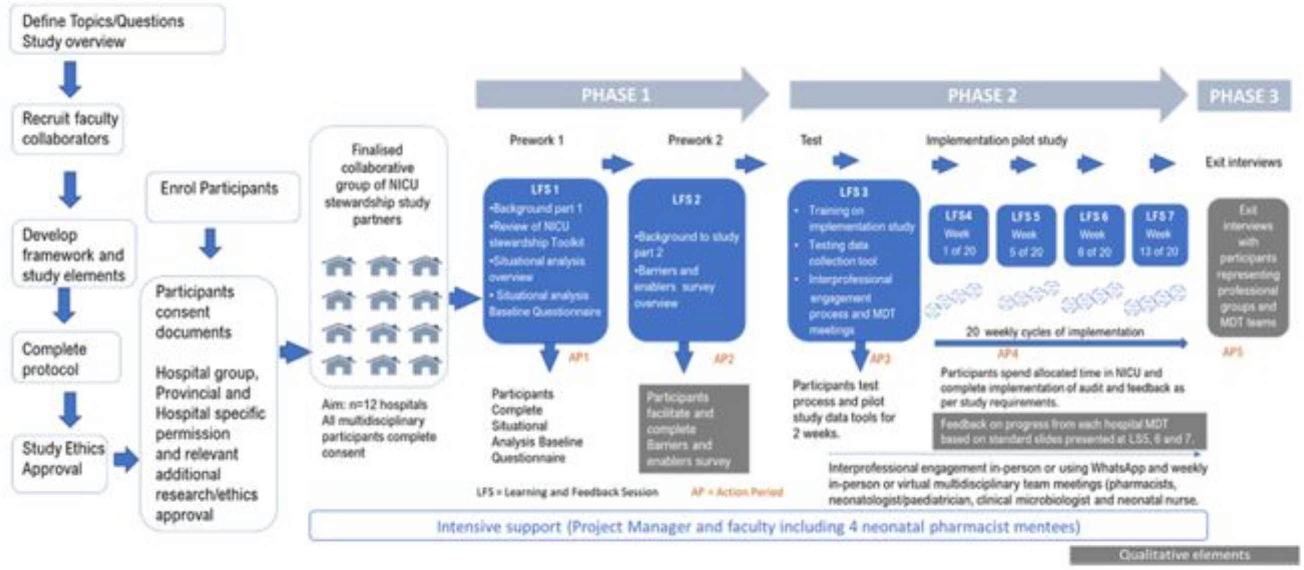
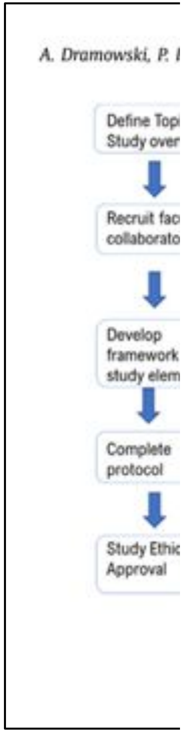


Figure 1. NeoAMS study procedures using the Breakthrough Series Collaborative Study Design.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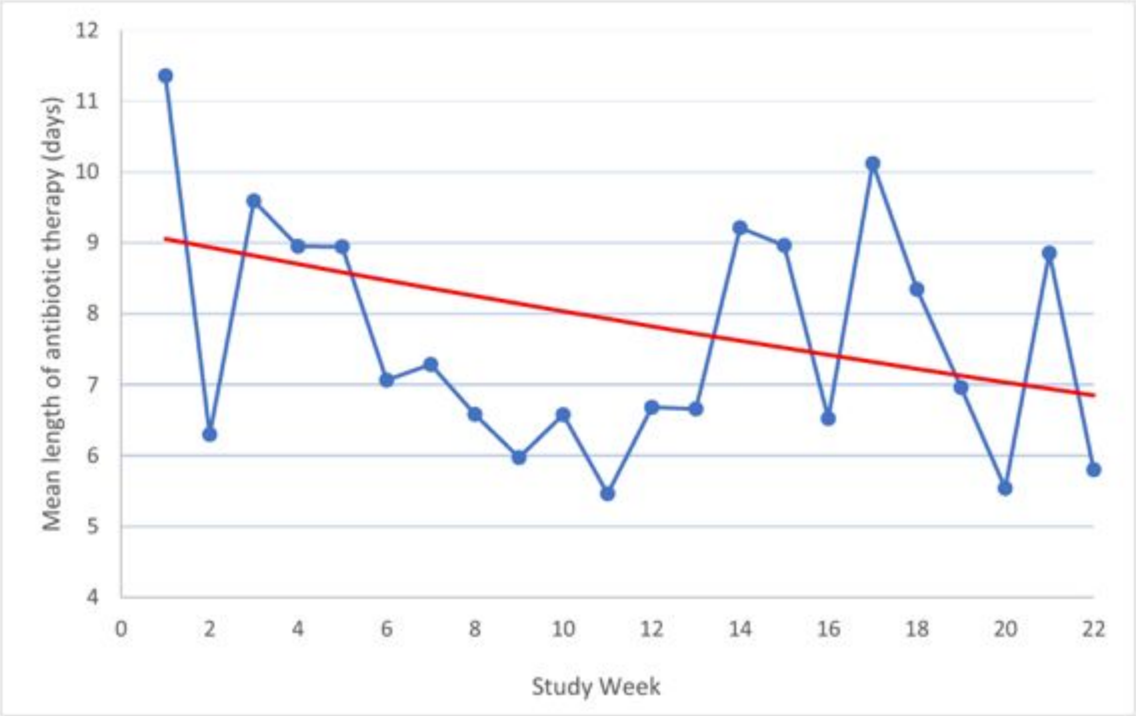
Mean length of antibiotic therapy (days)
12
11
10
9
8
7
6
5
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0
2
4
6
8
10
12
14
16
18
20
22
Study Week

Thank you

Wellcome Trust, WHO TDR, Eh!woza

Candice Bonaconsa, Anastasia Koch, Sanjeev Singh, Vrinda Nampoothiri, Ritika Kondal, Avaneesh Pandey, Arunima Sehgal Mukherjee, Nusrat Shafiq, Sipho Dlamini, Marc Mendelson

Closing Remarks

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Thank you.

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