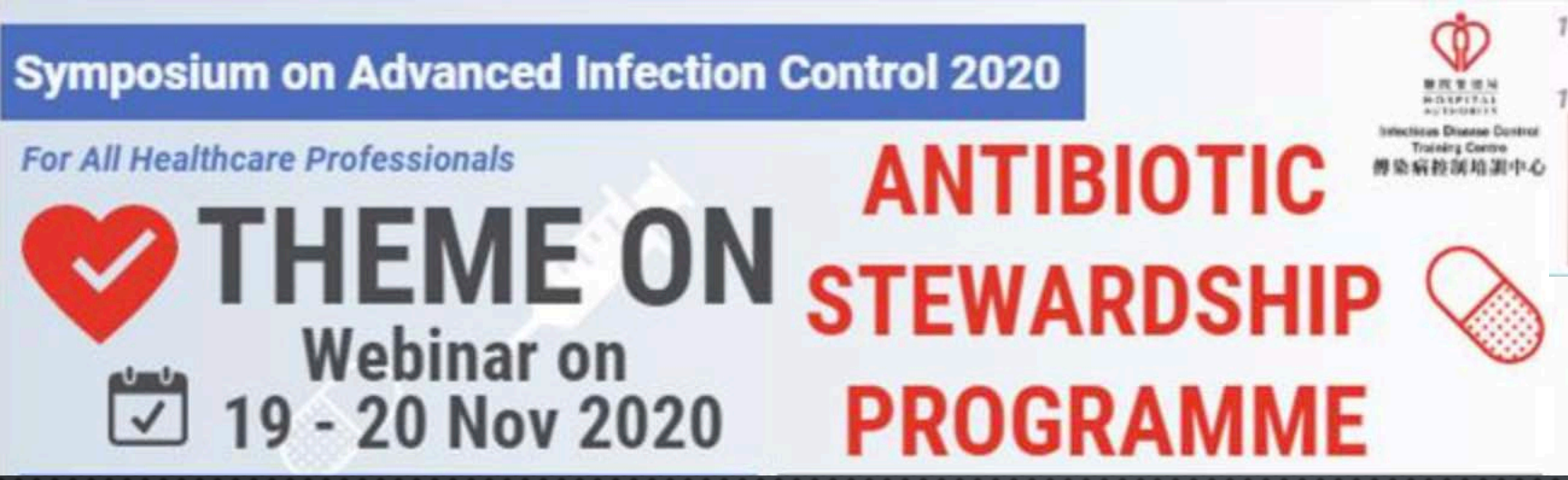


DEVELOPING AND IMPLEMENTING A NATIONAL ASP

DILIP NATHWANI

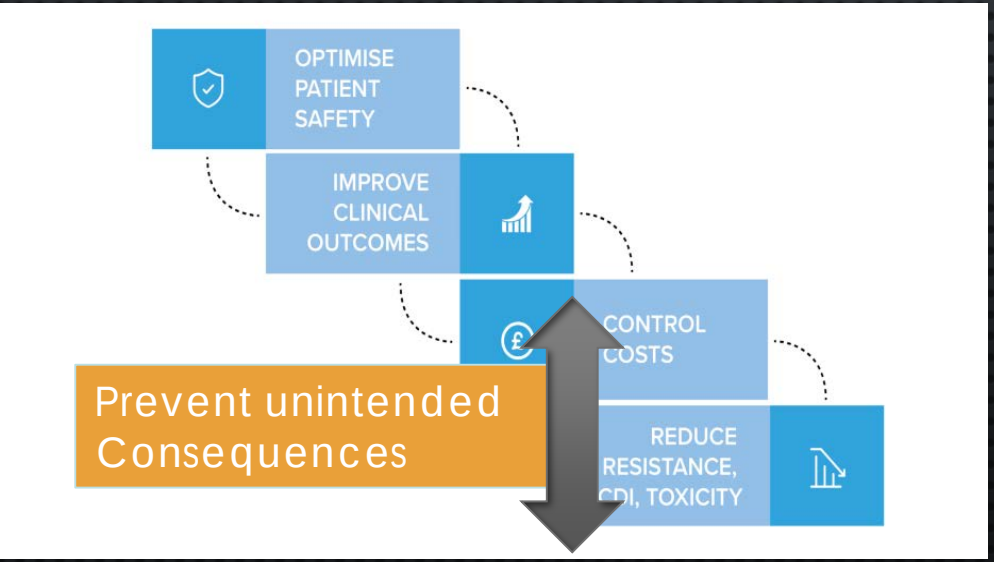
NOVEMBER 2020

OBJECTIVES

1. IMPACT OF AMS, AMS INTERVENTIONS
2. NATIONAL AMS APPROACHES
3. DEVELOPING AN ACTION PLAN FOR UK AND SCOTLAND
4. IMPLEMENTATION FOCUSED APPROACH IN SCOTLAND- DEVOLVED ADMINISTRATION
5. IMPACT
6. LESSONS LEARNT

ANTIMICROBIAL STEWARDSHIP: DEFINITION AND GOALS

The term ‘antimicrobial stewardship’ is defined as ‘an organisational or healthcare-system-wide approach to promoting and monitoring judicious use of antimicrobials to preserve their future effectiveness’.



Antimicrobial stewardship has been defined as “the optimal selection, dosage, and duration of antimicrobial treatment that results in the best clinical outcome for the treatment or prevention of infection, with minimal toxicity to the patient and minimal impact on subsequent resistance.

- **Minimize misdiagnoses or delayed diagnoses leading to underuse or overuse of antibiotics- diagnostic stewardship**

INTERVENTIONS TO IMPROVE ANTIBIOTIC PRESCRIBING PRACTICES FOR HOSPITAL INPATIENTS

Authors' conclusions:

We found high-certainty evidence that interventions are effective in increasing compliance with antibiotic policy and reducing duration of antibiotic treatment. Lower use of antibiotics probably does not increase mortality and likely reduces length of stay. Additional trials comparing antibiotic stewardship with no intervention are unlikely to change our conclusions. Enablement consistently increased the effect of interventions, including those with a restrictive component. Although feedback further increased intervention effect, it was used in only a minority of enabling interventions. Interventions were successful in safely reducing unnecessary antibiotic use in hospitals, despite the fact that the majority did not use the most effective behaviour change techniques. Consequently, effective dissemination of our findings could have considerable health service and policy impact. Future research should instead focus on targeting treatment and assessing other measures of patient safety, assess different stewardship interventions, and explore the barriers and facilitators to implementation. More research is required on unintended consequences of restrictive interventions.

Less antibiotics
No increase in mortality
Reduced LOS

Cochrane Library

9 February 2017


Cochrane Database of Systematic Reviews

Interventions to improve antibiotic prescribing practices for hospital inpatients

Cochrane Systematic Review - Intervention | Version published: 09 February 2017 see what's new

View article information

Peter Davey | Charis A Marwick | Claire L Scott | Esmita Charani | Kirsty McNeil | Erwin Brown | Ian M Gould | Craig R Ramsay | Susan Michie

View authors' declarations of interest

EDITORIAL

Antimicrobial stewardship: we know it works; time to make sure it is in place everywhere

Diamantis Plachouras, Susan Hopkins

Cochrane Database of Systematic Reviews 2017;(2):ED000119 https://doi.org/10.1002/14651858.ED000119

Publication date: 9 February 2017

~15% IMPROVEMENT

equally effective in reducing prescribing after six months.[6] The recent update demonstrates that enabling and restrictive interventions are associated with a 15% increase in compliance with desired practice, a 1.95-day decrease in duration of antibiotic treatment, and a 1.12-day decrease in inpatient length of stay, without compromising patient safety.[3]

Impact of antibiotic stewardship programmes in Asia: a systematic review and meta-analysis

Chun Fan Lee, Benjamin J. Cowling*, Shuo Feng, Hanae Aso, Peng Wu, Keiji Fukuda and Wing Hong Seto

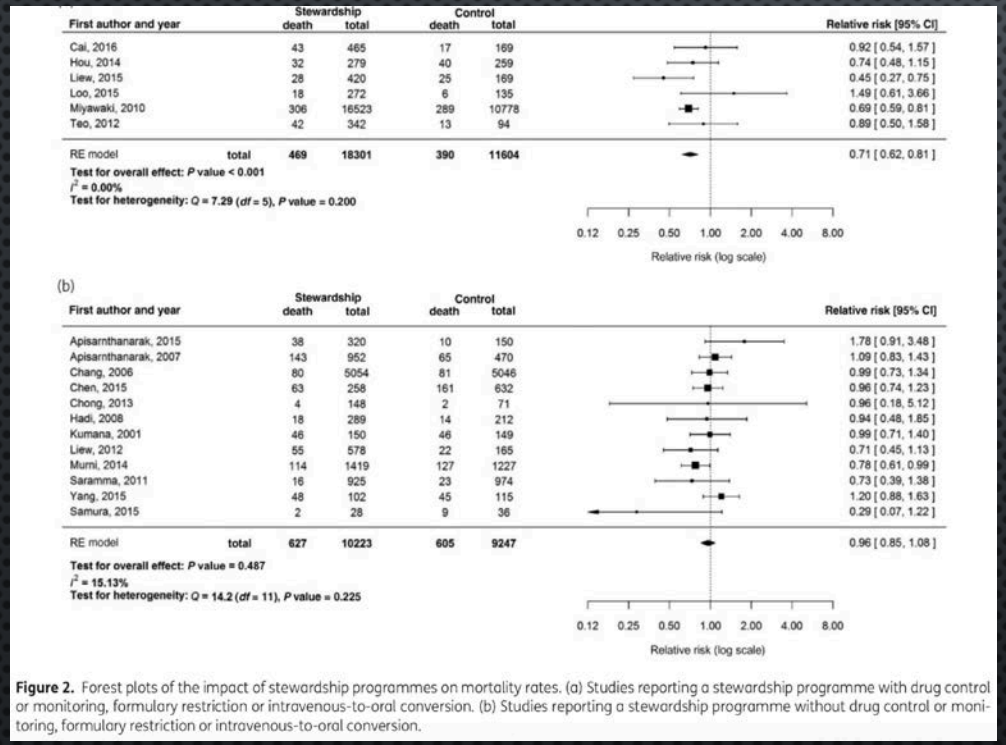


Figure 2. Forest plots of the impact of stewardship programmes on mortality rates. (a) Studies reporting a stewardship programme with drug control or monitoring, formulary restriction or intravenous-to-oral conversion. (b) Studies reporting a stewardship programme without drug control or monitoring, formulary restriction or intravenous-to-oral conversion.

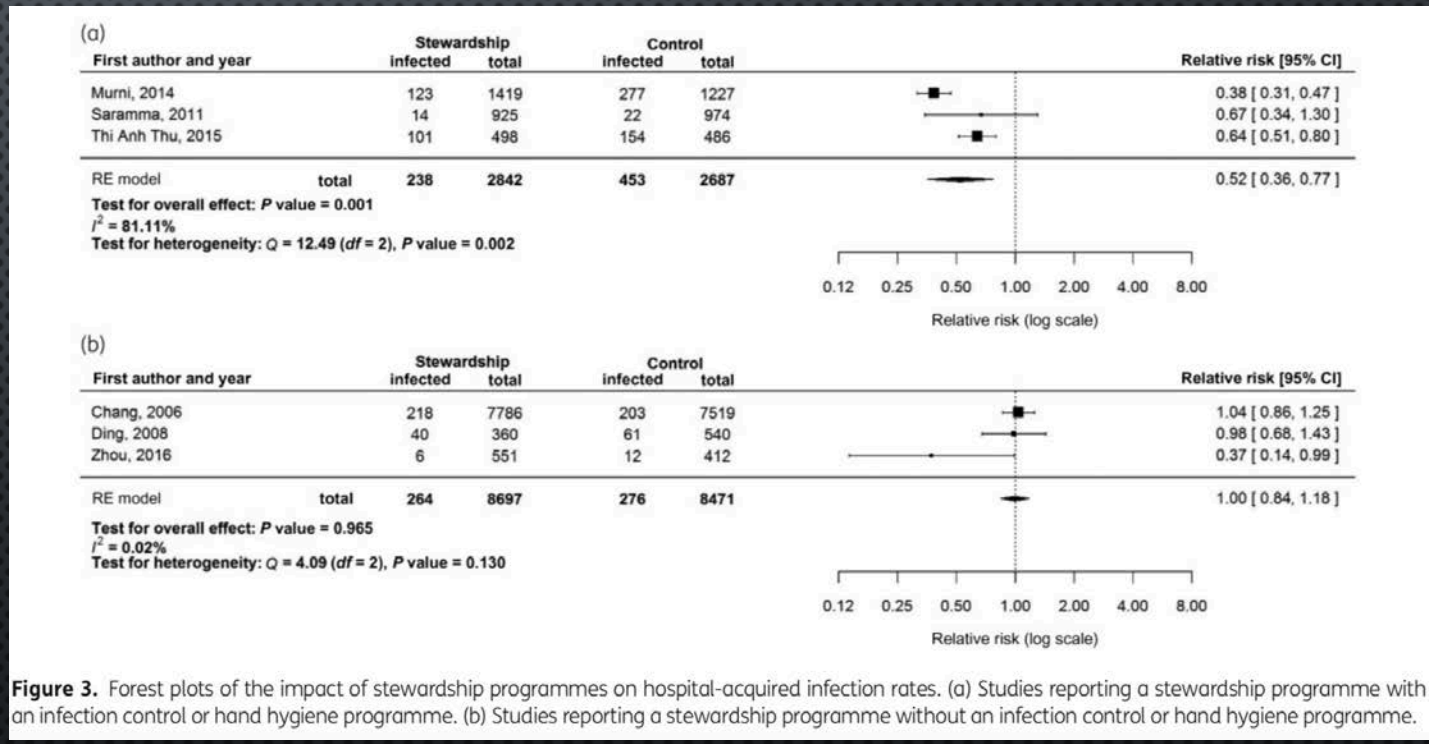


Figure 3. Forest plots of the impact of stewardship programmes on hospital-acquired infection rates. (a) Studies reporting a stewardship programme with an infection control or hand hygiene programme. (b) Studies reporting a stewardship programme without an infection control or hand hygiene programme.

ASP does not increased mortality and in more effective Combined with good IPC

J Antimicrob Chemother 2018; **73**: 844–851

Infection Control & Hospital Epidemiology (2018), **39**, 1237–1245
doi:10.1017/ice.2018.188

Review

Antimicrobial stewardship for acute-care hospitals: An Asian perspective

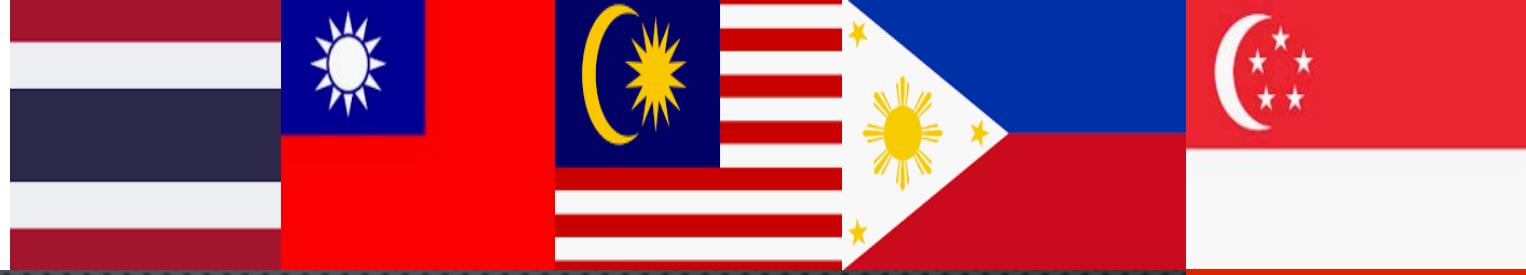
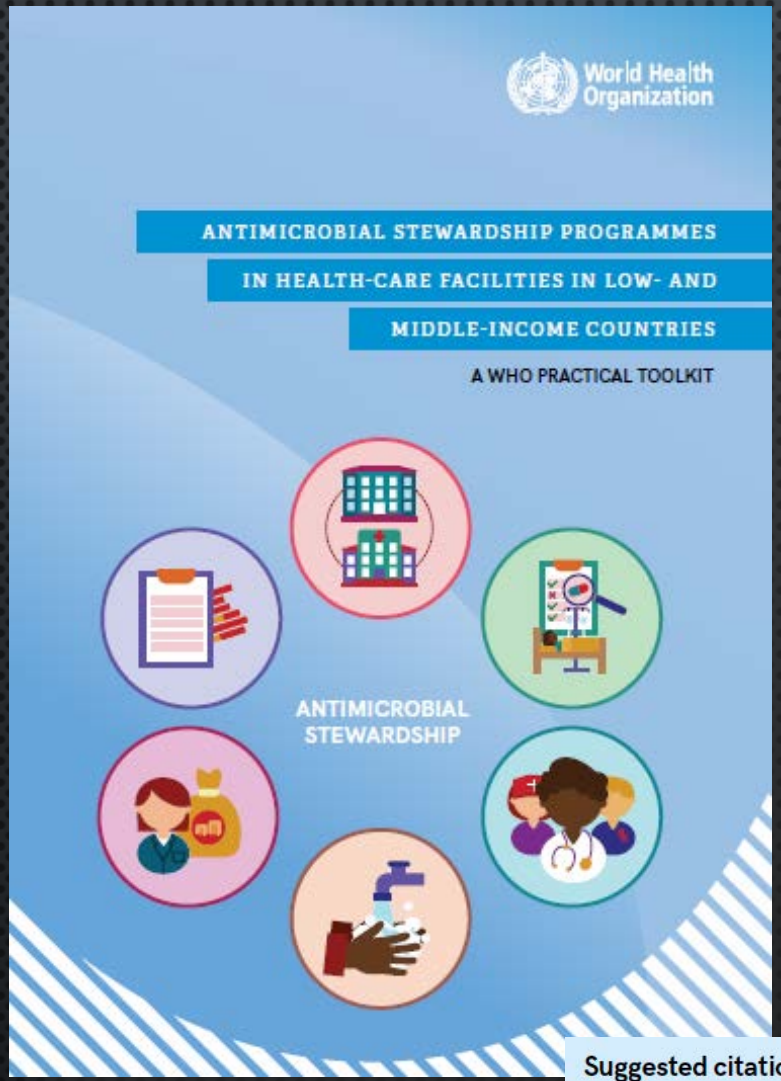


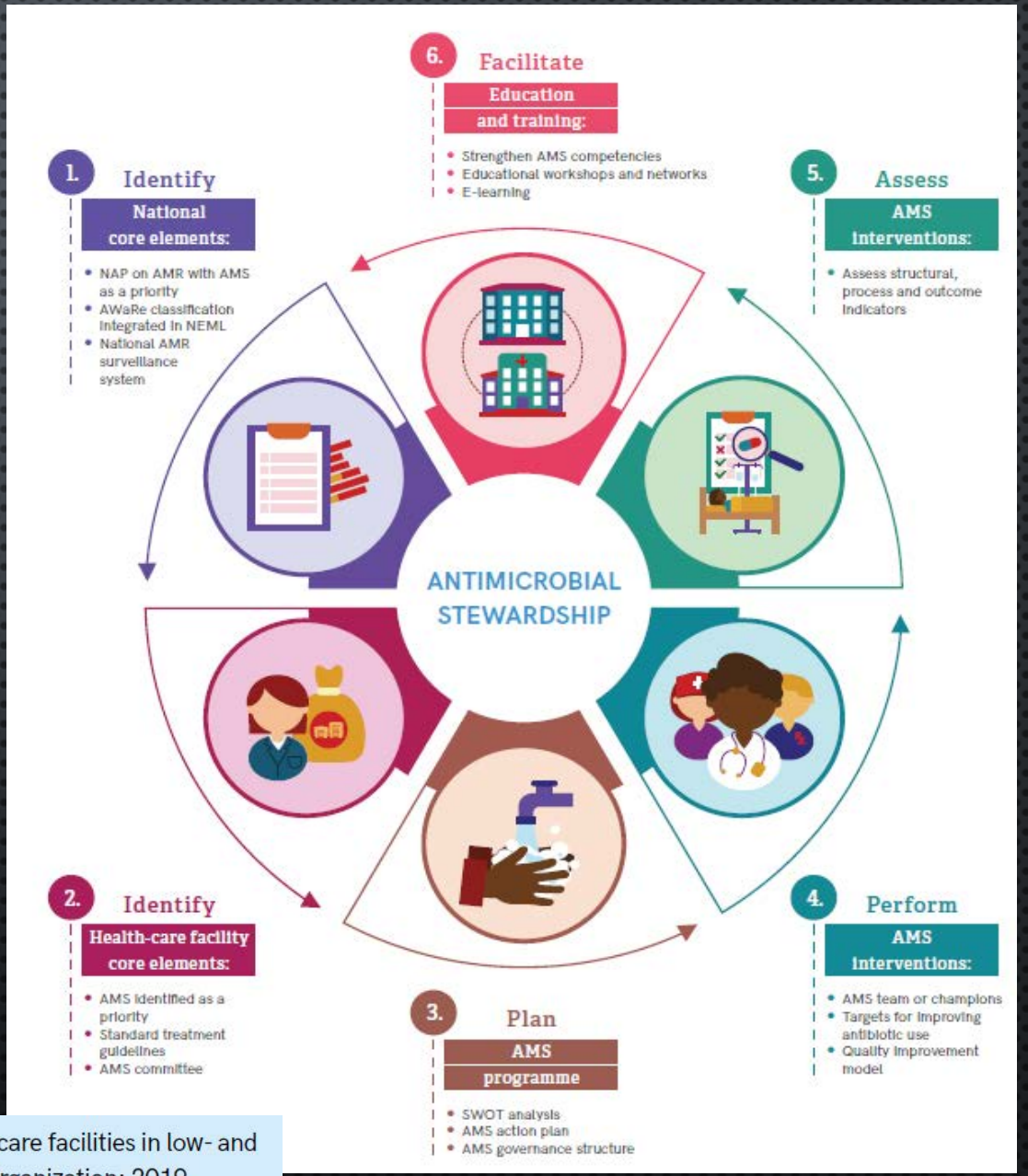
Table 2. Common Gaps and Challenges in Relation to Implementing AMS Programs in Hospitals in Asia

Common Gaps and Challenges in Implementing Hospital AMS Programs in Asia[a]	Potential Solutions to Overcoming Gaps in Hospital AMS Programs[b]
Lack of epidemiological data and surveillance systems	• Prioritize obtaining support for microbiology laboratory services for reliable culture-guided therapy, AMR surveillance and provision of hospital antibiograms
Lack of awareness of AMR	• Provide regular report of AMR data and AMS program performance to relevant hospital departments and hospital administration
Weak infrastructure	• If there is no infrastructure to set up IT systems to support a hospital AMS program, a paper-based system can be used in conjunction with syndrome-specific guidelines.
Insufficient education and training of hospital staff	• Obtain formal support from hospital administration for infectious disease and AMS training, and appropriate time commitment and remuneration for AMS providers based on the size of the hospital • Consider obtaining external infectious disease specialist advice and training from a more well-resourced hospital
Limited funding	• Provide hospital administrators with credible business case to persuade them that funding of an AMS program is beneficial to the hospital • Start small and build capacity over time; gradually introduce AMS interventions by hospital unit or ward
Prescriber resistance to AMS	• Provide regular feedback and education to prescribers in an easily interpreted format • Make efforts to understand the reasons for noncompliance to AMS recommendations and rectify the problems.
Poor infection control	• Include an infection control personnel in the AMS core team • AMS and infection control teams work together under the same leadership to achieve the goal of reducing the rate of multidrug-resistant infections.

Note. AMR, antimicrobial resistance; AMS, antimicrobial stewardship.
[a]See Supplementary Material S1 for an AMS program assessment checklist, for Asian hospitals to assess which aspects of the AMS programs are in place and what gaps need to be addressed.
[b]See Supplementary Material S2 for a flowchart of potential next steps and solutions to overcome gaps and challenges in AMS programs in Asian hospitals.

WHO PRACTICAL TOOLKIT: AMS IN HEALTH-CARE FACILITIES (2019)





Types of AMS interventions for improving antibiotic prescribing practices

INTERVENTION	WHAT IT IS
Persuasive (education)	• Educational meetings (e.g. basics on antibiotic use, case-based discussions, morbidity and mortality, significant event analysis, lectures on specified topics) • Distribution of and training on educational material (e.g. clinical practice guidelines) • Using local key opinion leaders (champions) to advocate for key messages • Reminders provided verbally, on paper or electronically • AMS e-learning resources made available to all health-care personnel • AMS education as part of continuing medical education
Persuasive (feedback)	• Audit with feedback to prescribers on their prescribing practice • AMS as a component of ward rounds (real-time feedback with educational component) • Patient handover meetings between two shifts with real-time feedback by consultants • Local consensus processes for changes in antibiotic treatment or surgical prophylaxis
Restrictive	• Formulary restrictions • Restricted prescribing of identified antibiotics (expert approval prior to prescription) (see Annex V) • Compulsory order forms for targeted antibiotics • Automatic stop orders (e.g. after a single dose of surgical prophylaxis) • Selective susceptibility reporting from the lab
Structural	• Rapid laboratory testing made available • Therapeutic drug monitoring

Suggested citation. Antimicrobial stewardship programmes in health-care facilities in low- and middle-income countries. A practical toolkit. Geneva: World Health Organization; 2019.

ANTIMICROBIAL STEWARDSHIP
Treatment algorithm

Front end

Back end

Start Smart

DO NOT START ANTIBIOTICS IN THE ABSENCE OF CLINICAL EVIDENCE OF BACTERIAL INFECTION

1. Take thorough drug allergy history
2. Initiate prompt effective antibiotic treatment within one hour of diagnosis (or as soon as possible) in patients with severe sepsis or life-threatening infections[α]
3. Comply with local antimicrobial prescribing guidance
4. Document clinical indication (and disease severity if appropriate), dose[β] and route[#] on drug chart and in clinical notes
5. Include review/stop date or duration
6. Obtain cultures prior to commencing therapy where possible (but do not delay therapy)

Then Focus

CLINICAL REVIEW & DECISION AT 48-72 HOURS

Clinical review, check microbiology and make a clear plan. Document this decision

1. STOP
2. IV to oral switch
3. Change antibiotic
4. Continue
5. OPAT*

Document Decision & Next Review Date or Stop Date

DOCUMENT ALL DECISIONS

[α] In accordance with surviving sepsis patient safety alert http://www.england.nhs.uk/wp-content/uploads/2014/09/psa-sepsis.pdf
[β] According to weight/age in children refer to local formulary or BNFc
[#] Use appropriate route in line with severity/patient factors
[*] Outpatient Parenteral Antibiotic Therapy

What Is the More Effective Antibiotic Stewardship Intervention: Preprescription Authorization or Postprescription Review With Feedback?

Clinical Infectious Diseases® 2017;64(5):537–43

Pranita D. Tamma,[1] Edina Avdic,[2] John F. Keenan,[3] Yuan Zhao,[4] Gobind Anand,[5] James Cooper,[6] Rebecca Dezube,[7] Steven Hsu,[8] and Sara E. Cosgrove[9]

Results. There were 2686 and 2693 patients admitted to the PPA and PPRF groups, with 29% and 27% of patients prescribed antibiotics, respectively. Initially, antibiotic DOTs remained relatively unchanged in the PPA arm. When changed to the PPRF arm, antibiotic use decreased (−2.45 DOT per 1000 patient-days [PD]). In the initial PPRF arm, antibiotic use decreased (slope of −5.73 DOT per 1000 PD) but remained constant when changed to the PPA arm. Median patient DOTs in the PPA and PPRF arms were 8 and 6 DOT per 1000 PD, respectively ($P = .03$). Antibiotic therapy was guideline-noncompliant in 34% and 41% of patients on days 1 and 3 in the PPA group ($P < .01$) and in 57% and 36% of patients on days 1 and 3 in the PPRF group ($P = .03$).

Conclusions. PPRF may have more of an impact on decreasing antibiotic DOTs compared with PPA. This information may be useful for institutions without sufficient resources to incorporate both stewardship approaches.

Figure 2. Study design comparing antibiotic use among providers receiving preprescription authorization vs postprescription review with feedback antibiotic stewardship strategies.

Figure 3. Time-series analyses comparing days of antibiotic therapy per 1000 patient-days during the study period. Dotted lines indicate preprescription authorization and solid lines indicate postprescription review with feedback. Dotted vertical line represents the four week washout period, during which antibiotics were not adjudicated.

USE OF POST-PRESCRIPTION REVIEW AND DDD PREDOMINATE IN CHINA HOSPITALS

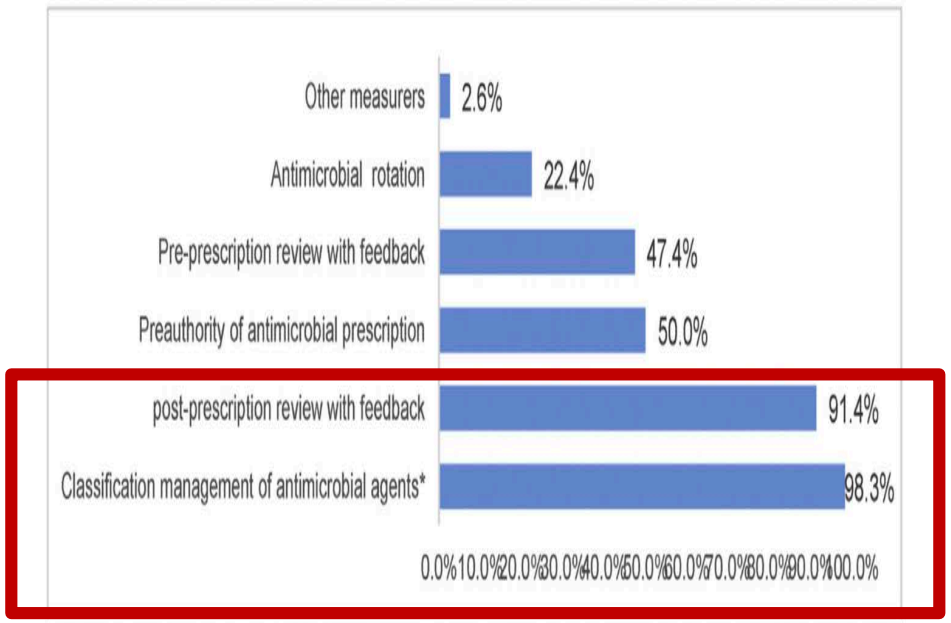


Fig. 2. Antibiotic stewardship interventions in 116 hospitals. Antimicrobial agents are classified into special-use level, restricted-use level and non-restricted-use level in China. Special-use-level antibacterials include imipenem, meropenem, fourth-generation cephalosporins, vancomycin, linezolid, teicoplanin, tigecycline, itraconazole, etc. This kind of antibacterial can be prescribed only by an associated chief physician or higher. Restricted-level antibacterials mainly include: ertapenem, third-generation cephalosporins, ampicillin/sulbactam, piperacillin/tazobactam, etc. This kind of antibacterial can be prescribed only by a attending physician or higher. Non-restricted-level antibacterials include other antibacterials except antibacterials above and can be prescribed by any rank physician.

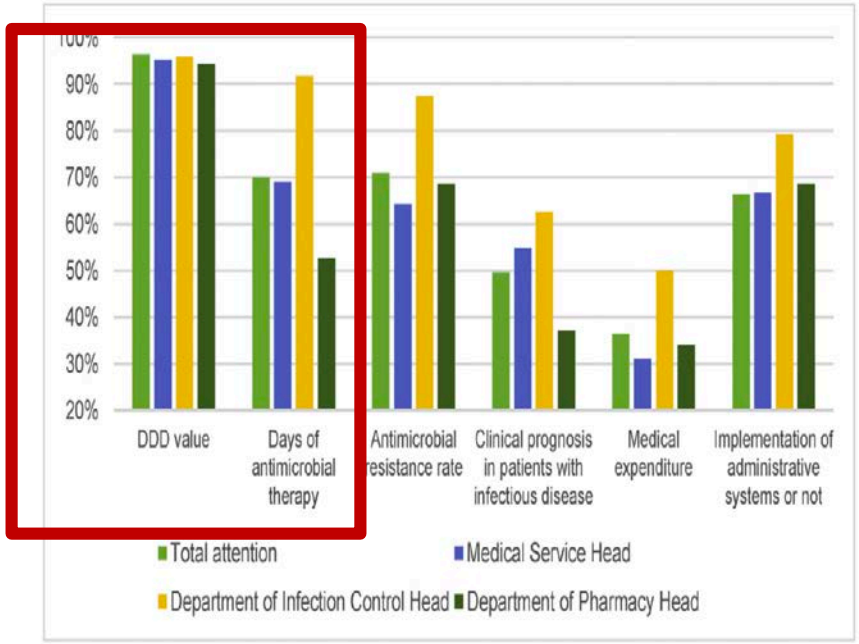


Fig. 3. Attention paid to the measures intended for evaluation of antimicrobial stewardship (AMS) outcome in 116 hospitals. The departments (whether or not for pharmacy, infection control or medical) only evaluated the defined daily dose (DDD) (>94%). But in hospitals where AMS was the responsibility of the pharmacy department, there are a few concerns about clinical prognosis and treatment cost. In hospitals where AMS is the responsibility of the infection control department more attention is paid to the number of days of therapy (DOT), antimicrobial resistance (AMR), clinical prognosis, and the cost of treatment.

A survey on antimicrobial stewardship in 116 tertiary hospitals in China

J. Zhou [1], X. Ma [2,*]

[1)] *Department of Medical Affairs, Peking Union Medical College Hospital Peking, China*
[2)] *Department of Infectious Diseases, Peking Union Medical College Hospital, Peking, China*

Clinical Microbiology and Infection 25 (2019) 759.e9–759.e14

OBJECTIVES

1. IMPACT OF AMS, AMS INTERVENTIONS
2. **NATIONAL AMS APPROACHES**
3. DEVELOPING AN ACTION PLAN FOR UK AND SCOTLAND
4. IMPLEMENTATION FOCUSED APPROACH IN SCOTLAND- DEVOLVED ADMINISTRATION
5. IMPACT
6. LESSONS LEARNT

Impact of national interventions to promote responsible antibiotic use: a systematic review

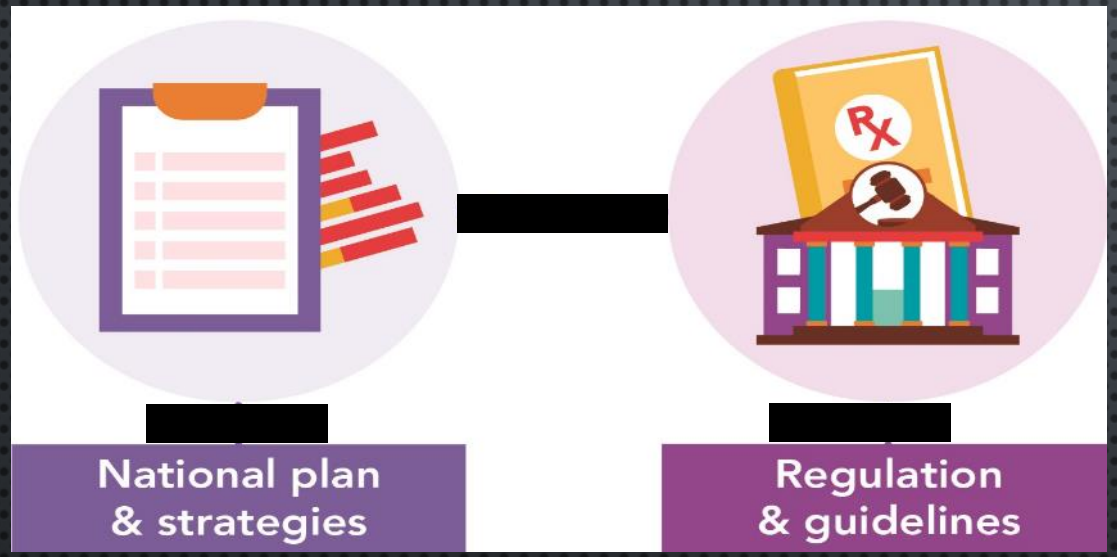
Jane Mingjie Lim [1], Shweta Rajkumar Singh[1], Duong Minh Cam[1], Helena Legido-Quigley[1,2], Hsu Li Yang[1] and Clarence C. Tam[1,2]*

Conclusions: National-level interventions to reduce inappropriate access to antibiotics can be effective. However, evidence is limited to high- and upper-middle-income countries, and more evidence is needed on the long-term sustained impact of interventions. There should also be a simultaneous push towards standardized outcome measures to enable comparisons of interventions in different settings.

J Antimicrob Chemother 2020; **75**: 14–29

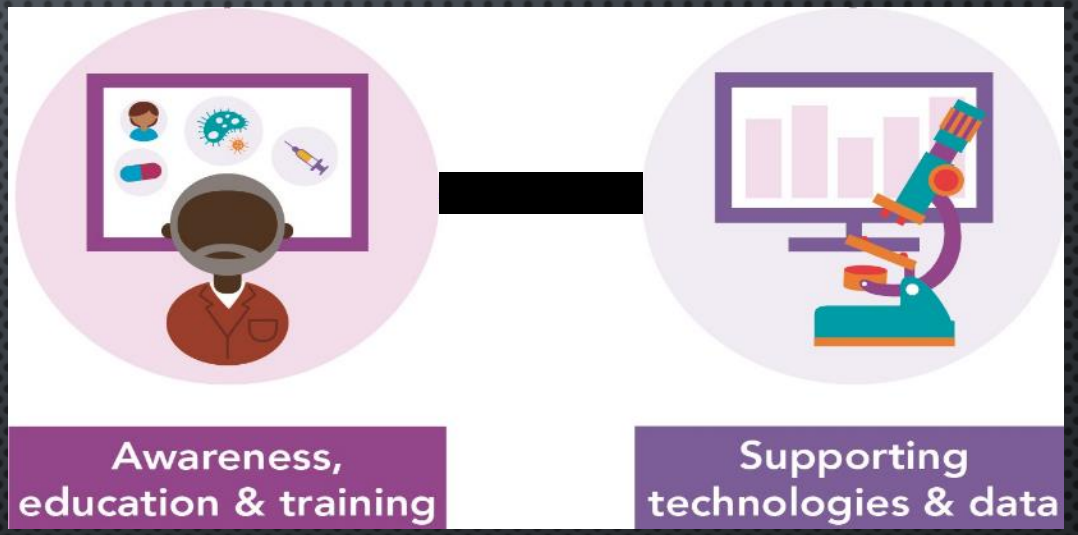
NATIONAL AMS PROGRAMME

Core elements



- ✓ **National Action Plan on AMR**
  - ✓ AMS as a priority
- ✓ **Dedicated NAP funding**
- ✓ **TWG** on AMS (ToR)

- ✓ **National Essential Medicines List**
  - AWaRe classification
- ✓ **Clinical guidelines**
- ✓ **Regulation & enforce** prescription-only sales of Abx



- ✓ **Antibiotic Awareness Campaigns**
- ✓ **Pre- and in-service training** for health professionals

- ✓ **National AMC surveillance**
- ✓ **Point prevalence surveys**
- ✓ **National AMR surveillance system**

NATIONAL AMS PROGRAMME

Key steps in establishing a national AMS programme to enable facility AMS

Audience: Ministry and/or department/s responsible for delivering quality-assured medical care and access to and rational use of medicines

1. Establish a governance structure – e.g. a national AMS technical working group (TWG) (Annex I) linked to the national AMR steering committee.
2. Review and prioritize the national core elements (Chapter 2):
   - 2.1. Identify what is already in place and the level of implementation required.
   - 2.2. Identify the short- and medium/long-term priority core elements.
   - 2.3. Identify the resources required.
3. Identify pilot health-care facilities (public and private) for initial AMS rollout:
   - 3.1. Tertiary teaching facilities;
   - 3.2. Regional/state and/or district facilities; and
   - 3.3. Primary care and/or community (as part of community AMS programmes not covered in this toolkit).
4. Develop a national AMS strategy* with national indicators.
5. Dedicate financial and human resources as required.
6. Monitor and evaluate implementation of the national AMS strategy (Chapter 6).
7. Facilitate access to and/or support pre- and in-service training on optimized antibiotic prescribing (Chapter 7).

* Include community and/or primary care AMS programmes (not covered in this toolkit).

Suggested citation. Antimicrobial stewardship programmes in health-care facilities in low- and middle-income countries. A practical toolkit. Geneva: World Health Organization; 2019.

Managing responsible antimicrobial use: perspectives across the healthcare system

Clinical Microbiology and Infection 23 (2017) 441–447

O.J. Dyar [1,4], G. Tebano [2,4], C. Pulcini [3,*], on behalf of ESGAP (ESCMID Study Group for Antimicrobial stewardshiP)

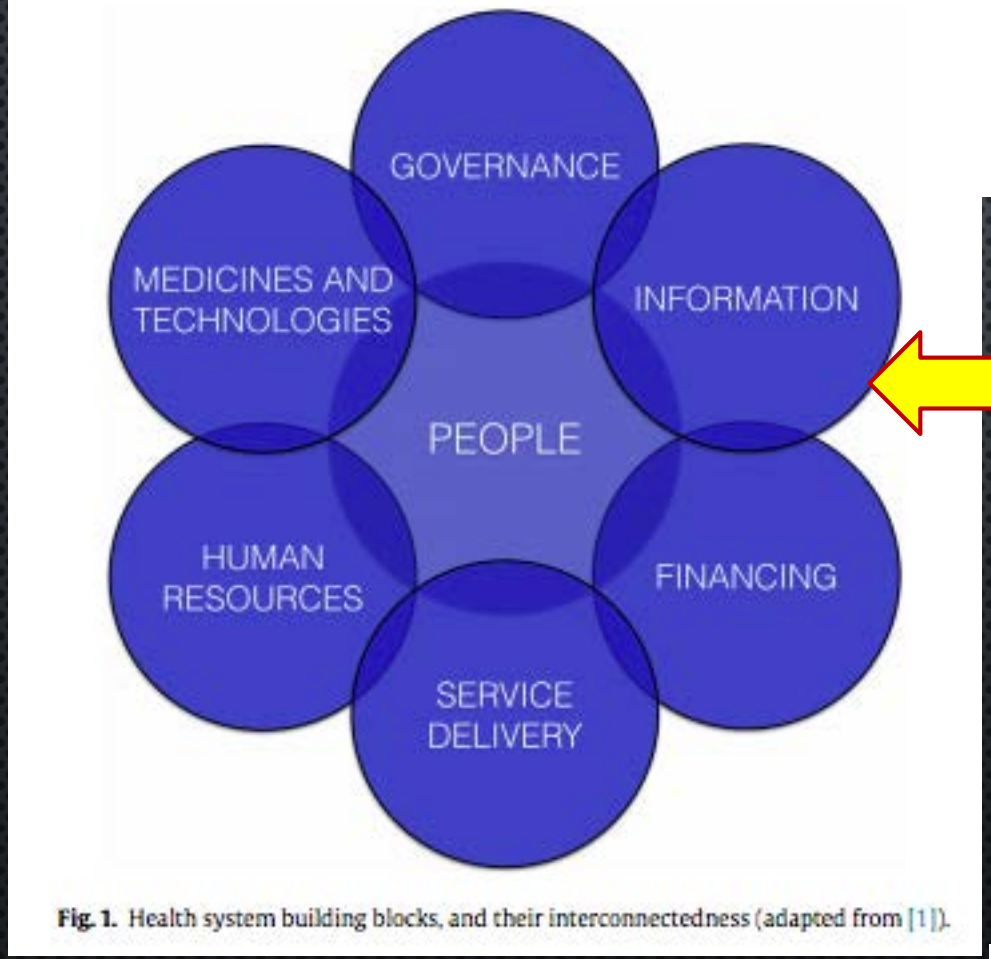
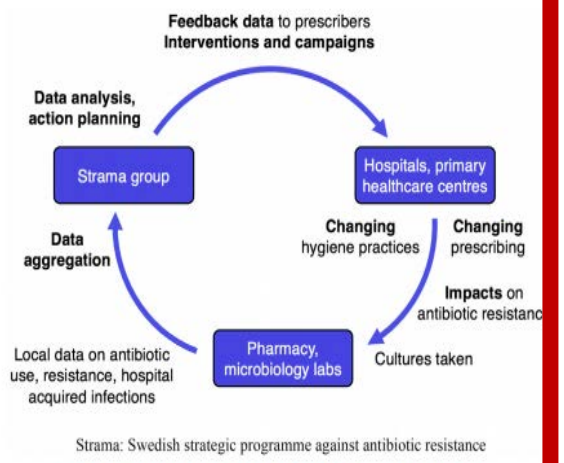


Fig. 1. Health system building blocks, and their interconnectedness (adapted from [1]).



Strama: Swedish strategic programme against antibiotic resistance

Fig. 2. Cyclical learning processes within the Strama network (adapted from [62]).

Hospital
LTCF
Primary care
Others

Example of One system Approach

Lessons learnt during 20 years of the Swedish strategic programme against antibiotic resistance

Sigvard Mölstad,[a] Sonja Löfmark,[b] Karin Carlin,[a] Mats Erntell,[c] Olov Aspevall,[b] Lars Blad, Håkan Hanberger,[e] Katarina Hedin,[f] Jenny Hellman,[b] Christer Norman,[b] Gunilla Skoog,[b] Cecilia Stålsby-Lundborg,[g] Karin Tegmark Wisell,[b] Christina Åhrén[i] & Otto Cars[b]

Download

Key features of Strama

Grounded in daily practice: Face-to-face visits at primary care practices are commonly carried out within regions. These allow feedback of data to prescribers and encourage prescribers to share their perceived barriers to responsible antibiotic use.

Regional autonomy: The decentralized organization of Strama has stimulated local goal setting and local piloting of improvement measures, accepting that there are multiple paths to the shared goal.

Multidisciplinary at each level: The regional Strama groups are led by a county medical officer (usually an infectious diseases doctor), and always contain specialists in primary care, clinical microbiology, infectious diseases, ear nose and throat, and paediatrics, together with pharmacists and representation from the local drug and therapeutics committee. Nurses and dentists are included in some regional groups. The national level Strama council involves clinical representation that mirrors the regional groups, and co-operates with 20 authorities across public health, animal health, food, and the environment, in part through an intersectoral coordinating mechanism introduced in 2012.

Data-driven: Data collection and analyses are coordinated and standardized, resulting in robust datasets for monitoring antibiotic use and resistance at national level, and for providing high resolution feedback at regional levels. Data collection has even included monitoring for adverse events of under-prescribing. IT systems are now being developed in many counties to provide individual prescriber feedback, including comparisons with local colleagues.

Managing responsible antimicrobial use: perspectives across the healthcare system

O.J. Dyar [1,4], G. Tebano [2,4], C. Pulcini [3,*], on behalf of ESGAP (ESCMID Study Group for Antimicrobial stewardshiP)

Clinical Microbiology and Infection 23 (2017) 441–447

Table 1
Activities of healthcare workers outside of the formal AMS team, which contribute to responsible antimicrobial management

Healthcare worker group	Activities contributing to optimal use of antimicrobials
Medical doctors and prescribers	• Accurate diagnoses of infections • Prescribing antimicrobials • Patient education
Pharmacists	• Reviewing prescriptions • Managing formularies and stocks • Patient education
Nurses	• Microbiology sample collection • Monitoring for adverse effects • Patient education
Hospital managers	• Resourcing antimicrobial stewardship (AMS) teams • Visibly prioritizing AMS within an institution • Encouraging AMS teams to support primary care
Emergency department	• Accurate diagnoses of infections • Collecting samples before starting therapy • Initiating timely and appropriate therapy
Laboratory staff	• Developing protocols for sample taking • Selective reporting of susceptibility testing

Patient/public
Data Analytics
QI methods
Communication/engagement
IT
Business expertise

POLICY FORUM

A whole-health–economy approach to antimicrobial stewardship: Analysis of current models and future direction

Monsey McLeod[1,2‡], Raheelah Ahmad[2‡], Nada Atef Shebl[3], Christianne Micallef[4], Fiona Sim[5,6], Alison Holmes[2*]

Citation: McLeod M, Ahmad R, Shebl NA, Micallef C, Sim F, Holmes A (2019) A whole-health–economy approach to antimicrobial stewardship: Analysis of current models and future direction. PLoS Med 16(3): e1002774. https://doi.org/10.1371/journal.pmed.1002774

Table 1. Critical health system functions and elements of integration adapted from Atun and colleagues [16,18] for AMS initiatives.

Facets of Critical Health System Function	Elements of Integration Adapted for AMS Initiatives
Stewardship and governance	• Regulatory mechanism • Accountability framework
Financing	• Pooling of funds • Provider payment methods • Funding source • Cross-program use of funds
Planning	• Planning
Service delivery	• Human resources for delivery of AMS • Physical infrastructure for laboratory testing
Monitoring and evaluation	• Data collection and recording • Data analysis • Reporting systems • Performance management system
Demand generation	• Financial incentives • Information, education, and communication

Definition of full and partial integration: An element was classed as fully or predominantly integrated across the health system if it was exclusively under the management and control of the wider healthcare system. An element was classed as partially integrated if some but not all cases were managed and controlled both by the wider healthcare system and a specific program-related structure. A dimension was not integrated if it was exclusively under the management and control of a specific program-related structure (which is distinct from the wider healthcare system).

Abbreviations: AMS, antimicrobial stewardship.

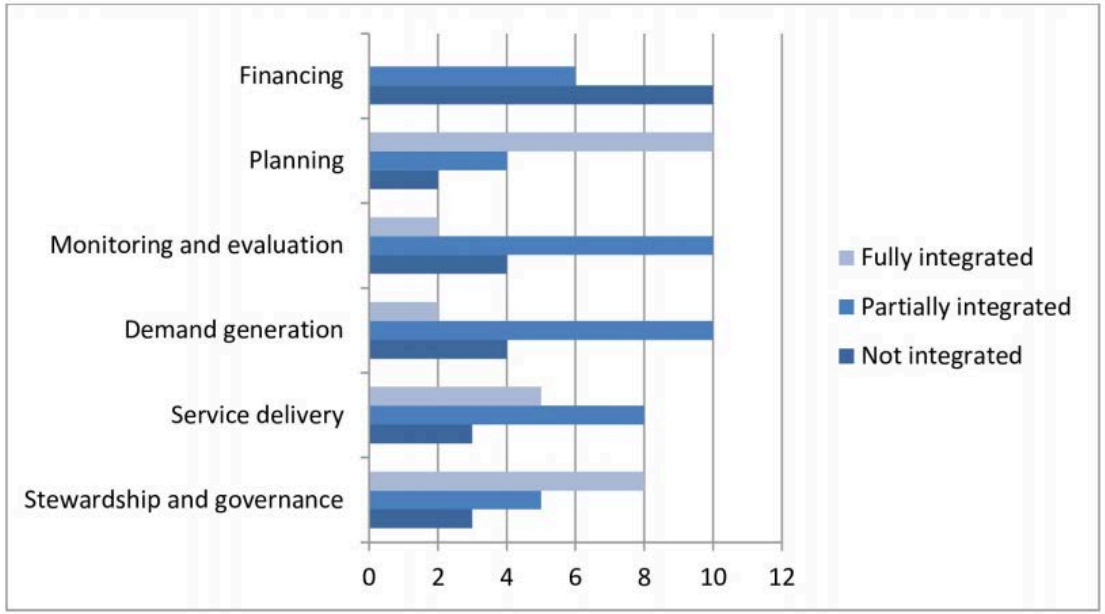


Fig 1. An overview of the extent of multisectoral AMS integration for each of the 16 AMS initiatives identified. The integration framework is based on all six facets of critical health system function defined by Atun and colleagues [16,18] (Table 1). AMS, antimicrobial stewardship.

AMS Initiative
Australia
Canada
Greece
Italy
Sweden
United Kingdom
United States of America
Zambia

POLICY FORUM

A whole-health–economy approach to antimicrobial stewardship: Analysis of current models and future direction

Monsey McLeod[1,2‡], Raheelah Ahmad[2‡], Nada Atef Shebl[3], Christianne Micallef[4], Fiona Sim[5,6], Alison Holmes[2*]

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United Kingdom

United Kingdom		
Enhanced AMS program in hospital and community [26], Northern Ireland	General practice staff and hospital clinical staff	Hospital clinical staff, GPs
Scottish Antimicrobial Prescribing Group [27], Scotland **SAPG**	Hospital-based antimicrobial pharmacists, microbiologists, infectious disease specialists, hospital medical and nonmedical leadership, infection prevention specialists, information/antimicrobial surveillance scientists, GPs, dentistry, veterinary medicine, quality improvement, pharmaceutical industry, other expert advisors	Broad audience including policy makers, physicians, and general public
The Cornwall One Health Antimicrobial Resistance Group [28]	Developed by a subgroup of the Health & Wellbeing Board's Health Protection Committee. The Chief Hospital Pharmacist and Medical Director initiated wide stakeholder engagement including members from wider hospital staff, clinical commissioning group, community hospital, out-of-hours GP service, dentistry, veterinary, and farming.	Broad audience including policy makers, physicians, and general public across sectors

OBJECTIVES

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Department of Health

Department for Environment Food & Rural Affairs

UK Five Year Antimicrobial Resistance Strategy 2013 to 2018

Northern Ireland Executive

Llywodraeth Cymru Welsh Government

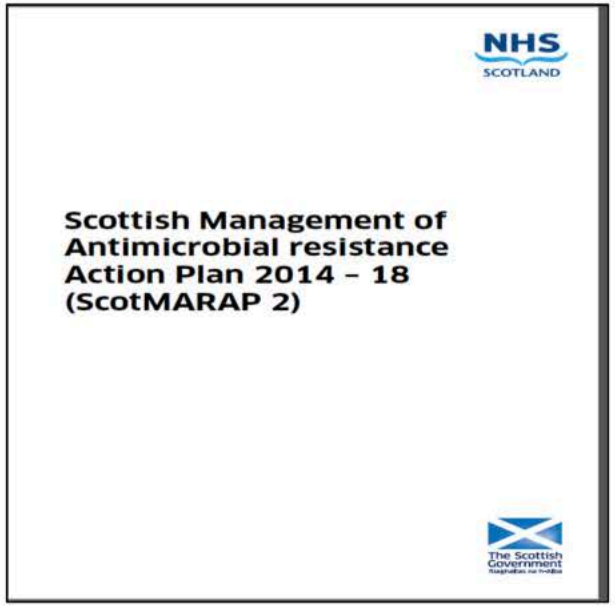
The Scottish Government Riaghaltas na h-Alba

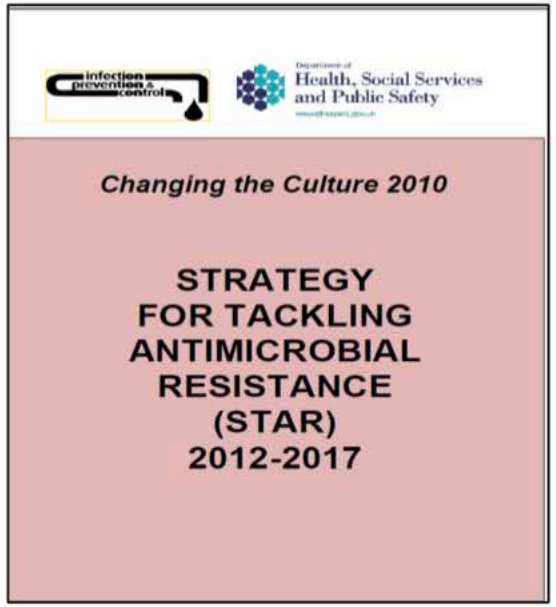
NHS SCOTLAND

Scottish Management of Antimicrobial resistance Action Plan 2014 – 18 (ScotMARAP 2)

The Scottish Government Riaghaltas na h-Alba

Scotland, Wales and Northern Ireland developed their own country level plans



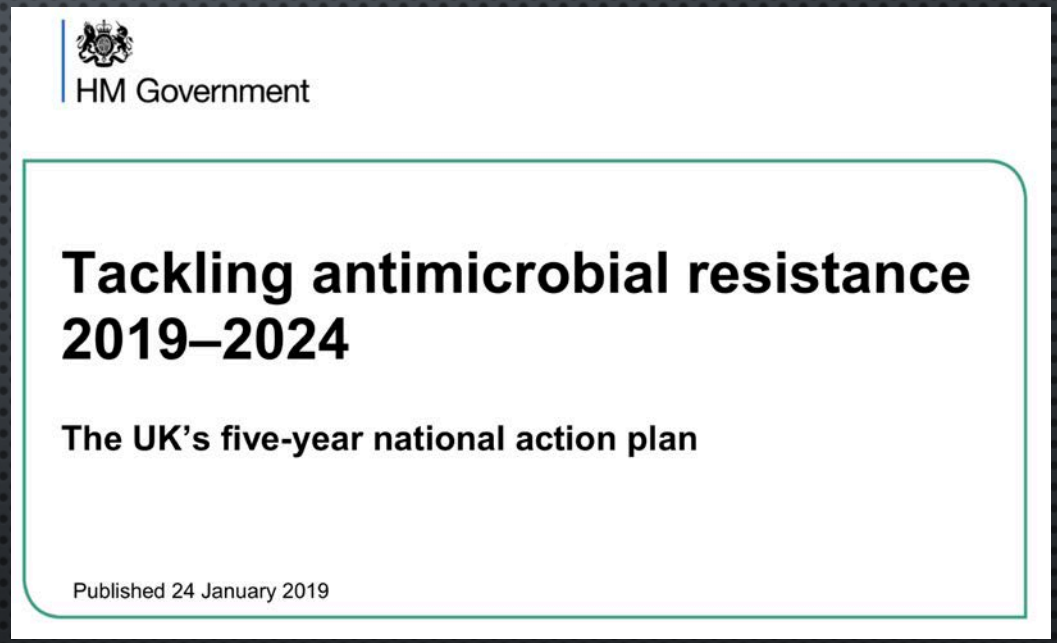


http://www.gov.scot/Resource/0045/00456736.pdf

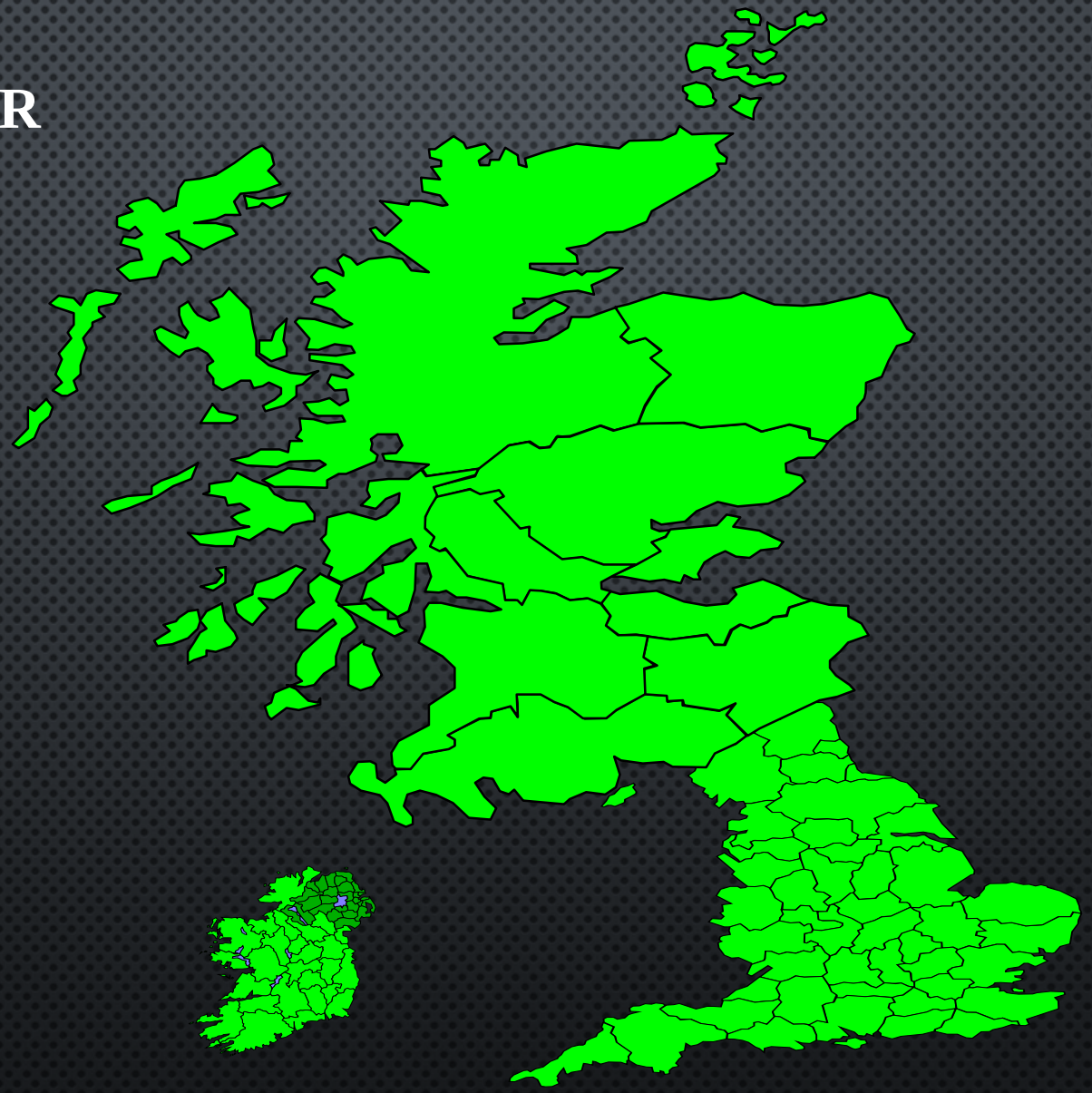
http://gov.wales/docs/dhss/publications/160330amr-

https://www.health-ni.gov.uk/sites/default/files/publications/dhssps/arac-strategy-for-tackling-antimicrobial-resistance-star-2012-17.pdf


Ambition 1:
Continue to be a good global partner
Ambition 2:
Drive innovation
Ambition 3:
Minimise infection
Ambition 4:
Provide safe and effective care to patients
Ambition 5:
Protect animal health and welfare
Ambition 6:
Minimise environmental spread
Ambition 7:
Support sustainable supply and access
Ambition 8:
Demonstrate appropriate use of antimicrobials
Ambition 9:
Engage the public on AMR


HM Government
Tackling antimicrobial resistance 2019–2024
The UK's five-year national action plan
Published 24 January 2019

SCOTLAND'S RESPONSE TO AMR



Health Directorates

The Scottish Government

Dear Colleague

PRUDENT ANTIMICROBIAL PRESCRIBING: THE SCOTTISH ACTION PLAN FOR MANAGING ANTIBIOTIC RESISTANCE AND REDUCING ANTIBIOTIC RELATED CLOSTRIDIUM DIFFICILE ASSOCIATED DISEASE

Antimicrobial resistance is widely recognised as a major threat to public health, exemplified by the international spread of MRSA. The recent high profile afforded to *Clostridium difficile* reflects its growing importance as a significant cause of morbidity and mortality in hospitals, care homes and the community. One key intervention in managing both problems is to robustly address the issue of prudent prescribing of antimicrobials within NHS Scotland, and this Letter seeks the immediate implementation of our national policies in this area.

1. You will be aware from CMO Letter CMO(2005)08 that the Healthcare Associated Infection Task Force guidance document Antimicrobial Prescribing Policy and Practice (APP&P 2005) set out recommendations for good practice in acute hospitals relating to healthcare structures and lines of responsibility, data requirements for monitoring resistance and antimicrobial use at local and national levels, issues relating to audit and performance management, and requirements for education and training. It also provided guidance on the development and monitoring of local antimicrobial prescribing policies and formularies.

2. This guidance was endorsed, widened and reinforced by publication of the HAI Task Force document Scottish Management of Antimicrobial Resistance Action Plan (ScotMARAP) launched by the Cabinet Secretary for Health and Wellbeing in March 2008, which replaced the 2002 Antimicrobial Resistance Strategy and Scottish Action Plan. ScotMARAP outlines the national programme for Scotland in tackling antimicrobial resistance and prudent prescribing over the next five years in primary and secondary care, and lays out the tasks set for the various health agencies; Chapters 10 to 13 refer directly to the responsibilities of NHS Boards and frontline staff.

CEL 30 (2008)

8 July 2008

Addresses

For action
NHS Board Chief Executives
Special Health Board Chief Executives
NHS Board Infection Control Managers
NHS Board Medical Directors
Chief Pharmacists
Lead Microbiologists

For information
Health Protection Scotland
Directors of Public Health
Scottish Antimicrobial Prescribing Group
Scottish Microbiology Forum

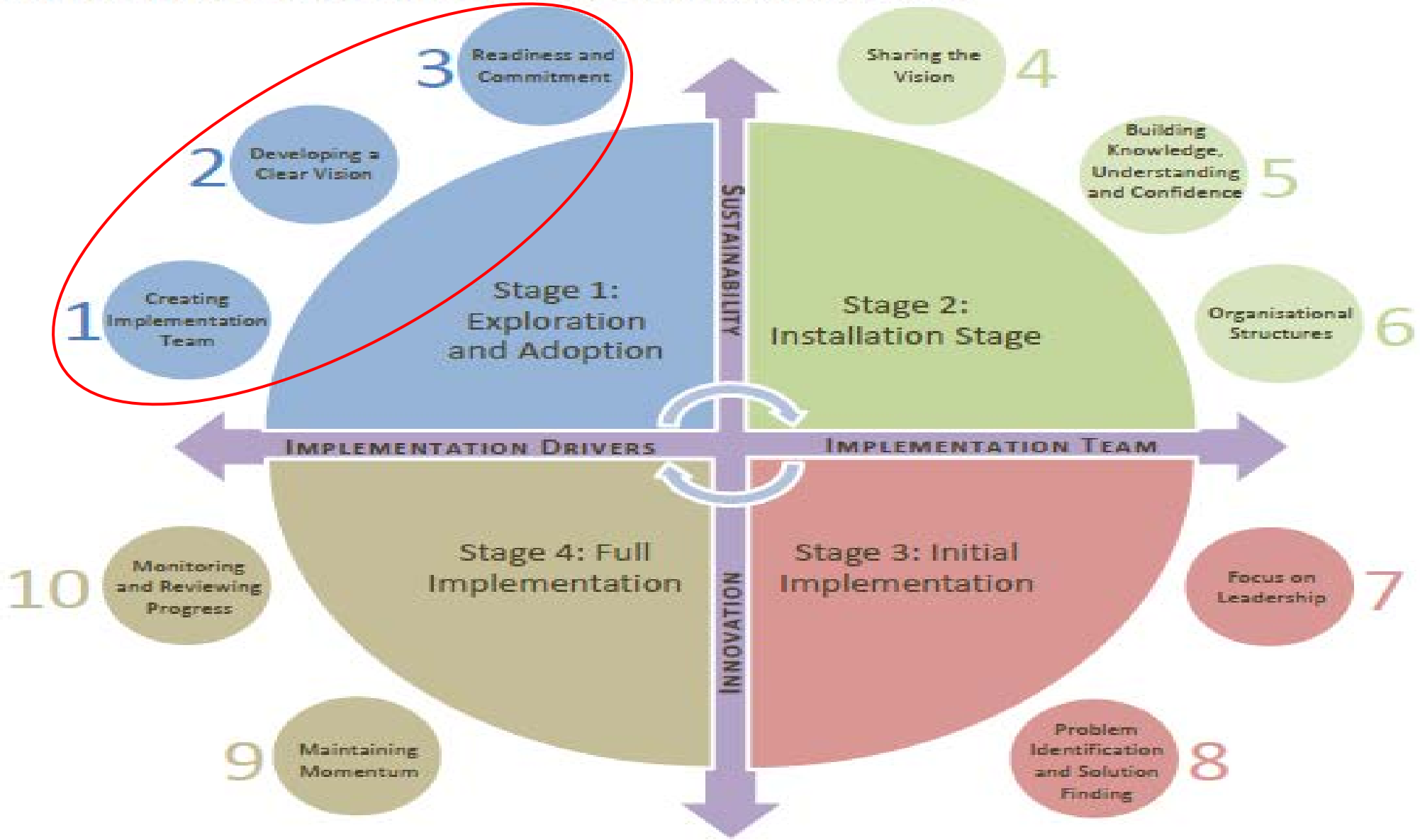
Enquires to:
Dr Peter Christie
Senior Medical Officer
St Andrew's House
Regent Road
Edinburgh EH1 3DG

Tel: 0131-244 2806
Fax: 0131-244 2030
Peter.Christie@scotland.gsi.gov.uk
http://www.scotland.gov.uk

3. One of the main ScotMARAP national initiatives, the establishment of the Scottish Antimicrobial Prescribing Group (SAPG), has already been actioned by the Scottish Medicines Consortium, and is under the Chairmanship of Professor Dilip Nathwani.

4. SAPG has advised that not every Board has an established Antimicrobial Management Team (AMT) as set out in APP&P and ScotMARAP, and some of those which have been set up do not cover primary care prescribing. As an immediate intervention to reduce the risks from *C.difficile*, we accept SAPG's recommendation that all Boards should immediately establish an AMT which covers primary and secondary care prescribing activities.

Implementing New Interventions Whole School Implementation Planning

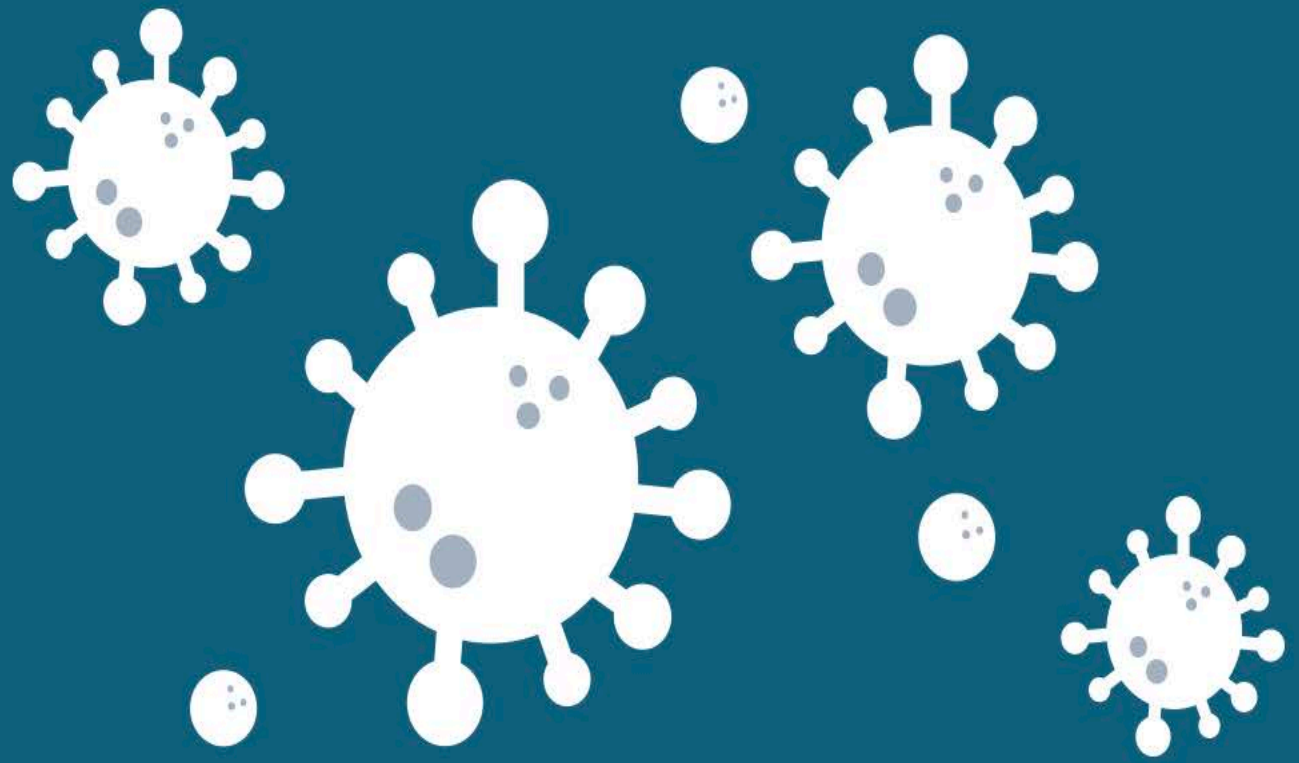


Healthcare Improvement Scotland | SAPG

About us | Quality improvement | Antibiotic awareness | Education | Surveillance & informatics

A NATIONAL ASP

Safeguarding antibiotics for Scotland, now and for the future

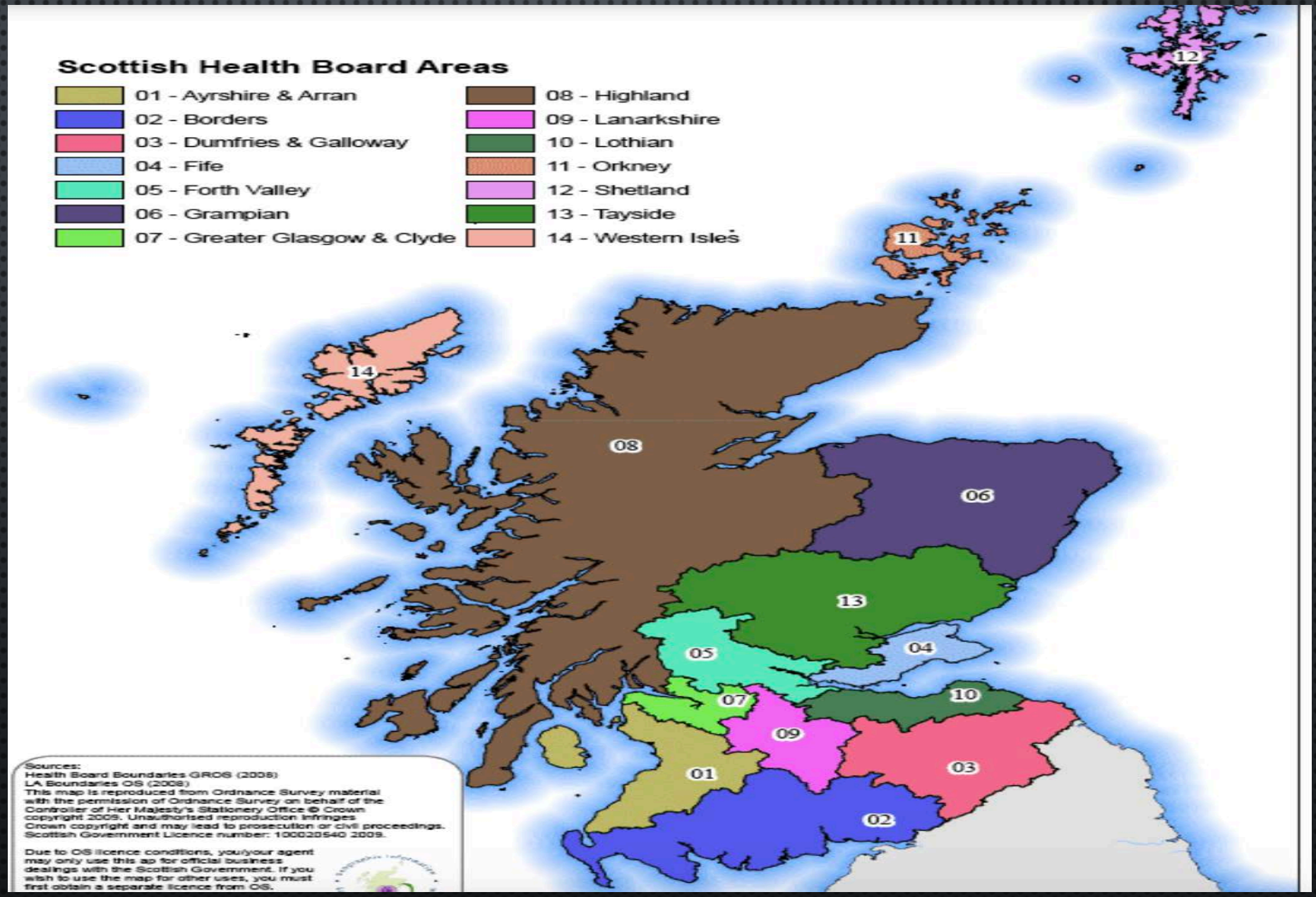


NHS SCOTLAND

Scottish Management of Antimicrobial resistance Action Plan 2014 – 18 (ScotMARAP 2)

We work with NHS boards across health and care settings in Scotland to improve antibiotic use, to optimise patient outcomes and to minimise harm to individuals and to wider society.

The Scottish Government


Scottish Health Board Areas
01 - Ayrshire & Arran
02 - Borders
03 - Dumfries & Galloway
04 - Fife
05 - Forth Valley
06 - Grampian
07 - Greater Glasgow & Clyde
08 - Highland
09 - Lanarkshire
10 - Lothian
11 - Orkney
12 - Shetland
13 - Tayside
14 - Western Isles
Sources:
Health Board Boundaries GROS (2008)
LA Boundaries OS (2008)
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~5.4 M

Quality Assessment

Donabedian's Structure – Process - Outcome

Antecedents → **Structure** → **Process** → **Outcome**

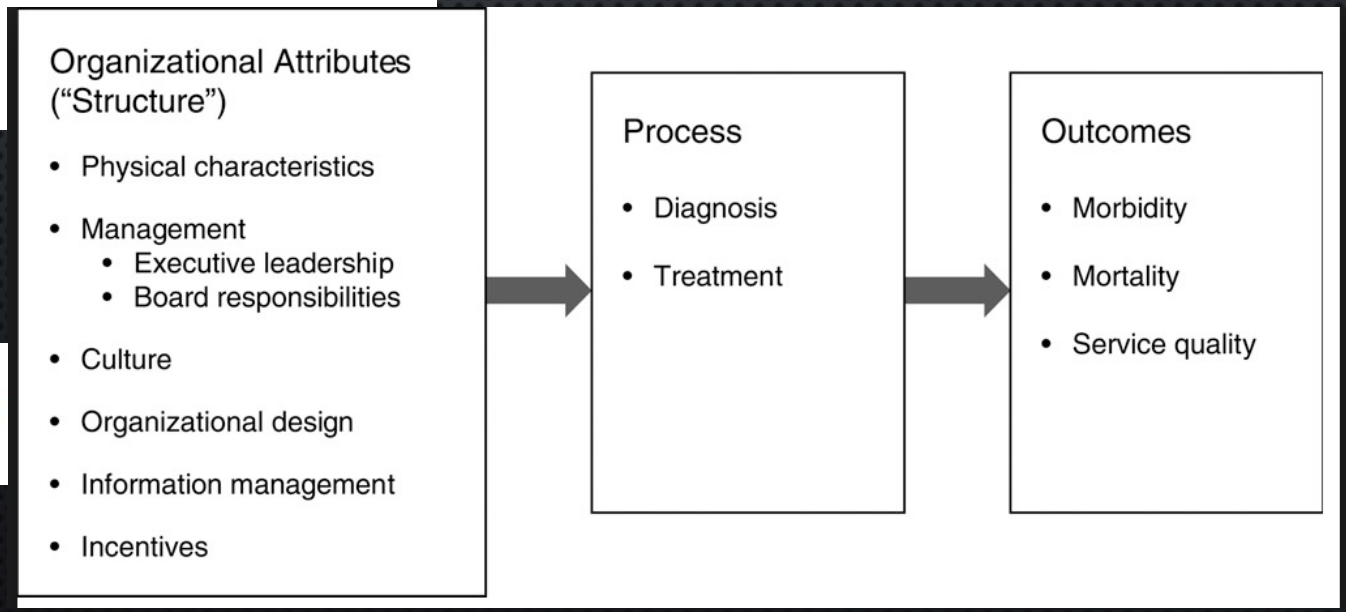
Factors that can influence structure, process:
- Environmental factors
- Patient factors (also influence outcomes)

Organizational characteristics

Interactions between healthcare practitioner & patient

Changes (desirable or undesirable) in individuals & populations

Embraced QI /IS methodology
At the onset



Donabedian A, Wheeler JR, Wvszewianski L. Quality, cost, and health: an integrative model. Med Care. 1982 Oct:20(10):975-92.

OBJECTIVES

1. IMPACT OF AMS, AMS INTERVENTIONS
2. NATIONAL AMS APPROACHES
3. DEVELOPING AN ACTION PLAN FOR UK AND SCOTLAND
4. IMPLEMENTATION FOCUSED APPROACH IN SCOTLAND- DEVOLVED ADMINISTRATION
5. IMPACT
6. LESSONS LEARNT

DOING ANTIMICROBIAL STEWARDSHIP

S [c] + P[i] = O

S= STRUCTURE

I= CULTURE

P= PROCESS

I= IMPLEMENTATION OF PROCESSES

O= OUTCOMES

HOW TO START A HOSPITAL ANTIMICROBIAL STEWARDSHIP PROGRAMME: H-ASP

PLANNING PHASE MONTH 1-2

Depends on resources, readiness, culture, priority, etc

80% PLANNING

Prepare- training in AMS/infection management

- Toolbox of AMS interventions [process- adapt, endorse, adopt]
- Seek multi-stakeholders support, especially clinicians, hospital leadership
- Be familiar with core elements and checklist
- Be familiar with regional/national plans, regulations, requirements
- Assess local situation[SWOT analysis- use checklist]
- Assess systems, organization-structures, governance, laboratory capacity
- **Assess/familiarize with prescribing culture/etiquette**
- **Meet with people, observe-listen, understand barriers-facilitators, identify champions and early adopters**
- Set up AMS multi-disciplinary team committee, work with other key /enabling structures- IPC, Patient safety, QI, ID consultation
- Start to design an action plan- see WHO LMIC tool kit
- **Embrace/seek QI/implementation science resource if available**
- Consider monitoring/ dissemination, evaluation and communication plan

20% IMPLEMENTATION

How to start an antimicrobial stewardship programme in a hospital

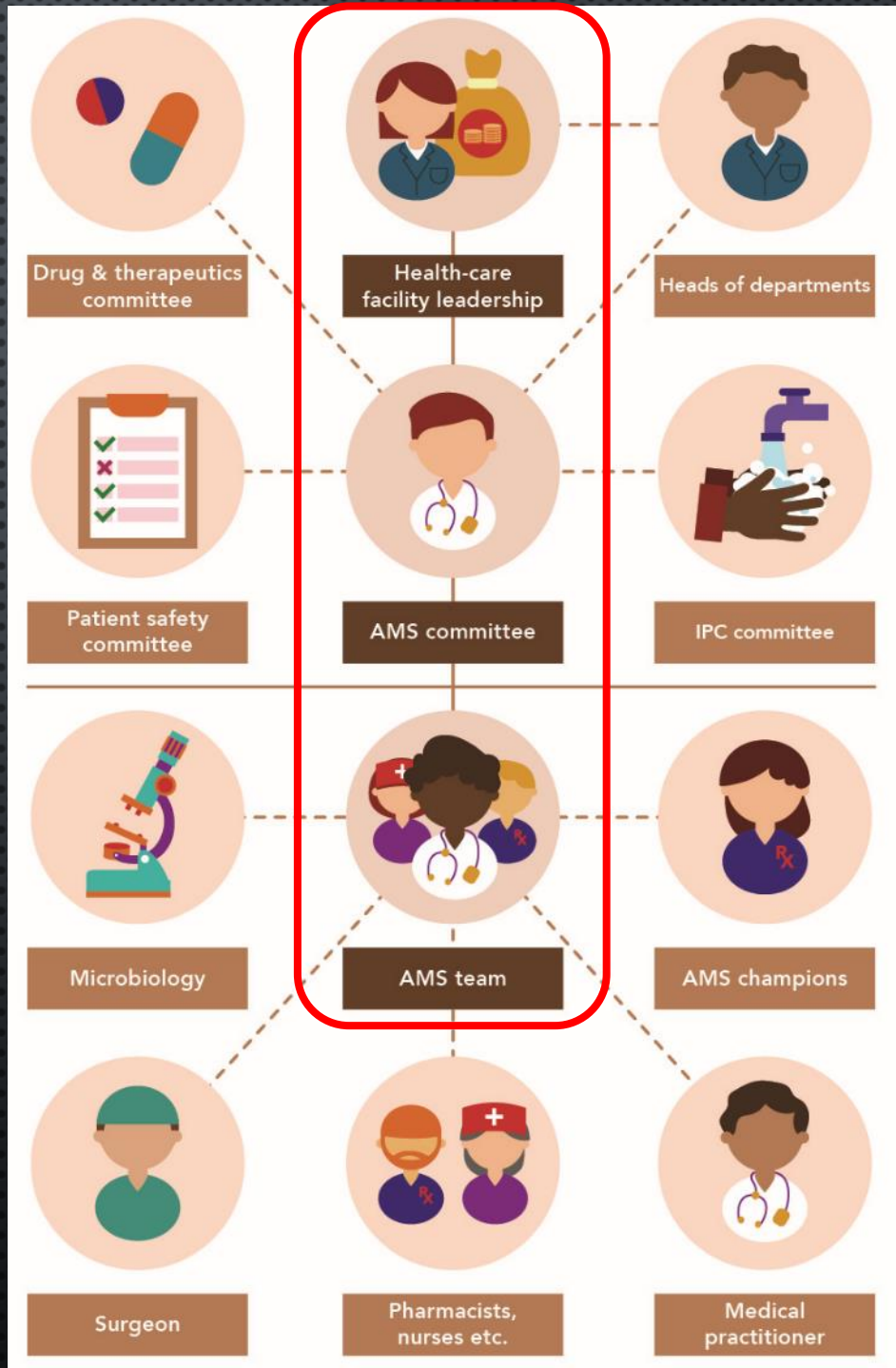
M. Mendelson, Clin Microbiol Infect 2019;▪:1

Planning AMS programmes

Table 5	
Situational or SWOT analysis	Conduct a SWOT analysis: • Structures, policies and guidelines • Human resources • Data: antibiotics, resistance • AMS activities implement, monitor
Facility AMS action plan	To ensure accountability, prioritize activities and measure progress

Governance

- ✓ Responsibilities and accountability
- ✓ AMS team and/or AMS champions
- ✓ Links to other programmes/ committees



Barriers and Facilitators to Implementation of Antibiotic Stewardship Programmes in Hospitals in Developed Countries: Insights From Transnational Studies

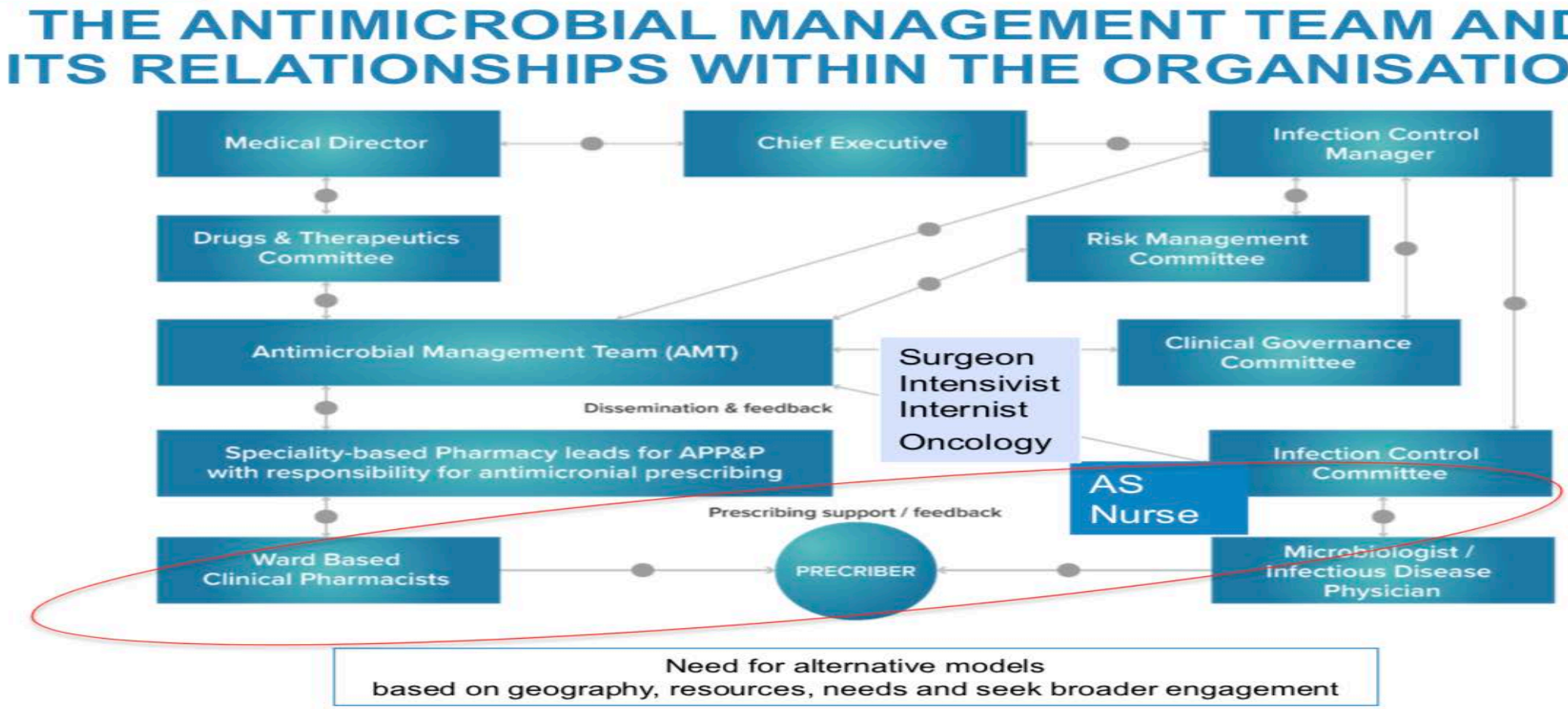
Magdalena Rzewuska[1], Eilidh M. Duncan[1], Jill J. Francis[2], Andrew M. Morris[3,4], Kathryn N. Suh[5,6], Peter G. Davey[7], Jeremy M. Grimshaw[8,9] and Craig R. Ramsay[1] on behalf of the JPIAMR (Joint Programming Initiative on Antimicrobial Resistance) Working Group on Behavioural Approaches to Antibiotic Stewardship Programmes*

Rzewuska M, Duncan EM, Francis JJ, Morris AM, Suh KN, Davey PG, Grimshaw JM and Ramsay CR (2020) Barriers and Facilitators to Implementation of Antibiotic Stewardship Programmes in Hospitals in Developed Countries: Insights From Transnational Studies. Front. Sociol. 5:41. doi: 10.3389/fsoc.2020.00041

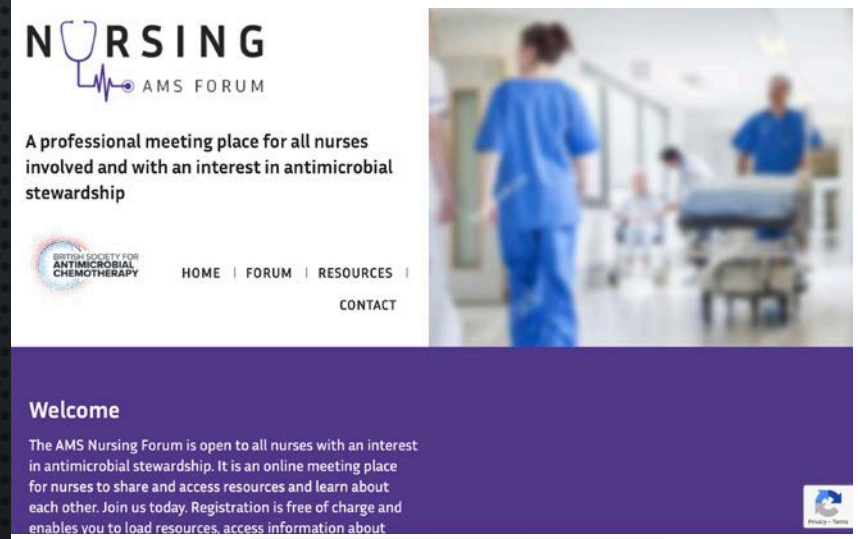
Theoretical domains framework–domains	Subthemes (Table S3) within each domain derived from coded data (Table S2)	No. of studies
Environmental context and resources	(B) Lack of key personnel (e.g., infectious disease clinicians, pharmacy staff, microbiologist)	6
	(B) Problems with data and information systems (e.g., inadequate information technology, lack of dedicated IT assistant, lack of good quality data, and resources to utilize it)	6
	(B, F) The influence of adequacy of financial resources	4
	(B) Lack of time	3
	(B) Inadequate supply of laboratory provisions	1
	(B) Problem of limited antibiotic options available in settings with prevalent multi drug resistant bacteria	1
Goals	(B) Other higher priority initiatives hindering the ASP's use	4
Social influences	(B) Resistance from medical staff	3
	(B, F) The influence of clinical leadership (e.g., pharmacists, infectious diseases physicians, senior clinicians)	3
	(B) Lack of leadership from hospital administration	3
	(B) Poor communication, including interpersonal, within teams (e.g., inconsistency or conflict) and between private and public sectors	3
	(B) Perceived unhelpful attitudes of oncology clinicians	1
Behavioural regulation	(B, F) The influence of local guidelines and clinical practice protocols	2
	(F) Electronic prescribing as a mean to effectively change prescribing patterns by providing easier and quicker feedback	1
	(B) Lack of national and/or international standards required for a specific antibiotic stewardship strategy	1
	(B) Lack of standards for measuring performance of a specific antibiotic stewardship intervention	1
Knowledge	(B) Lack of knowledge of patient test or results	3
	(B) Lack of knowledge about ASPs (e.g., due to poor education or inevitable loss of knowledge due to high staff turnover)	2
	(B) Lack of knowledge of current use of antibiotics	1
Beliefs about consequences	(B) Lack of certainty about usefulness of an ASP or a specific antimicrobial stewardship strategy	2
	(B) ASP clinicians' belief in competing consequences of managing infections in different patient groups acting as a barrier	1
	(F) Focussing ASPs efforts on serious infectious disease as a mean to improving effectiveness of ASPs	1
Social/professional role and identity	(B) ASP derived jurisdiction gives antimicrobial stewardship clinicians limited power or authority	1
	(B) Uncertainties around overlapping responsibilities between multiple infectious diseases groups within a hospital	1
Intentions	(B) Lack of willingness to change	1
Reinforcement	(B) A specific antimicrobial stewardship strategy not being covered by a reimbursement system	1
Skills	(B) Medical professionals lacking relevant skills for a specific antimicrobial stewardship strategy (e.g., training in clinical microbiology)	1

The Antimicrobial Management team and its relationships within the organisation

S = structure



Where Can Nurses/Midwives Contribute to AMS?



nursing-ams-forum.co.uk

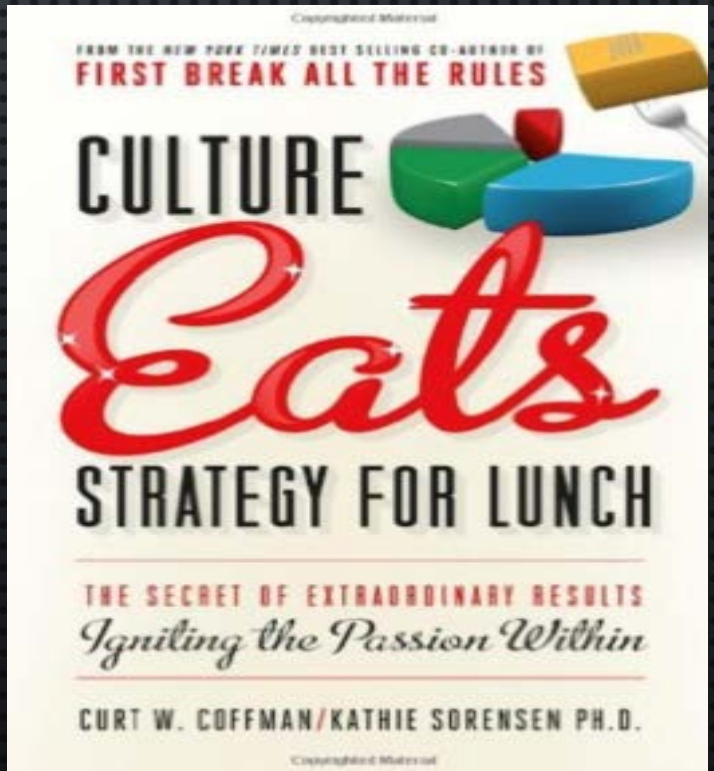
Table 1. Overlap of nursing activities with function attribution in current antimicrobial stewardship models

	Nursing	Microbiology	Case management	Pharmacy	Infectious Diseases	Infection Control	Inpatient Physician	Administration
Patient admission								
Triage and appropriate isolation	•					•		
Accurate allergy history	•			•	•		•	
Early and appropriate cultures	•				•		•	
Timely antibiotic initiation	•				•		•	•
Medication reconciliation	•			•			•	
Daily(24h) clinical progress monitoring								
Progress monitor and report	•		•		•		•	
Preliminary micro results and antibiotic adjustment	•	•		•	•		•	
Antibiotic dosing and de-escalation	•			•	•		•	
Patient safety and quality monitoring								
Adverse events	•			•	•		•	
Change in patient condition	•				•		•	
Final culture report and antibiotic adjustment	•	•		•	•	•	•	
Antibiotic resistance identification	•	•			•	•	•	
Clinical progress/patient education/discharge								
IV to PO antibiotic, outpatient antibiotic therapy	•		•	•	•		•	
Patient education	•				•	•	•	
Length of stay	•		•		•		•	•
Outpatient management, long term care, readmission	•		•		•	•		•

Olans, Olans & De Maria, 2015 Clinical Infectious Diseases

Figure 2: Dimensions needed to achieve clinical quality improvement

Strategic	×	Cultural	×	Technical	×	Structural	=	Result
0		1		1		1	=	No significant results on anything really important
1		0		1		1	=	Small, temporary effects; no lasting impact
1		1		0		1	=	Frustration and false starts
1		1		1		0	=	Inability to capture the learning and spread it throughout the organisation
1		1		1		1	=	Lasting organisation-wide impact
0 = absent; 1 = fully present								



Meropenem
+Vanco

Pip-Tazo
+ Cipro

Imipenem+
linezolid

Cefepime

Ceftazidime
+Clindamycin
+ Gentamicin
+ Caspofungin
+linezolid

watch and wait
a bit

Imperial College London

MAJOR ARTICLE

Behavior Change Strategies to Influence Antimicrobial Prescribing in Acute Care: A Systematic Review

MAJOR ARTICLE

Understanding the Determinants of Antimicrobial Prescribing Within Hospitals: The Role of "Prescribing Etiquette"

Table 3. Rules of Antimicrobial Prescribing Etiquette

1. Noninterference with the prescribing decisions of colleagues: reluctance to interfere with the prescribing decisions of colleagues. In the case of antimicrobial prescribing, there is a reluctance to intercept antimicrobial prescriptions started by colleagues. This recognizes the autonomous decision-making process of prescribing.
2. Accepted noncompliance to policy: Deviations from policy recommendations are tolerated and put in the context of the prescriber's experience and expertise and the specific clinical scenario. This leads to hierarchy and expertise, and not policy as determinants of prescribing practice behaviors.
3. Hierarchy of prescribing: Prescribing as an activity is performed by junior doctors. But it is the senior doctors who decide what is prescribed.

Clin Infect Dis. 2011 Oct;53(7):651-62. doi: 10.1093/cid/cir445
Clin Infect Dis. 2013 Jul;57(2):188-96. doi: 10.1093/cid/cit212

E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL

NHS National Institute for Health Research

PLOS ONE

RESEARCH ARTICLE

Investigating the cultural and contextual determinants of antimicrobial stewardship programmes across low-, middle- and high-income countries—A qualitative study

Table 2. Key stewardship activities present across the hospitals in this study by country (*In India, one hospital in this study exhibited positive deviance).

The 2014 CDC Key components of stewardship	Norway	France	India*	England	Burkina Faso
Providing antimicrobial prescribing guidelines	√ national	√ local and national	√ state-wide–not implementable	√ local and national	√ local
Leadership Commitment: Dedicating necessary human, financial and information technology resources.	√	√		√	
Accountability: Appointing a single leader responsible for program outcomes. Experience with successful programs show that a physician leader is effective.	√	√			
Drug (Pharmacist) Expertise: Appointing a single pharmacist leader responsible for working to improve antimicrobial use.					
Action: Implementing at least one recommended action, such as systemic evaluation of ongoing treatment need after a set period of initial treatment (i.e. "antimicrobial time out" after 48 hours).		√			
Tracking: Monitoring antimicrobial prescribing and resistance patterns.	√	√			
Reporting: Regular reporting information on antimicrobial use and resistance to doctors, nurses and relevant staff.	√	√			
Education: Educating clinicians about resistance and optimal prescribing.	√	√			

https://doi.org/10.1371/journal.pone.0209847.t002

5 countries, 24 hospitals, 54 HCWs

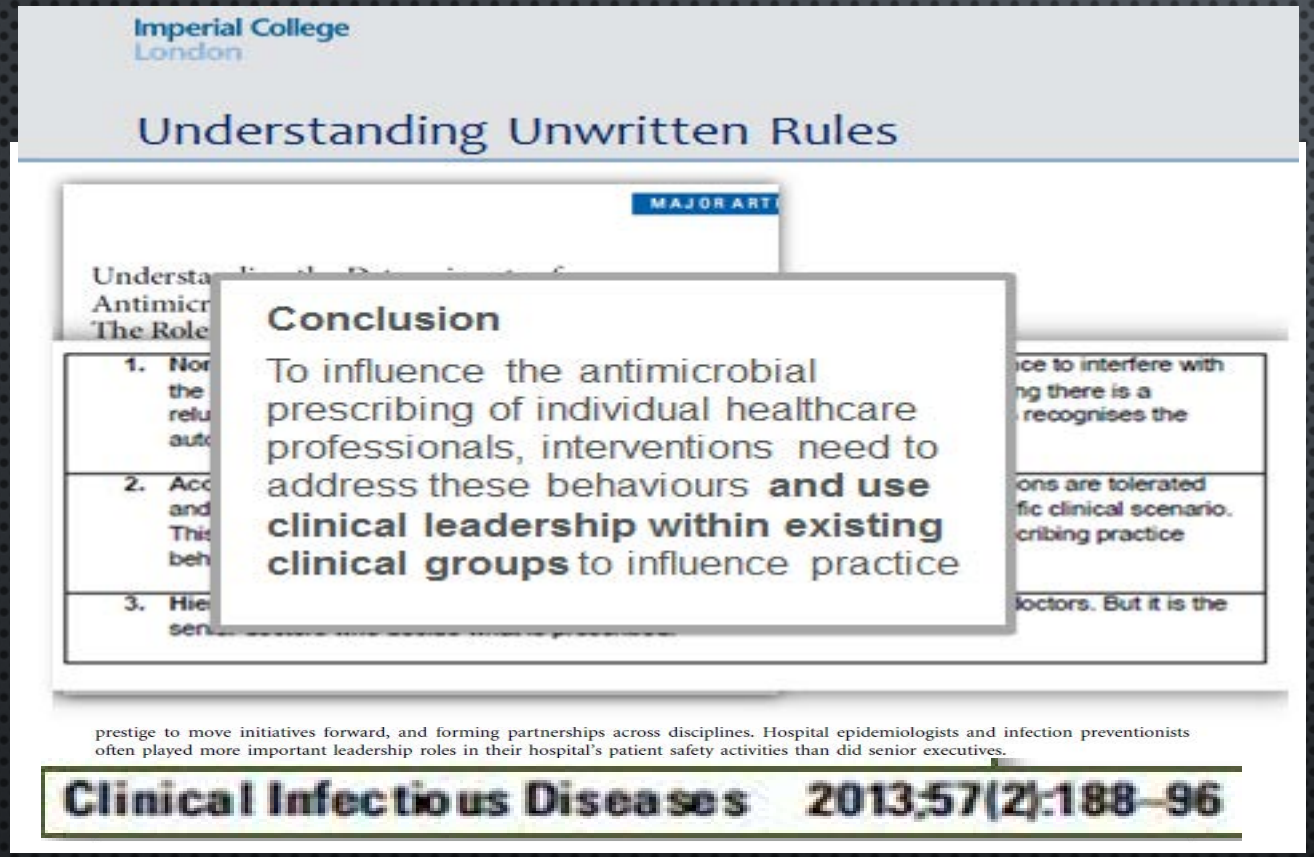
AMS restricted by professional boundaries

Lack of engagement with wider healthcare workforce

In LMICs lack of heterogeneity in AMS

Surgical specialty most difficult to engage with in AMS

CONSIDER CULTURE AND THE BROADER LEADERSHIP



- MUCH FOCUS ON LEADERSHIP……
- BUT LESS ON HOW TO USE CLINICAL LEADERS…..
- ***ACTIVELY INVOLVE CLINICAL LEADERS IN ANTIBIOTIC STEWARDSHIP***

Clinical leaders

MDT leaders

DOING ANTIMICROBIAL STEWARDSHIP

S [c] + P[i] = O

S= STRUCTURE

I= CULTURE

P= PROCESS

I= IMPLEMENTATION OF PROCESSES

O= OUTCOMES

HOW TO START A HOSPITAL ANTIMICROBIAL STEWARDSHIP PROGRAMME: H-ASP

EARLY IMPLEMENTATION PHASE MONTH 3-4

40% PLANNING

- Resources – human capital, fiscal, QI-implementation science, data collection/analysis
- Step Wise approach – plan core areas for early interventions, the measures for target, and so this step wise
- **Identify which patients are getting antibiotics, how much, where and quality of the prescribing; use audit, PPS etc**
- **Based on data and observations identify which areas to target- consider the "low hanging fruit",**
- **Agree which types of interventions or processes to implement- persuasive, restrictive, enabling, educational, bundles**
- Agree which measures [what, who, how, where and when] for evaluation- ensure resources available- IT not essential to do this
- Be available to support team, clinicians for advice etc –"go on the improvement journey together

Depends on resources, readiness, culture, priority, etc

60% IMPLEMENTATION

How to start an antimicrobial stewardship programme in a hospital

M. Mendelson, Clin Microbiol Infect 2019;■:1

AUDIT/REVIEW METHODS TO UNDERSTAND PROBLEM AREAS

Health-care facility PPS

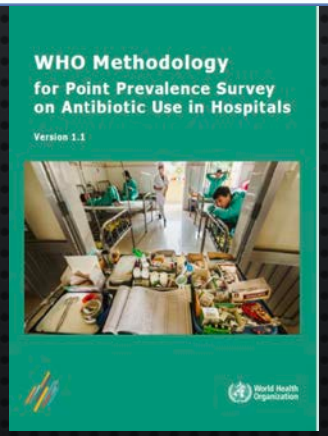
Step 1: Structures and governance
- Identify the team/committee in the facility with the overarching responsibility of the PPS, often the committee also responsible for AMS
- As part of this team/committee, appoint a facility PPS focal point responsible for the coordination and the day-to-day management of the survey

Step 2: Objectives and methodology
- Define the objectives and output of the PPS in the facility
- Select a standardized PPS protocol to for the survey, e.g. WHO PPS protocol, Global PPS.
- Train the hospital PPS focal point and team in the methodology

Step 3: Preparation
- Obtain ethical approval and other necessary permissions to undertake the survey
- Agree on the days to conduct the surveys in the respective wards
- Prepare the necessary materials for undertaking the survey

Step 4: Data collection and validation
- Undertake a pilot survey in one ward and validate the data
- Conduct the survey in all wards according to predefined timelines
- Transfer data from paper form to electronic format when applicable, and validate the data.

Step 5: Data analyses and reporting
- Clean and analyse the data according to a pre-defined data analysis plan
- Report results to the responsible team/committee, the facility management etc..
- Identify areas for improvement for antimicrobial prescribing and use based on results and agree on AMS interventions to address these areas
- Monitor and evaluate the AMS interventions with e.g. a targeted PPS or audits or audits



5.8. Audit with feedback

5.8.1 Prospective (real-time) audit with feedback

5.8.2 Retrospective audit with feedback

5.8.3 Selecting one or more infections for audit

Point prevalence surveys

Local point prevalence surveys (PPS) are recommended on a bi-annual or annual basis(5) as a tool to assess compliance with antimicrobial guidelines. Results of PPS should be shared with the executive team and disseminated to specialities who are responsible for developing action plans within their area. Key metrics which should be included in PPS are shown in figure 23

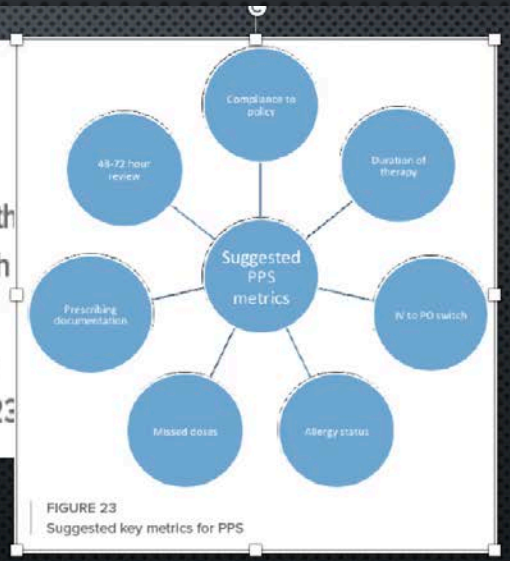


FIGURE 23
Suggested key metrics for PPS

http://bsac.org.uk/antimicrobial-stewardship-from-principles-to-practice-e-book/

NATIONAL POINT PREVALENCE STUDY 2009 (ESAC-3)
SCOTTISH DATA

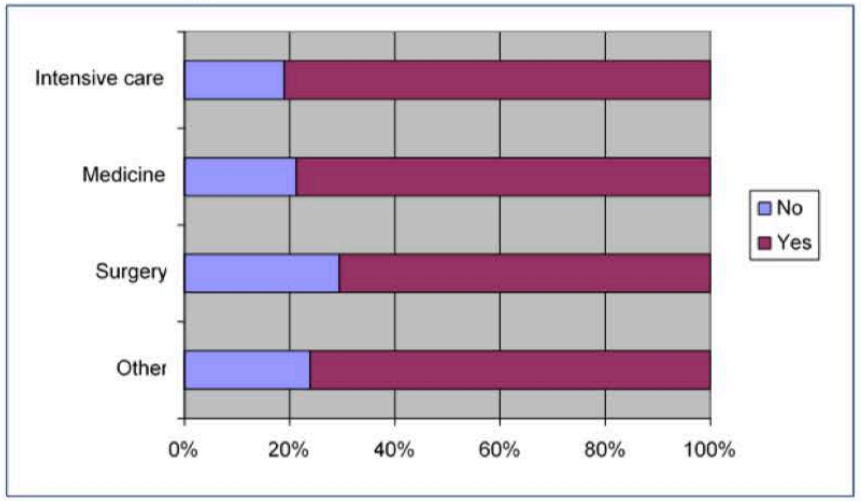
- 31 HOSPITALS (8732 PATIENTS)
- 27.8% PATIENTS ON ANTIMICROBIALS
- 50.5% GIVEN INTRAVENOUSLY
- 76.1% REASON RECORDED IN CASE NOTES
- 57.9% COMPLIANT WITH LOCAL GUIDELINES
- 30.3% SURGICAL PROPHYLAXIS MORE THAN ONE DAY

~45% SINGLE DOSE

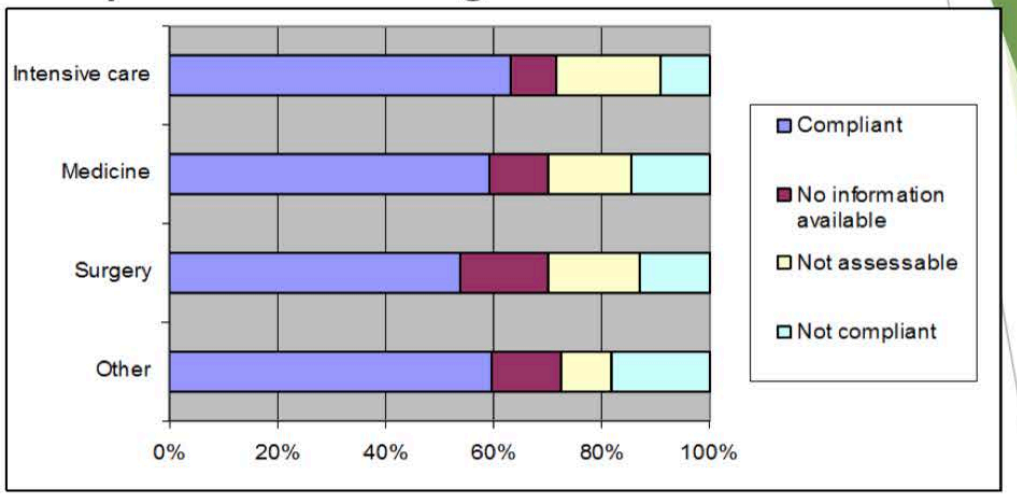
SOME ROOM FOR IMPROVEMENT

Example results from hospital wide PPS

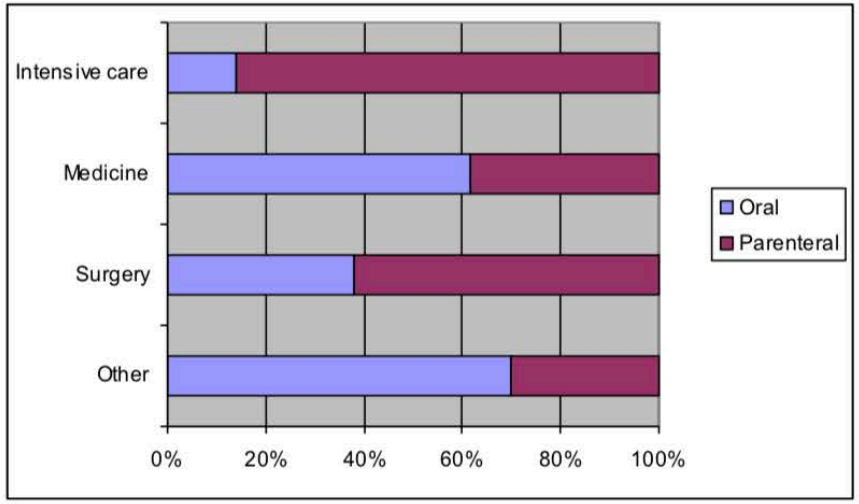
Recording of indication in notes



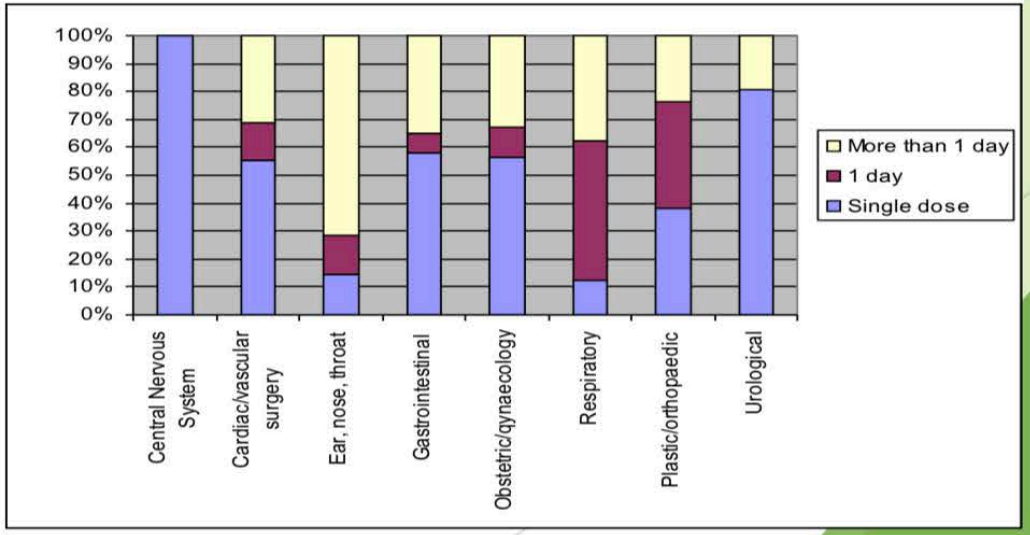
Compliance with local guidelines



Route of administration



Duration of surgical prophylaxis by specialty



Is the "Low-Hanging Fruit" Worth Picking for Antimicrobial Stewardship Programs?

Debra A. Goff,[1] Karri A. Bauer,[1] Erica E. Reed,[1] Kurt B. Stevenson,[2,3] Jeremy J. Taylor,[1] and Jessica E. West[2]

[1]Department of Pharmacy, The Ohio State University Wexner Medical Center, [2]Division of Infectious Diseases, College of Medicine, and [3]Division of Epidemiology, College of Public Health, The Ohio State University, Columbus

PRIORITISING AMS INTERVENTIONS

TYPES OF LOW HANGING FRUIT

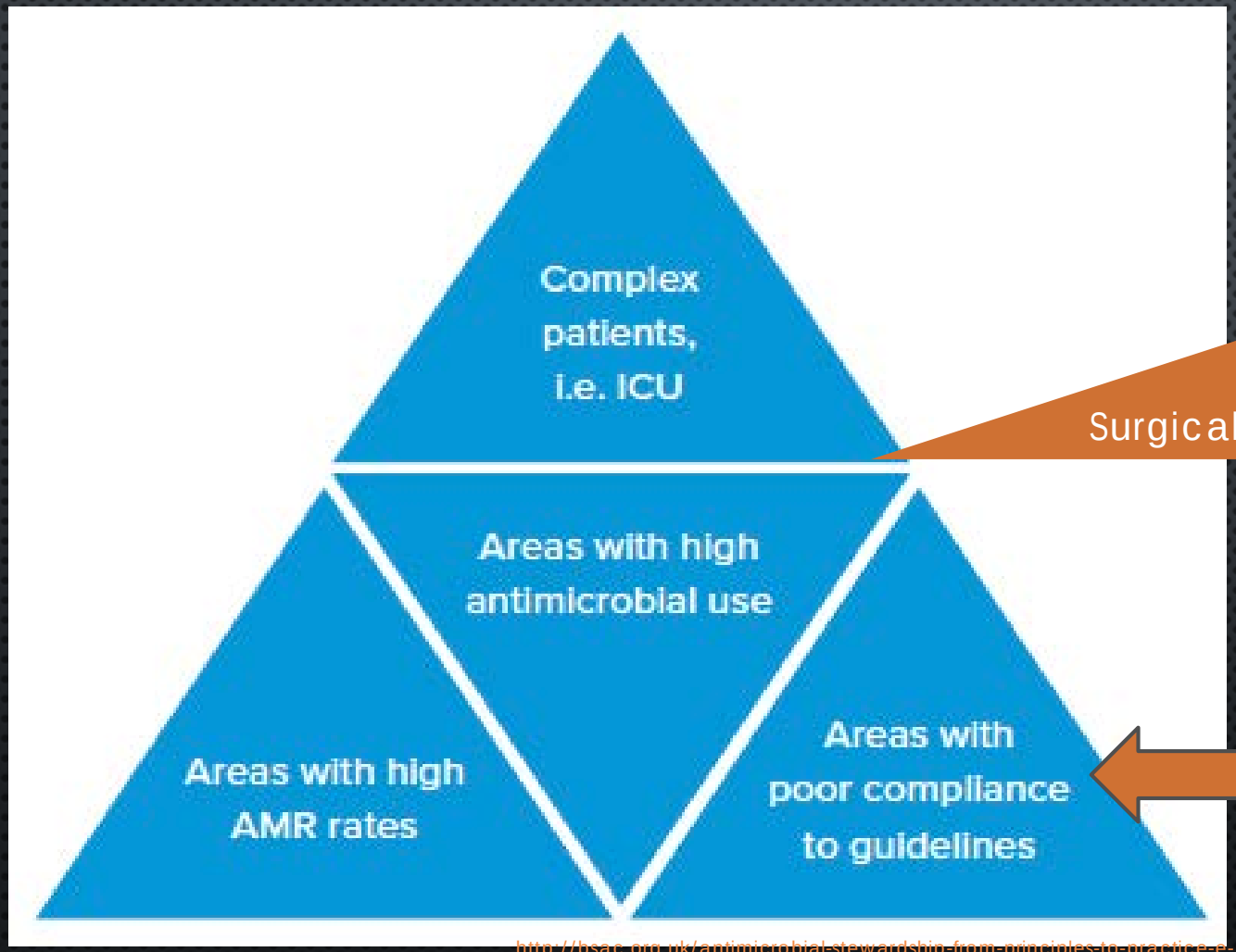
- **PROTOCOL DRIVEN EMPIRIC TREATMENT WITH ADHERENCE**
- LOADING DOSE IN SEVERE INFECTIONS
- TAKING OF CULTURES
- **DE-ESCALATION**
- **IV TO ORAL SWITCH WITH A VIEW TO EARLY DISCHARGE**
- DURATION ; < 7 DAYS ; < 14 DAYS
- **SURGICAL PROPHYLAXIS**

Basic AMS interventions

1. Educate prescribers and health personnel involved in antibiotic use (see Chapter 7).
2. Develop and update a standardized medical record and medical chart to ensure that information on patients' medicines is all in one place (see Annex VI).
3. Review whether patients who receive antibiotic treatment have written indications.
4. Review antibiotic treatment for patients prescribed three or more broad-spectrum antibiotics.
5. Review the dose of antibiotics prescribed.
6. Review surgical antibiotic prophylaxis where it is prescribed for >24 hours and where a single dose is appropriate.
7. Develop local guidelines for surgical prophylaxis and treatment of common clinical conditions such as community-acquired pneumonia, UTIs, skin and soft tissue infection (SSTIs), as well as common health-care-associated infections such as pneumonia, UTIs and catheter-related infections.
8. Work to ensure leadership and identify expertise in infection management.
9. Improve the supply and management of medicines, including essential antibiotics, e.g. by establishing a drug and therapeutics committee.
10. Work to establish basic microbiology laboratory facilities.
11. Work to establish regular surveillance activities (e.g. AMR, AMC, health-care-associated infections).

Suggested citation. Antimicrobial stewardship programmes in health-care facilities in low- and middle-income countries. A practical toolkit. Geneva: World Health Organization; 2019.

IDENTIFY PRIORITY AREAS FOR AMS INTERVENTIONS- USE ANTIMICROBIAL USE/ QUALITY DATA OR RESISTANCE DATA OR AREAS WHERE PATIENTS AT HIGH RISK OF AMR

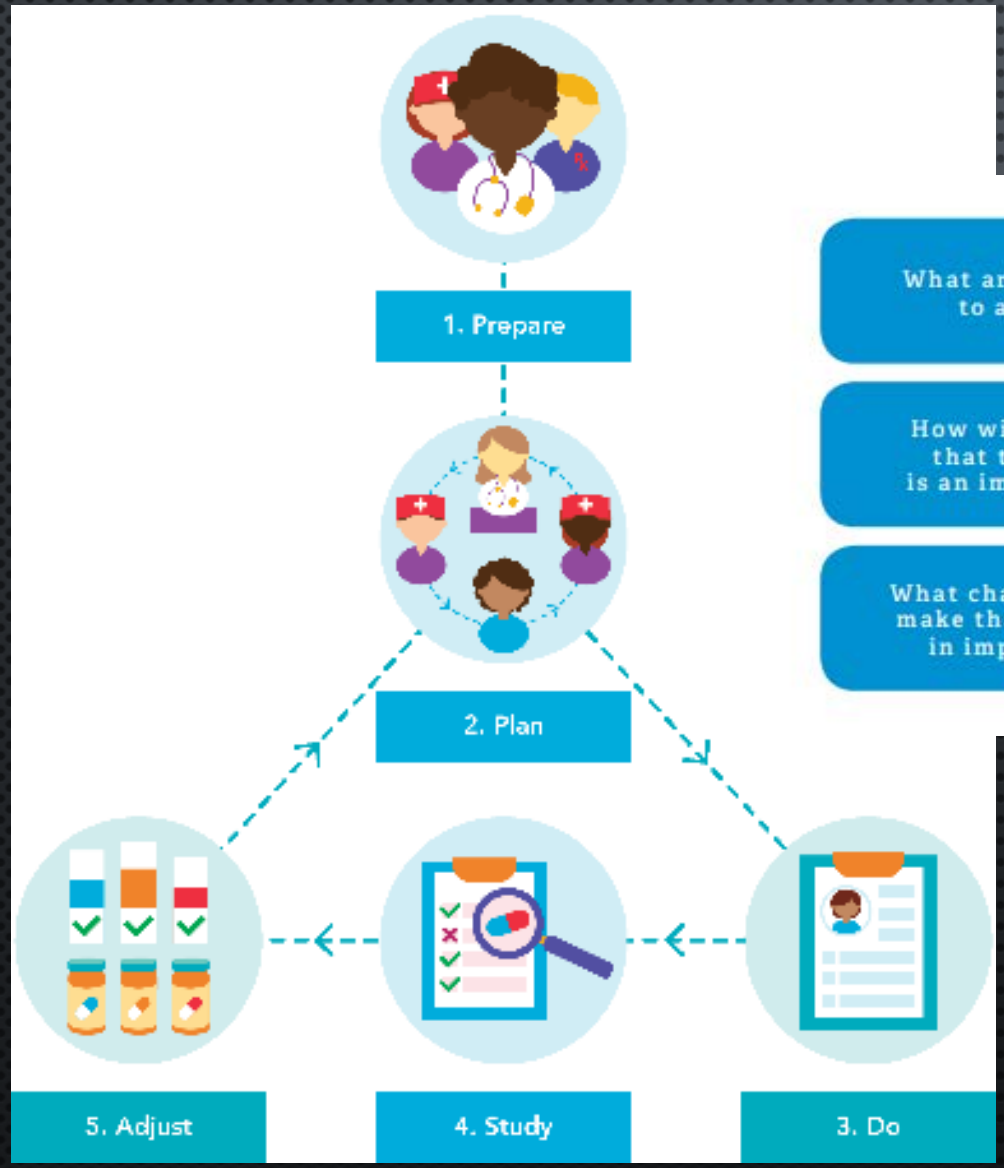


Surgical prophylaxis

Medicine, MFE, Surgery

http://bsac.org.uk/antimicrobial-stewardship-from-principles-to-practice-e-book/

Performing AMS interventions : QI Approach



What are you trying to achieve ?	Set a goal for change in antibiotic use that is SMART (i.e. specific, measurable, achievable, relevant and time-bound).
How will you know that the change is an improvement?	Determine what quantitative measures to use to show improvement (measurements).
What changes can you make that will result in improvement?	Not all changes are an improvement. Identify the behaviour changes that will result in improvement (AMS interventions).

Driverdiagram

Who, what, by when:
Main Goal/ target

Who: patient group?
What: quantify change?
By When: deadline for change?

Secondary goal:
Primary drivers

Knowledge: about the topic of change

Structures: make it easy to do what is right

Leadership: commitment to goal and necessary interventions

AMS interventions:
Secondary drivers

Provide education and training for HCWs

Antibiotic guideline

Easy access to guidelines

Arena discuss diagnosis and AB use

Written goals and interventions; leaders and champions

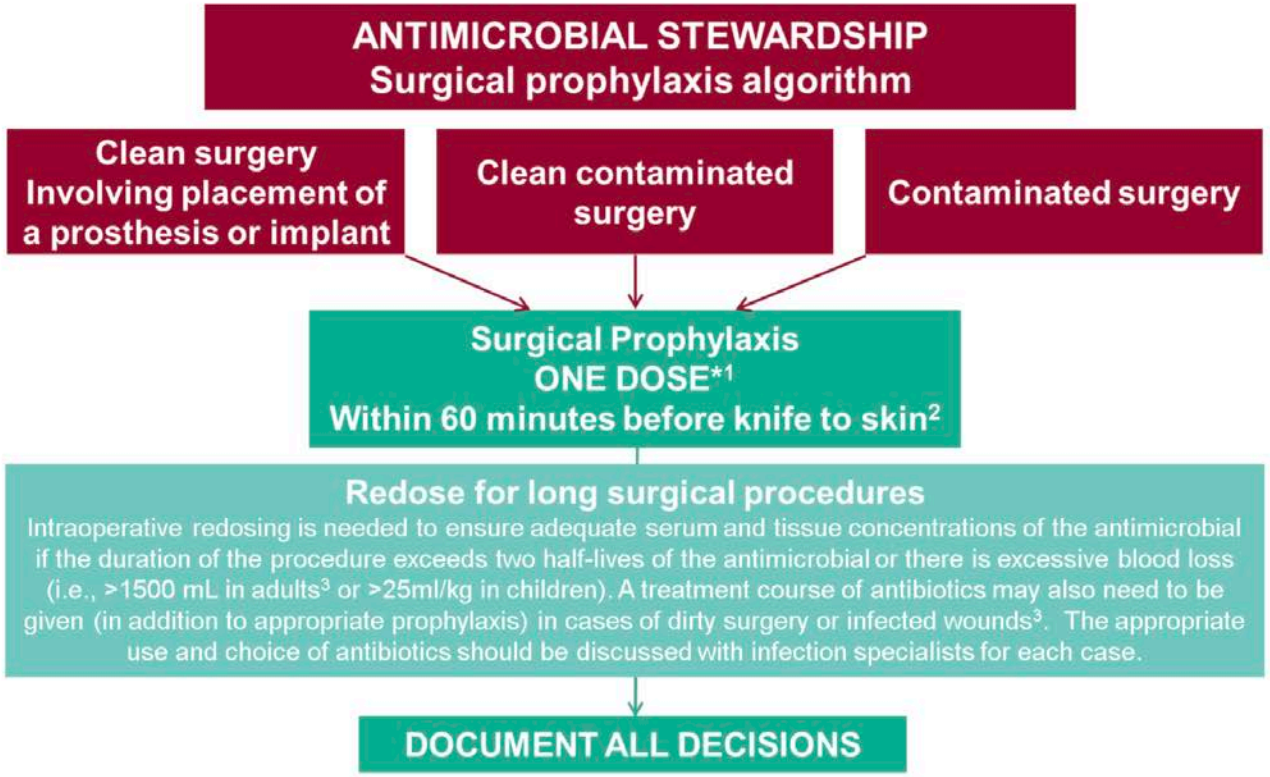
Culture for evaluating results and adjust interventions

Scottish Management of Antimicrobial resistance Action Plan 2014 – 18 (ScotMARAP 2)

AIM	PRIMARY DRIVERS	SECONDARY DRIVERS
Timely and appropriate antimicrobial use in all health and care settings • Improved clinical outcomes for patients with infections • Decreased incidence of antimicrobial-related adverse drug events (ADEs) • Decreased prevalence of antimicrobial resistant healthcare-associated pathogens • Decreased incidence of healthcare-associated *Clostridium difficile* infection (CDI) • Improved cost-effective use of antimicrobials	Timely and appropriate initiation of antimicrobial treatment	• Identify and reassure patients who do not require antibiotics • Promptly identify patients who require antibiotics and in patients with sepsis syndrome start treatment within one hour • Obtain cultures (where appropriate) prior to starting antibiotics • Do not give antibiotics with overlapping activity or combinations not supported by evidence or guidelines • Determine and verify antibiotic allergies and tailor therapy accordingly • Consider local antibiotic susceptibility patterns in selecting therapy • Start treatment promptly following local guidelines • Specify expected duration of therapy based on evidence and national and local guidelines
	Appropriate administration and de-escalation	• Clearly identify currently prescribed antibiotics, indication for treatment, start dates and intended duration or review date for each patient at the point of care. • Give antibiotics at the right dose and interval • Stop or de-escalate therapy promptly based on culture and sensitivity results; consider role of biomarkers • Ensure therapeutic drug monitoring and dosage adjustment is carried out reliably • Reconcile and adjust antibiotics at all transitions and changes in patient's condition • Consider need for use of IV route throughout the patient's episode of treatment; consider IVOST • Monitor for toxicity reliably and adjust agent and/or dose promptly when required
	Stewardship infrastructure, data monitoring and staff education	• Establish stewardship as an organisational priority, ensure resources are made available and identify accountability • Ensure local structures for antimicrobial stewardship and links to management, infection prevention and control and patient safety are in place • Monitor, feedback, and make visible data regarding antibiotic utilisation, antibiotic resistance, ADEs, CDI, cost, and adherence to the organisation's recommended microbiology and prescribing practices • Ensure national and local education programmes on antimicrobial stewardship meet the training needs of health and care staff and promote patient and public awareness about use of antimicrobials
	Availability of expertise at the point of care	• Develop and make available multi-professional expertise in antimicrobial use • Ensure expertise is available at the point of care across all health and care settings

Based on the CDC/IHI Antimicrobial stewardship Driver Diagram http://www.cdc.gov/getsmart/healthcare/pdfs/Antibiotic_Stewardship_Driver_Diagram_10_30_12.pdf

Antimicrobial Stewardship – Surgical Prophylaxis Algorithm

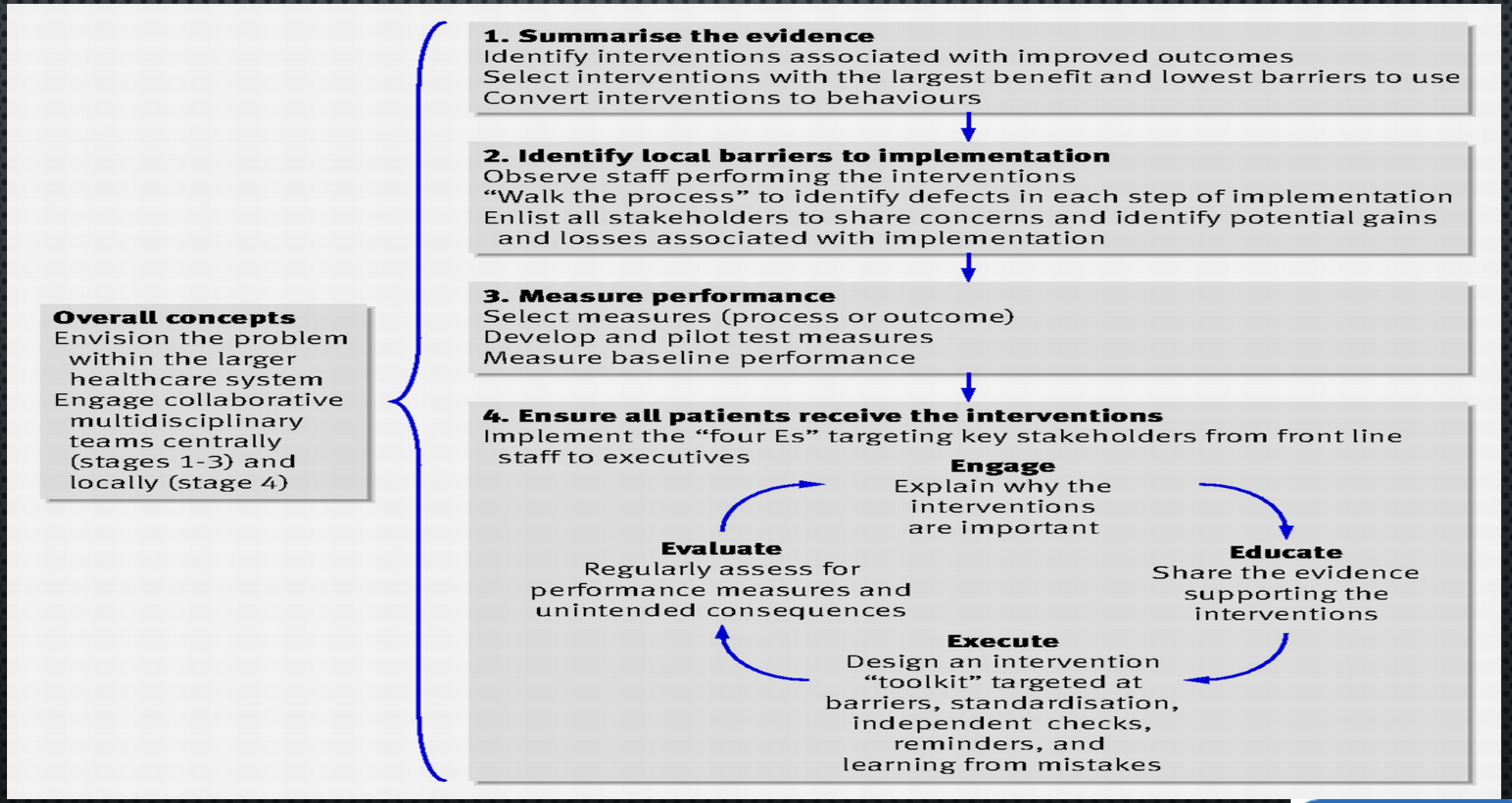


References:

1. NICE clinical guideline 74: Surgical site infection – Prevention and treatment of surgical site infection http://www.nice.org.uk/Guidance/CG74
2. World alliance for Patient Safety. WHO surgical safety checklist June 2008 http://www.who.int/patientsafety/safesurgery/tools_resources/SSSL_Checklist_finalJun08.pdf?ua=1
3. Bratzler DW, Dellinger EP, Olsen KM et al. (2013). Clinical practice guidelines for antimicrobial prophylaxis in surgery. Am J Health Syst Pharm 2013; 70(3): 195-283

Advocating patient safety and auditing of antimicrobial stewardship in hospitals should be based around the principles stated in this algorithm. Examples of audit tools are shared in the following pages

Strategy for translating evidence into practice.



Pronovost P, Berenholtz S, Needham D. BMJ 2008;337:a1714

Peter J Pronovost et al. BMJ 2008;337:bmj.a1714

DOING ANTIMICROBIAL STEWARDSHIP

S [c] + P[i] = O

S= STRUCTURE

I= CULTURE

P= PROCESS

I= IMPLEMENTATION OF PROCESSES

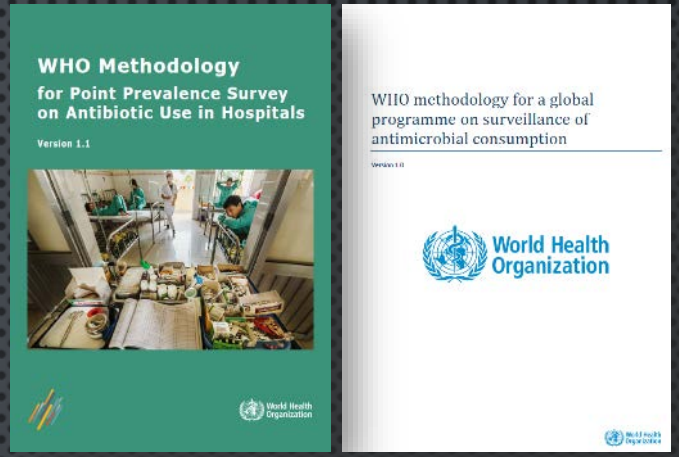
O= OUTCOMES

Data for Improvement, Accountability, Research

Aspect	Improvement	Accountability (Judgment)	Research
Aim	Improvement of care Process, system, and outcomes **(efficiency & effectiveness)**	judgment, choice, reassurance, spur for change	New generalizable knowledge **(efficacy)**
Methods: • Test Observability	Test observable	No test, evaluate current performance	Test blinded or controlled
• Bias	Accept consistent bias	Measure and adjust to reduce bias	Design to eliminate bias
• Sample Size	**"Just enough" data,** small sequential samples	Obtain 100% of available, relevant data	**"Just in case" data**
• Flexibility of Hypothesis	Flexible hypotheses, changes as learning takes place	No hypothesis	Fixed hypothesis (null hypothesis)
• Testing Strategy	Sequential tests	No tests	One large test
• Determining if a change is an improvement	**Analytic Statistics** **(statistical process control)** Run & Control charts	No change focus maybe compute a percent change or rank order the results)	**Enumerative Statistics** (t-test, F-test, chi square, p-values)
• Confidentiality of the data	Data used only by those involved with improvement	Data available for public consumption and review	Research subjects' identities protected

Provost and Murray The Healthcare Data Guide. San Francisco. Jossey-Bass 2011. Page 27.

Assessing AMS programmes



- **Baseline**: Measure **quantity** and **quality** of **antibiotic use,** to identify priority areas for AMS interventions
- **Objective:** to **compare** results (in hospital, department or ward) **over time**

✓ ***Structure measures***: core elements

✓ ***Process measures***: proportions e.g. of patients Dx receiving appropriate antibiotic treatment

✓ ***Outcome measures***: Antibiotic use, patient outcomes

AMS METRICS SUMMARY

STRUCTURAL INDICATORS

- Availability of **multi-disciplinary antimicrobial stewardship team**
- Availability of **guidelines** for empiric treatment and surgical prophylaxis
- Provision of education in the last 2 years

PROCESS MEASURES

- **Amount of antibiotic** in DDD/100 bed days
  - Promoted antibiotics
  - Restricted antibiotics
- **Compliance with acute empiric guidance** (documented notes and policy compliance)
- % appropriate **de-escalation**; % appropriate switch from **IV to oral**
- Compliance with **surgical prophylaxis** (<60 min from incision, <24 hours and compliance with local policy
- Compliance with **care "bundles"** – all or nothing (3-day antibiotic review bundle, ventilator-associated pneumonia, community-acquired pneumonia, sepsis)

OUTCOME MEASURES

- *C. difficile* infection rates
- Surgical Site Infection (SSI) rates
- Surveillance of resistance
- Mortality: Standardized Mortality Rates (SMRs)

BALANCING MEASURES

- Mortality
- SSI rates
- Readmission within 30 days of discharge
- Admission to ICU
- Rate of complications
- Treatment-related toxicity (e.g. aminoglycoside-related toxicity)

OUTCOME MEASURES	REMARKS
CLINICAL	
Mortality	Important, but less suitable for mild infections (e.g. uncomplicated UTI)
Length of Stay	General or ward-specific (e.g. ICU stay); easy to obtain, but highly sensitive to biases
Complications	Eg: IV catheter-related problems and phlebitis
Clostridium difficile	Indirect measure for antimicrobial use
Readmission rates	Due to relapse. Also consider effect of neighboring institutions
Toxicity (systemic)	Most frequently in renal function and liver
MICROBIOLOGICAL	
Resistance levels	Difficult to measure due to generally long time frame (months to years)
ANTIMICROBIAL CONSUMPTION	
Total use	Often measured in DDDs
IV/PO ratio	Of interest with an active IV-to-PO switch program
Broad/narrow ratio	Potentially relevant with regard to resistance development
FINANCIAL	**Preferably done as cost-effectiveness study**

UTI: urinary tract infection; ICU: intensive care unit; PO: per os; LOS: Length of stay; DDDs: defined daily doses; IV: intravenous.

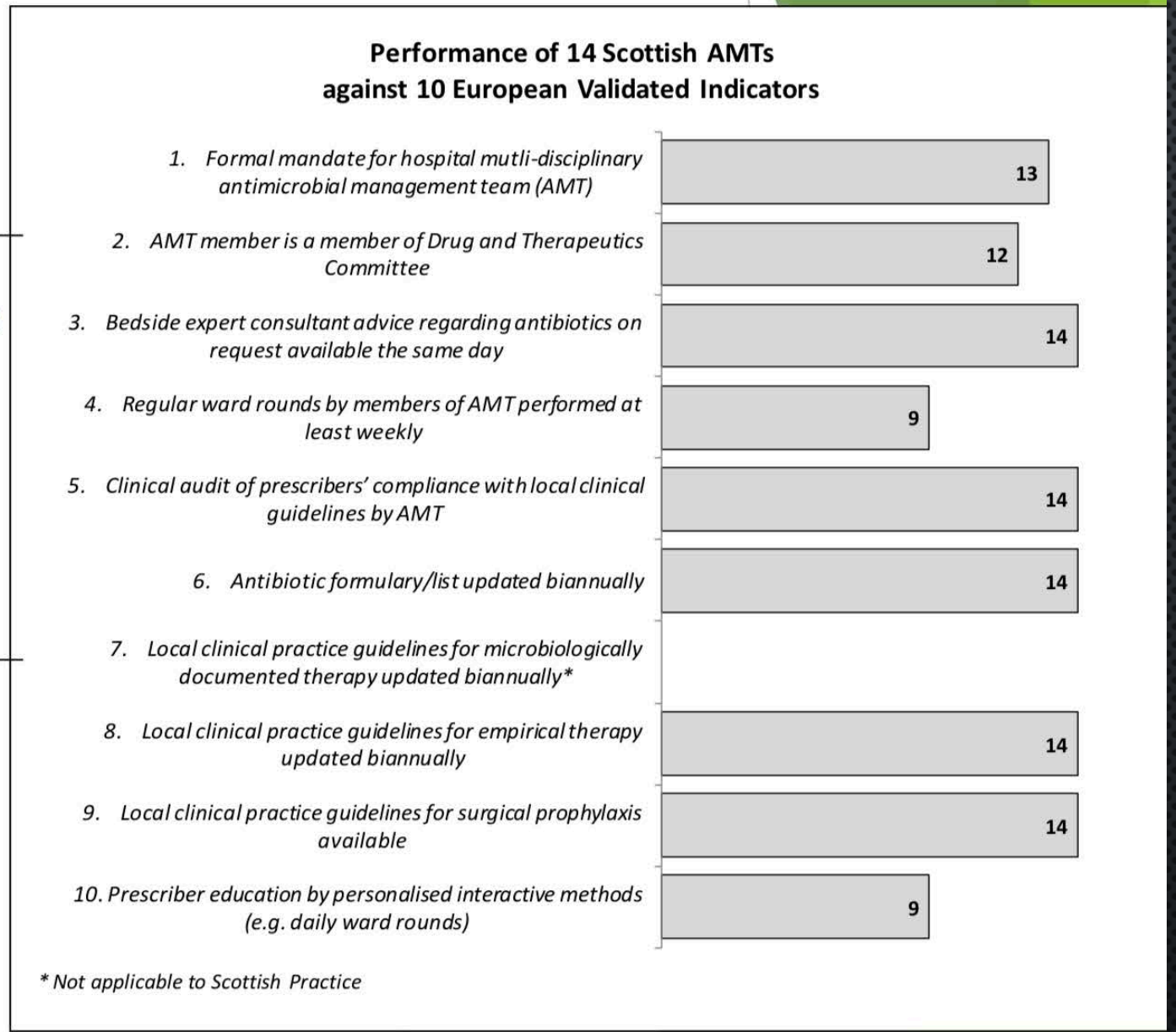
http://bsac-jac-amr.com/wp-content/uploads/2019/04/Biomer-2019-ANTIMICROBIAL-STEWARDSHIP-BOOKLET-FINAL2.pdf

Structure indicators for stewardship

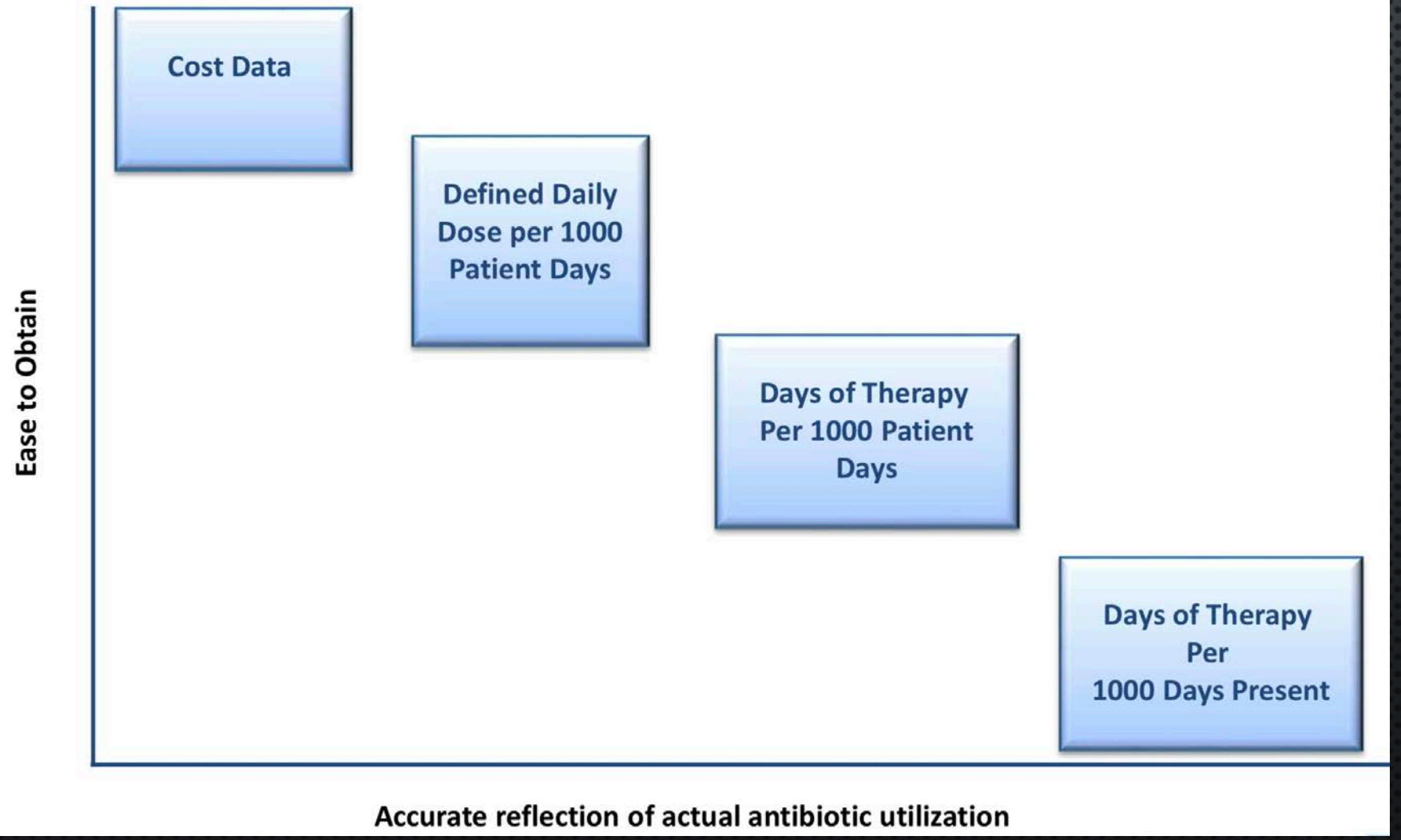
Development and validation of potential structure indicators for evaluating antimicrobial stewardship programmes in European hospitals

F. M. Buyle · S. Metz-Gercek · R. Mechtler · W. V. Kern · H. Robays · D. Vogelaers · M. J. Struelens · on behalf of members of the Antibiotic Strategy International (ABS) Quality Indicators Team

Eur J Clin Microbiol Infect Dis. 2013; 32: 1161-70



Measuring Antibiotic Use



From intermittent antibiotic point prevalence surveys to quality improvement: experience in Scottish hospitals

William Malcolm[1*], Dilip Nathwani[2], Peter Davey[3], Tracey Cromwell[4], Andrea Patton[5], Jacqueline Reilly[1], Shona Cairns[1] and Marion Bennie[4,6]

Malcolm *et al. Antimicrobial Resistance and Infection Control* 2013, **2**:3
http://www.aricjournal.com/content/2/1/3

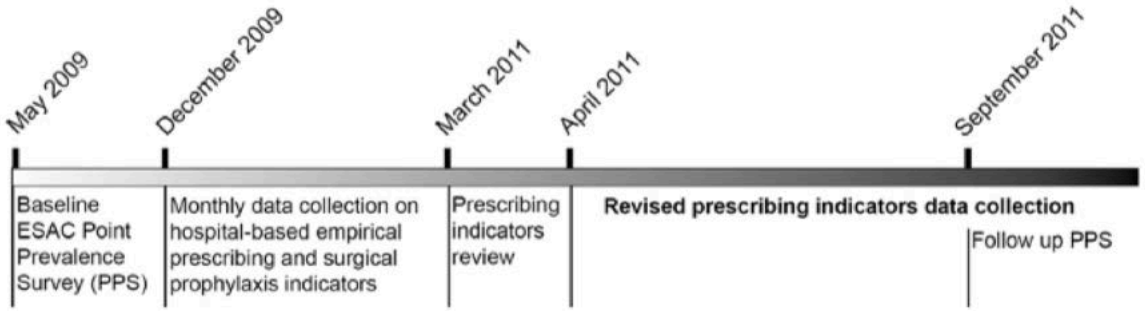


Figure 1 Time line showing progress from Point Prevalence Survey to Continuous Quality improvement.

Table 1 Overview of prescribing from baseline PPS (May 2009) and follow up PPS (September 2011)

Measure	Baseline PPS (May 2009)			Follow up PPS (Sept 2011)
	Scotland acute hospitals	Europe	Odds ratio (p value)	Scotland acute hospitals
Number of patients surveyed	7,573	73,060		11,604
Number of patients (%) prescribed antimicrobials	2,289 (30.2%)	21,197 (29.0%)	1.06 (0.03)	3,728 (32.3%)
Number of patients (%) prescribed single antimicrobial	1,432 (62.6%)	14,403 (67.9%)	0.79 (<0.001)	2,268 (60.8%)
Number of prescriptions (%) for parenteral antimicrobials	1,731 (51.8%)	17,947 (60.5%)	0.7 (<0.001)	2,147 (47.8%)
Number of prescriptions (%) with indication recorded in notes	2,538 (75.9%)	22,456 (75.7%)	1.01 (0.78)	3,811 (86.8%)
Number of prescriptions (%) compliant with local policy	1939 (81.0%)	17,223 (82.5%)	0.90 (0.06)	2,245 (82.8%)
Number of surgical prophylaxis prescriptions (%) with duration single dose	146 (49.3%)	927 (27.0%)	2.92 (<0.001)	287 (59.5%)
Number of surgical prophylaxis prescriptions (%) with Duration = 1 day	57 (19.3%)	723 (21.1%)	0.85 (0.27)	81 (16.8%)
Number of surgical prophylaxis prescriptions (%) with duration >1 day	93 (31.4%)	1783 (51.9%)	0.41 (<0.001)	114 (23.7%)

Aim: To reduce **SSI**

How: Improve quality of surgical antibiotic prophylaxis

What: Implement AMS interventions

Measures: Identify and agree surgical prophylaxis process and **outcomes**

HOW IMPROVING PROCESS IMPROVES OUTCOMES:

1. PRE-OP TIMING = **SSI**
2. CHOICE OF ANTIBIOTIC [NARROW PREFERRED] = **SSI AND POTENTIAL FOR ADVERSE EVENT SUCH AS RESISTANCE & *C.DIFFICILE***
3. DURATION OF ANTIBIOTIC <24H = **RESISTANCE AND *C. DIFFICILE***

Prescribing indicators – using a quality improvement approach

AIM MEASURES CHANGES

Start small – focus on one ward with high prevalence of antibiotic use

Frequent data collection and feedback – focus on a few measures

Test changes and repeat – discuss improvements with clinical team

Example data collection

Empirical Prescribing indicator	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5
Indication for Antibiotic Treatment Recorded in Notes?	Y / N	Y / N	Y / N	Y / N	Y / N
Antibiotic(s) Compliant with Local Prescribing Policy?	Y / N	Y / N	Y / N	Y / N	Y / N
All doses administered as per medicine chart?	Y / N	Y / N	Y / N	Y / N	Y / N

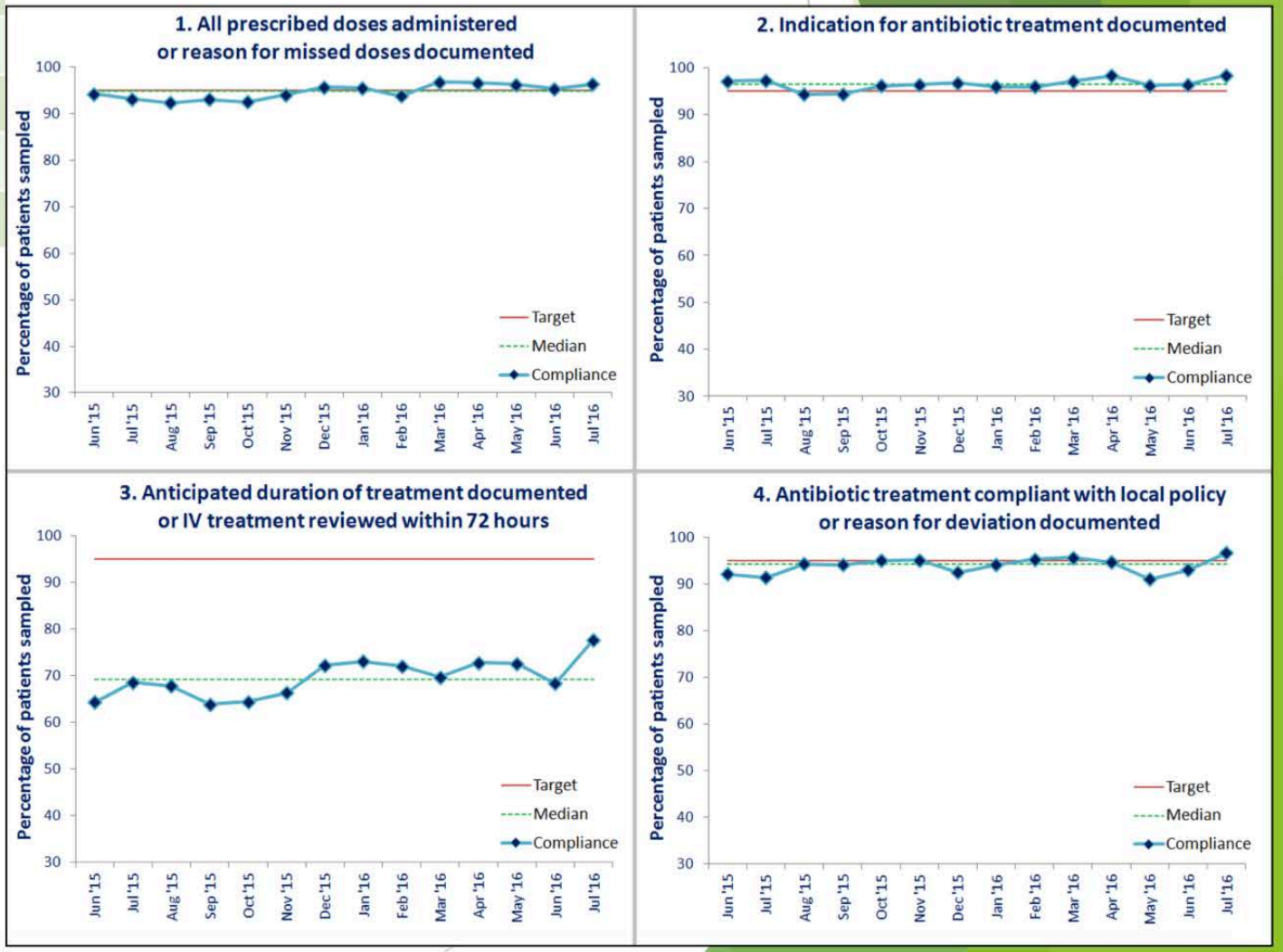
J. SNEDDON

Prescribing quality indicators – Scotland

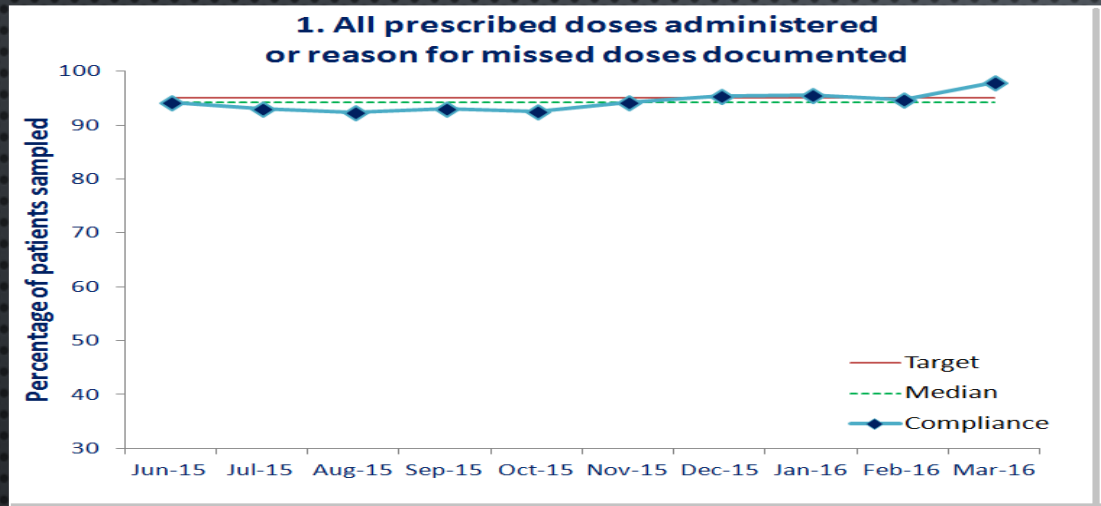
	Medical				Surgical			
Measure	Median (%)	Min (%)	Max (%)	Boards compliant	Median (%)	Min (%)	Max (%)	Boards compliant
1. Doses administered	95	91	100	8/14	94	84	100	6/15
2. Indication documented	96	84	100	10/14	93	86	100	6/15
3. Duration documented	69	45	95	1/14	54	29	97	1/15
4. Compliant with policy	94	90	100	8/14	90	82	100	3/15

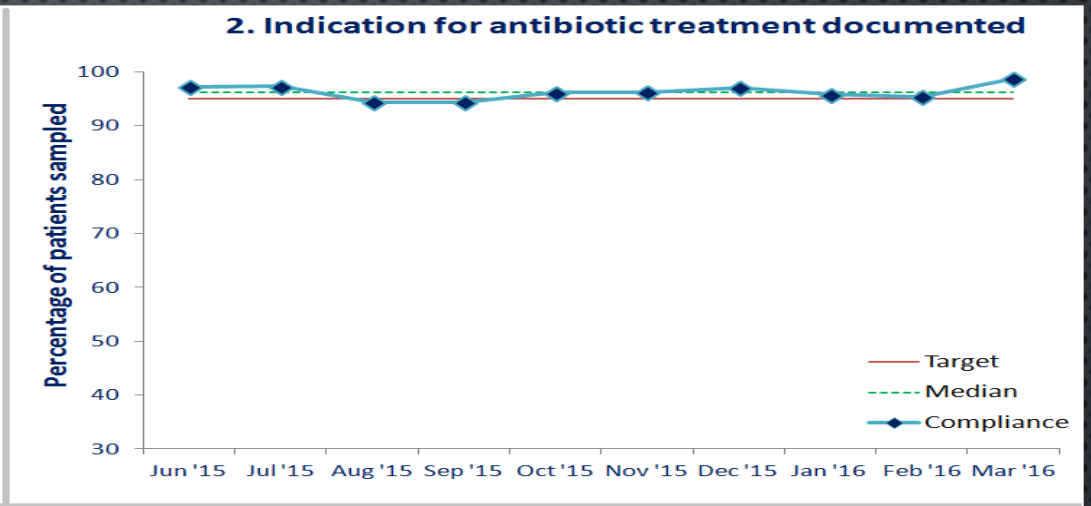
Median percentage compliance with measures at a national level and number of health boards reaching target 95% compliance.

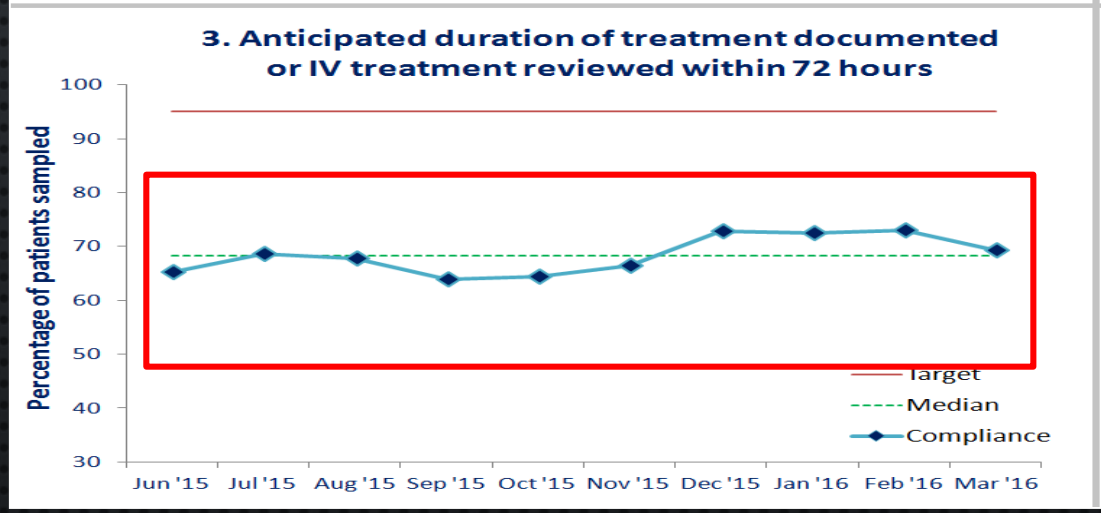
J. SNEDDON

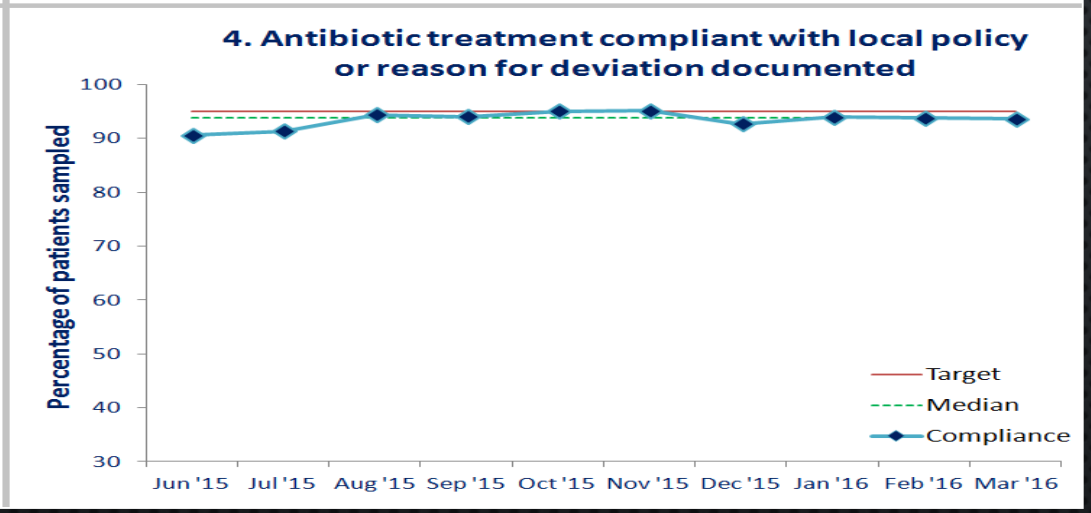


“FRONT END” AND “BACK END” INTERVENTION MEASURES”









Antimicrobial consumption and resistance in adult hospital inpatients in 53 countries: results of an internet-based global point prevalence survey

Quality

*Ann Versporten, Peter Zarb, Isabelle Caniaux, Marie-Françoise Gros, Nico Drapier, Mark Miller, Vincent Jarlier, Dilip Nathwani, Herman Goossens, on behalf of the Global-PPS network**

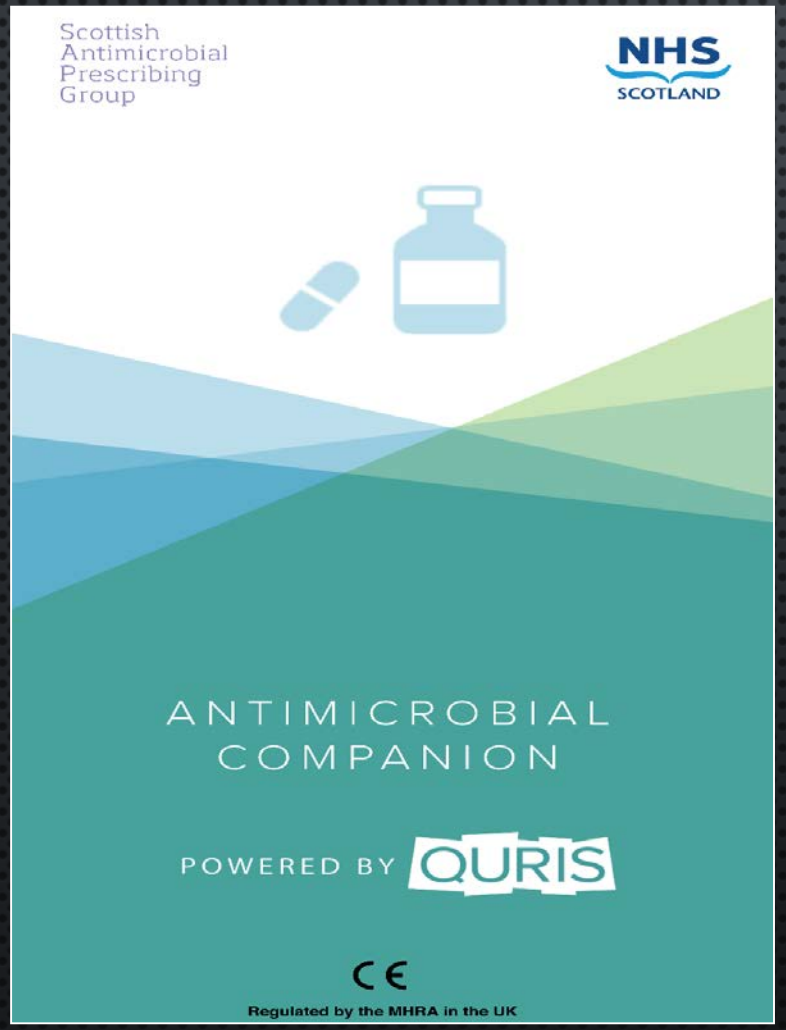
	Antimicrobial prescriptions	Antibiotic prescriptions	Targeted treatment*	Targeted treatment (resistant organisms)*	Reason recorded†	Stop or review date recorded†	Parenteral administration‡	Guidelines available§	Compliant to local guidelines¶	No guidelines available‖
Eastern Europe (n=653)	747	708	51 (7·8%)	42 (6·4%)	64·3%	50·5%	87·6%	79·8%	85·7%	19·2%
Northern Europe (n=2783)	3880	3536	396 (14·2%)	80 (2·9%)	81·4%	51·6%	62·2%	90·0%	83·4%	6·5%
Southern Europe (n=5534)	7674	6837	838 (15·1%)	292 (5·3%)	69·5%	29·1%	80·0%	60·5%	70·8%	29·6%
Western Europe (n=8458)	10612	9485	2204 (26·1%)	469 (5·5%)	80·5%	40·3%	64·0%	81·0%	78·7%	10·1%
Africa (n=899)	1502	1213	131 (14·6%)	25 (2·8%)	70·4%	36·6%	62·7%	49·5%	67·9%	26·7%
East and south Asia** (n=5363)	7607	6781	938 (17·5%)	287 (5·4%)	74·6%	43·5%	71·8%	76·4%	81·5%	21·4%
West and central Asia (n=1612)	2252	2084	236 (14·6%)	153 (9·5%)	72·8%	19·8%	85·2%	53·4%	66·3%	40·5%
Oceania (n=932)	1411	1226	218 (23·4%)	63 (6·8%)	85·1%	27·0%	60·5%	87·4%	73·2%	11·7%
Latin America (n=1518)	2403	2170	403 (26·5%)	231 (15·2%)	81·4%	40·3%	84·4%	76·5%	64·1%	19·9%
North America (n=2139)	3125	2752	511 (23·9%)	127 (5·9%)	84·9%	39·6%	73·1%	77·3%	85·8%	18·5%
Total (n=29 891)	41 213	36 792	5926 (19·8%)	1769 (5·9%)	76·9%	38·3%	71·4%	74·3%	77·4%	19·2%

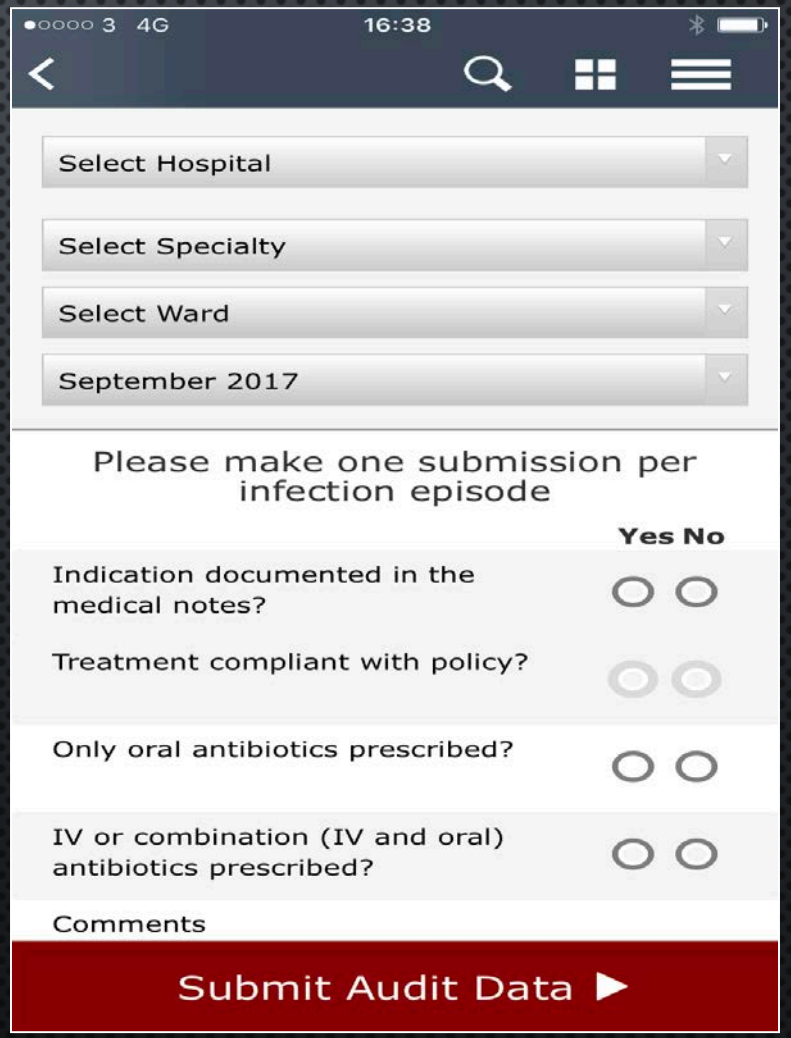
Data are n or %. A version of this table containing numerical data for all percentages is in the appendix. *Patients receiving at least one antibiotic for systemic therapeutic use only (ie, health-care-associated or community-acquired infection). †Includes all antimicrobials; the total number of antimicrobial prescriptions was used to calculate percentages. ‡Patients who received at least one parenteral antibiotic for systemic use. §Antibiotic prescriptions for which guidelines were available to guide antibiotic choice (not route, dose, or duration), which was calculated as all antibiotic prescription for which a local guideline was available/all antibiotic prescription. ¶The number of antibiotic prescriptions for which guidelines were available was used as the denominator to calculate percentages. ‖The total number of antibiotic prescriptions was used as the denominator to calculate percentages. **Includes south, east, and southeast Asia.

Table 4: **Overview of antimicrobial and antibiotic quality indicators for adult inpatients by region, year 2015**

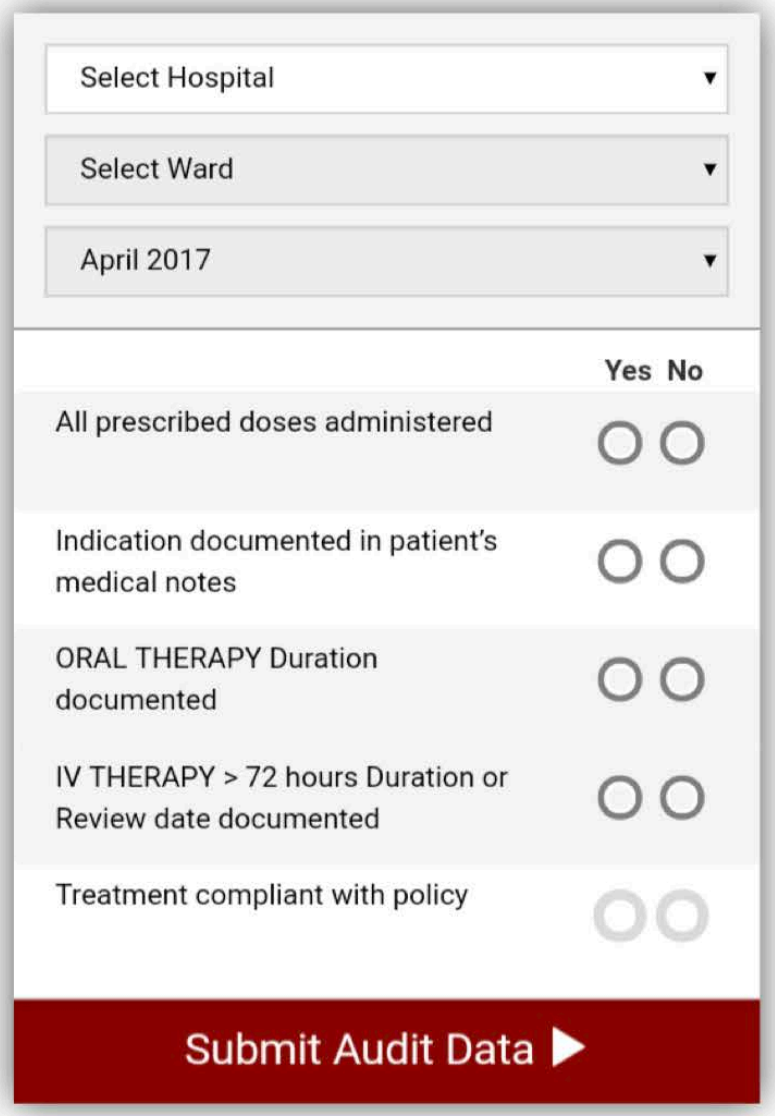
Lancet Glob Health 2018; 6: e619–29

2017 – Guideline App, Calculators, Audit





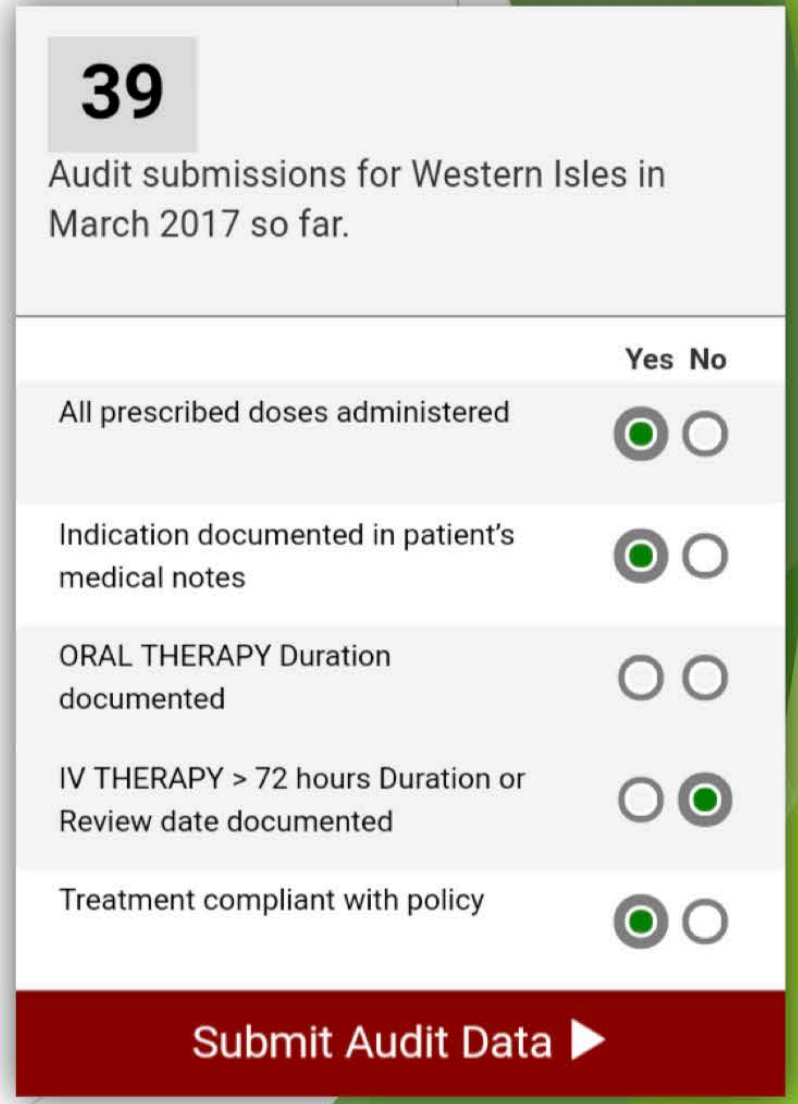
Using technology to make QI easy
Antimicrobial Companion App.



After login, the audit tool allows submission of audit data.

After submission of data, the audit tool displays the number of submissions for that period within the selected ward.

Reports created monthly by app administrator in each hospital



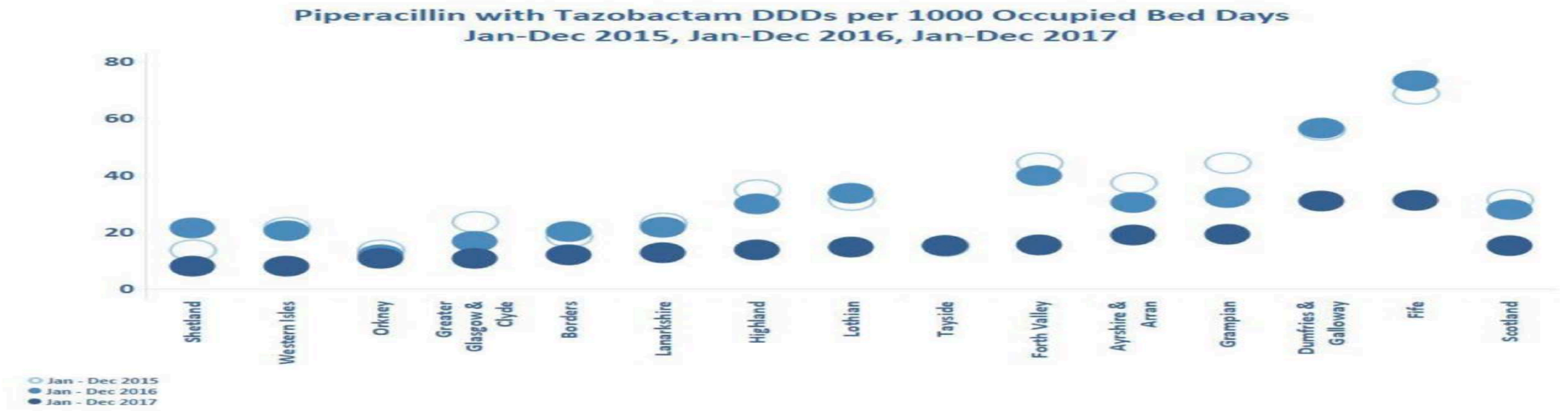
Secondary Care National Therapeutic Indicators 2018/19

Antibiotics

A. Total antibiotic use (DDDs) per 1000 occupied bed days
B. Carbapenem use (DDDs) per 1000 occupied bed days
C. Piperacillin / and tazobactam use (DDDs) per 1000 occupied bed days

Data - Piperacillin with Tazobactam

Figure 6: Piperacillin with Tazobactam use in acute hospitals



Number of DDDs issued where drug substance is: piperacillin + tazobactam per 1,000 occupied bed days.
Source: SAPG Antimicrobial Use Dashboard

J Antimicrob Chemother 2015
doi:10.1093/jac/dkv127
Advance Access publication 25 May 2015

Reduction in broad-spectrum Gram-negative agents by diverse prescribing of aztreonam within NHS Tayside

Heather Kennedy[1]*, Sarah Wilson[1], Charis Marwick[1], William Malcolm[2] and Dilip Nathwani[1]

[1]*Ninewells Hospital, Ninewells Avenue, Dundee DD1 9SY, Scotland;*
[2]*HAI and Infection Control Group, NHS National Services Scotland, 4th Floor, Meridian Court, 5 Cadogan Street, Glasgow G2 6QE, Scotland*

Scottish Medicines Consortium

Scottish Antimicrobial Prescribing Group

NHS SCOTLAND

POSITION PAPER ON OPTIMISING ANTIMICROBIAL PRESCRIBING IN POSSIBLE OR SUSPECTED INFECTIONS DUE TO MULTI-DRUG RESISTANT GRAM NEGATIVE BACTERIA

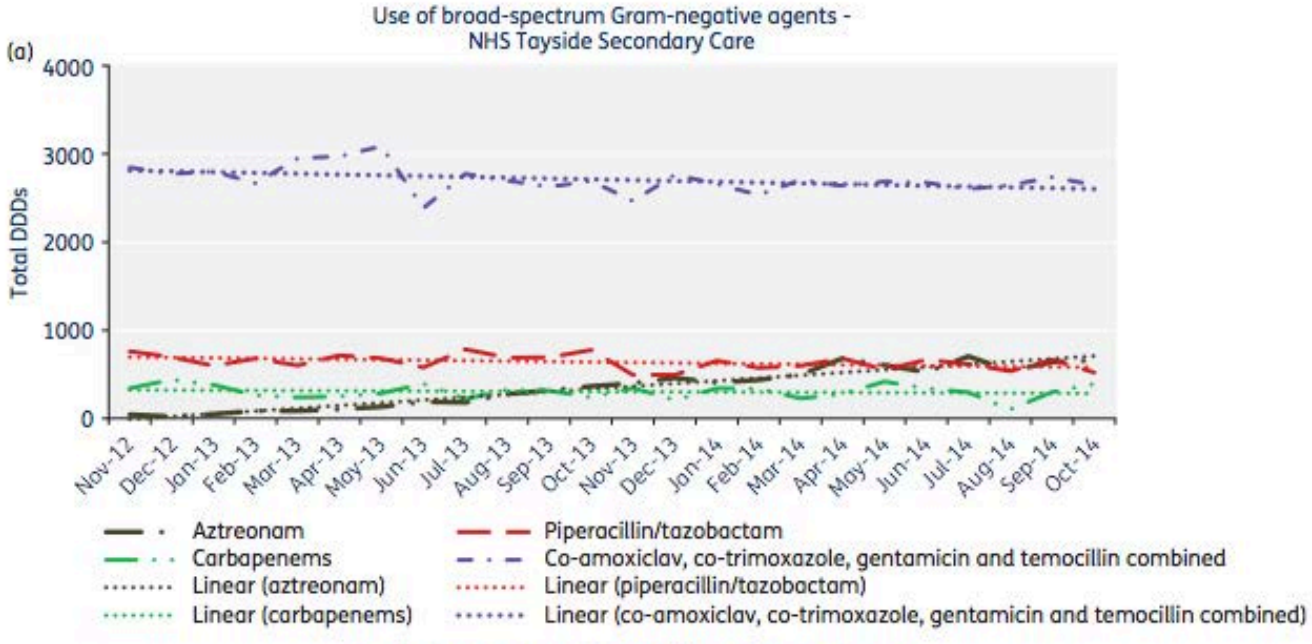
This advice has been developed by the Scottish Antimicrobial Prescribing Group (SAPG) through consultation with clinical specialists to provide practical advice for Antimicrobial Management Teams and Infection Specialists.
The aims are to:

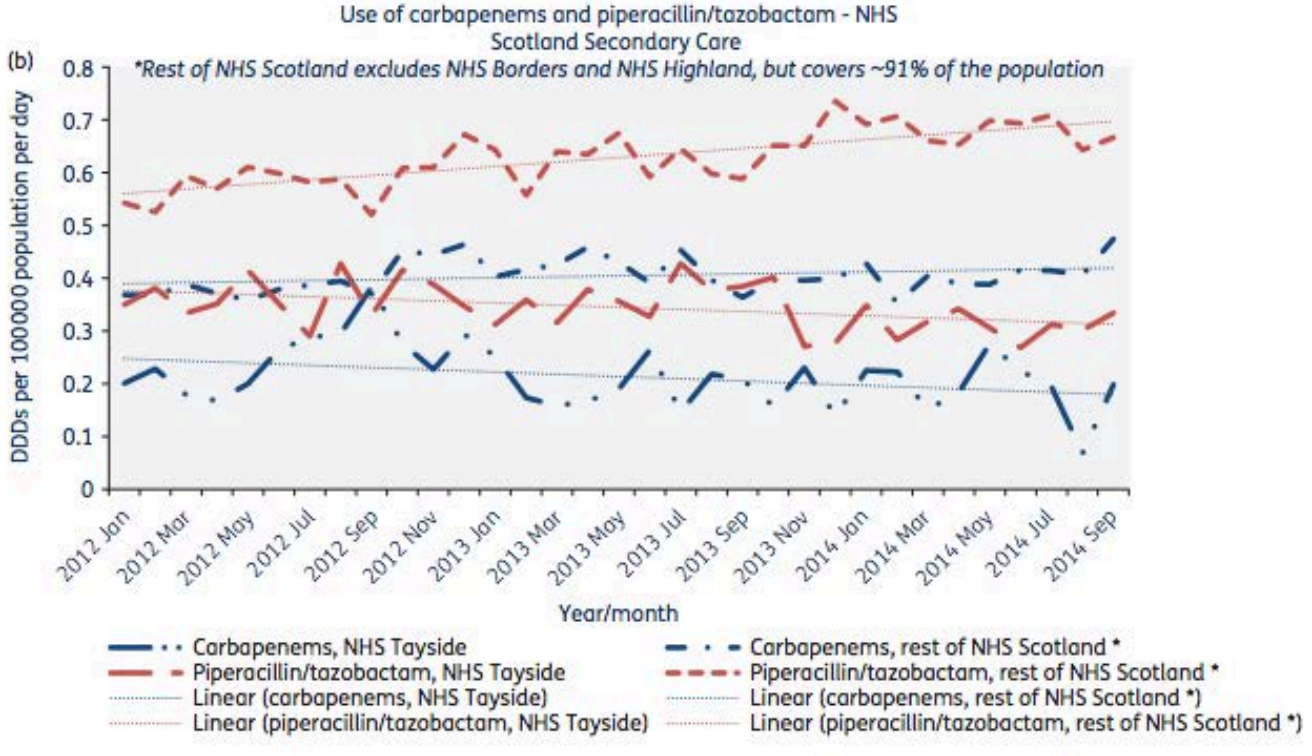
1. **Support** clinical management of Gram negative infections
2. **Reduce** emergence of MDRGNB
3. **Promote** more judicious use of broad spectrum antimicrobials
4. **Protect and preserve** the carbapenem and other key classes of antibiotics.

4. Carbapenem-sparing approaches for suspected or proven Gram negative infections

5. Microbiology laboratory practical advice

AZTREONAM is available on the VITEK 2 AST-N297 (systemic Enterobacteriaceae) and AST-N253 (systemic non-fermenter) cards.
FOSFOMYCIN is available on the VITEK 2 AST –N254 (urine Enterobacteriaceae) card. This can also be used, if required, for systemic isolates.
PIVMECILLINAM cannot be included on a VITEK 2 AST card for technical reasons. Disc testing remains the only way to assess sensitivity.
TEMOCILLIN is available on the AST-N297 (systemic Enterobacteriaceae) card, having replaced chloramphenicol at the request of SMVN. It is also available on the VITEK 2 AST-N254 (urine Enterobacteriaceae) card.





Optimizing carbapenem use through a national quality improvement programme

J Antimicrob Chemother
doi:10.1093/jac/dky171

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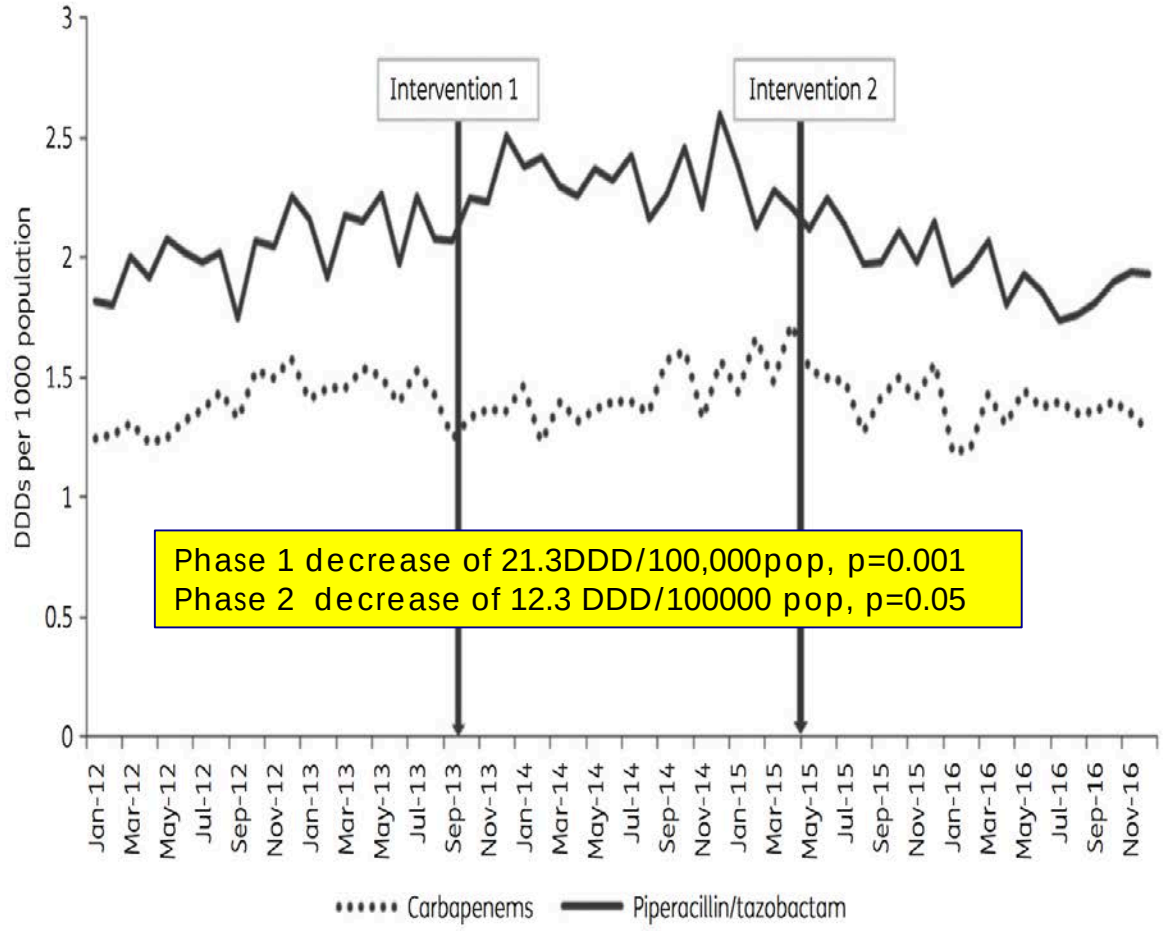
Siân E. Robson[1], Alison Cockburn[1,2], Jacqueline Sneddon[1]*, Abdulrhman Mohana[3], Marion Bennie[3,4], Alexander B. Mullen[3], William Malcolm[5], Jennifer Armstrong[4], Andrea Patton[1] and Ronald Andrew Seaton[1,6]



Phase 1 decrease of 21.3DDD/100,000pop, p=0.001
Phase 2 decrease of 12.3 DDD/100000 pop, p=0.05

Figure 4. NHS Scotland: carbapenem and piperacillin/tazobactam use (DDDs) from January 2012 to March 2017. Intervention 1: SAPG guidance on MDR Gram-negative bacteria (October 2013); intervention 2: quality improvement [AMT Survey (May 2015), bespoke point prevalence survey (October 2015), reports shared with boards (January 2016) and AMT event (March 2016)].

Table 1. Thematic analysis of clinician interviews about meropenem- and carbapenem-sparing agents (CSAs) ($n = 21$)

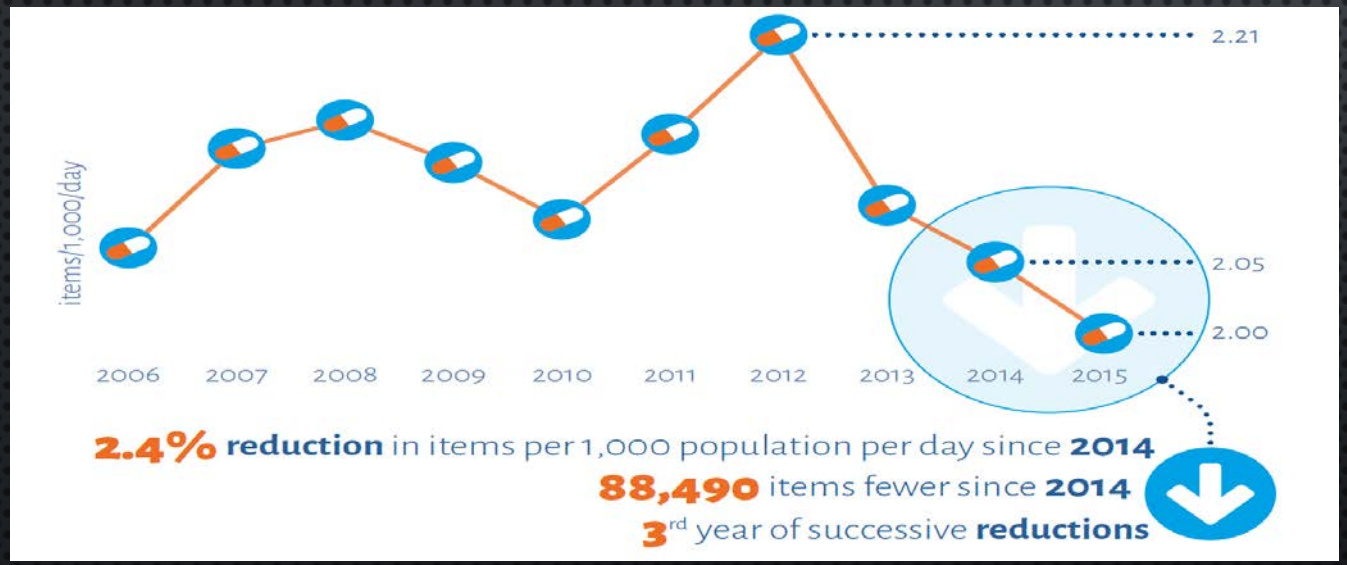
Topic	Themes
Initiation phase	*Factors influencing prescribing of meropenem and CSAs:*
	Local guidelines and policies
	Prescribers seeking advice or laboratory results
	Patient-related factors
	Carbapenem-sparing agent prescribing levers
Continuation phase	*Factors influencing review of meropenem and CSA prescriptions:*
	Formal review policy and guidance
	Duration documentation
	De-escalation guide
	Microbiology evidence and reports
Areas for improvement	*Factors to target identified by clinicians:*
	Better communication with specialists and within clinical teams
	Review prescribing practice in high usage wards
	Piperacillin/tazobactam overuse
	Audit and feedback to prescribers on their use

INTEGRATED APPROACH WITH PRIMARY CARE AND CARE HOMES

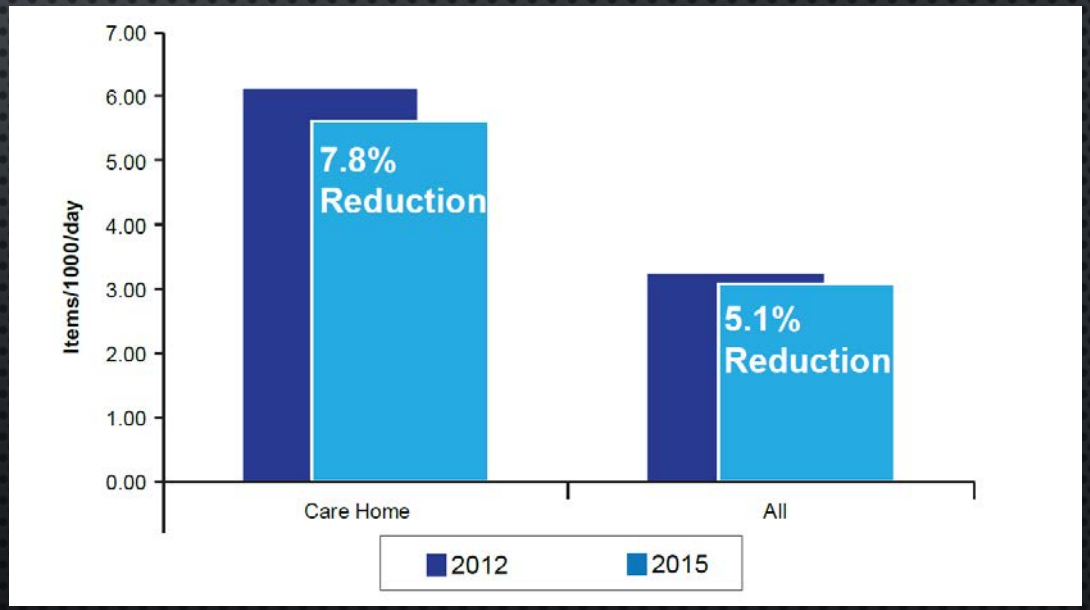
COMPELLING DATA ON OUTCOMES

NHS Scotland: Use of antibiotics in primary care items/1000/day 2006-2015- "THE 4C APPROACH"

selection pressures arising from population use of specific drugs. We examined the effect of a national antibiotic stewardship intervention limiting the use of 4C antibiotics (fluoroquinolones, clindamycin, co-amoxiclav, and cephalosporins) and other infection prevention and control strategies on the clinical and molecular epidemiology of *C difficile* infections in northeast Scotland.



NHSScotland: Antibiotic prescribing for those aged 65 years and over in care homes and non–care homes in 2012 and 2015



J Antimicrob Chemother 2015; **70**: 2397–2404
doi:10.1093/jac/dkv095 Advance Access publication 7 May 2015

Journal of Antimicrobial Chemotherapy

Time series analysis of the impact of an intervention in Tayside, Scotland to reduce primary care broad-spectrum antimicrobial use

Virginia Hernandez-Santiago*, Charis A. Marwick, Andrea Patton, Peter G. Davey, Peter T. Donnan and Bruce Guthrie

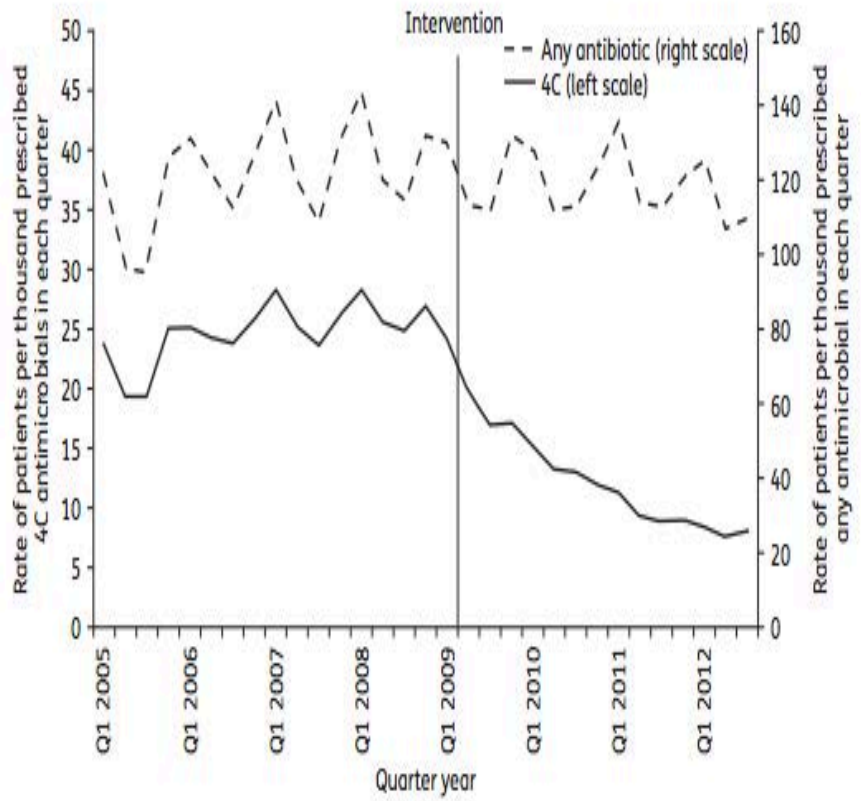


Figure 1. Prescribing of: (i) 4C antimicrobials (left-hand scale); and (ii) all antimicrobials (right-hand scale).

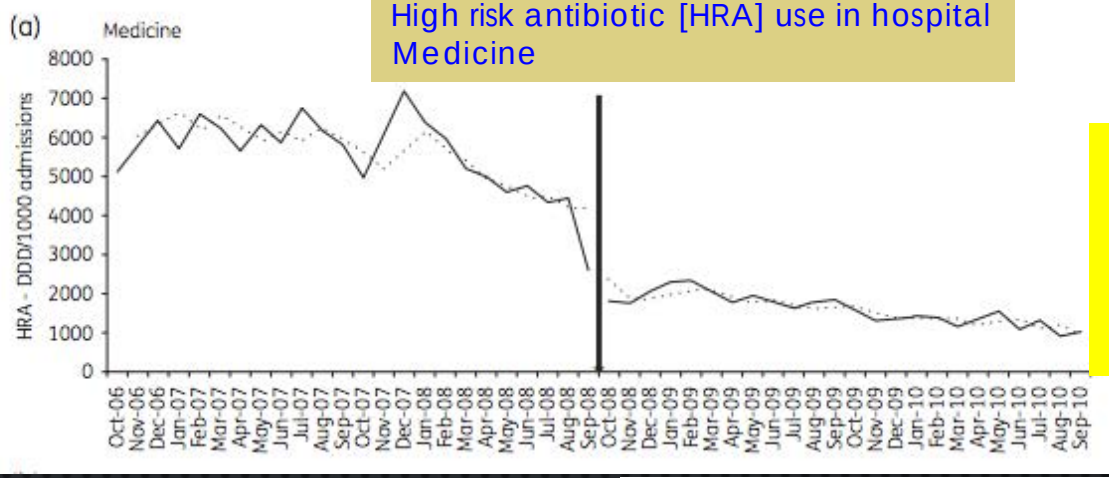
J Antimicrob Chemother 2018; **73**: 517–526
doi:10.1093/jac/dkx413 Advance Access publication 21 November 2017

Journal of Antimicrobial Chemotherapy

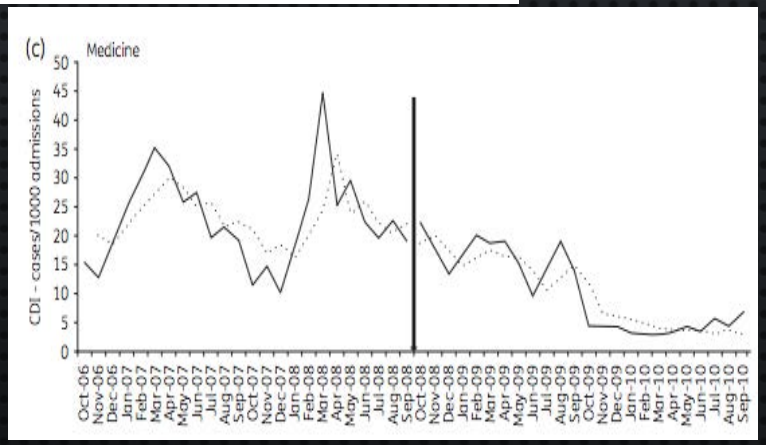
Impact of antimicrobial stewardship interventions on *Clostridium difficile* infection and clinical outcomes: segmented regression analyses

Andrea Patton[1,2], Peter Davey[1], Stephan Harbarth[3], Dilip Nathwani[4], Jacqueline Sneddon[2] and Charis A. Marwick[1,4]*

High risk antibiotic [HRA] use in hospital Medicine



33% reduction in HRA
24% reduction in CDI
No change in mortality



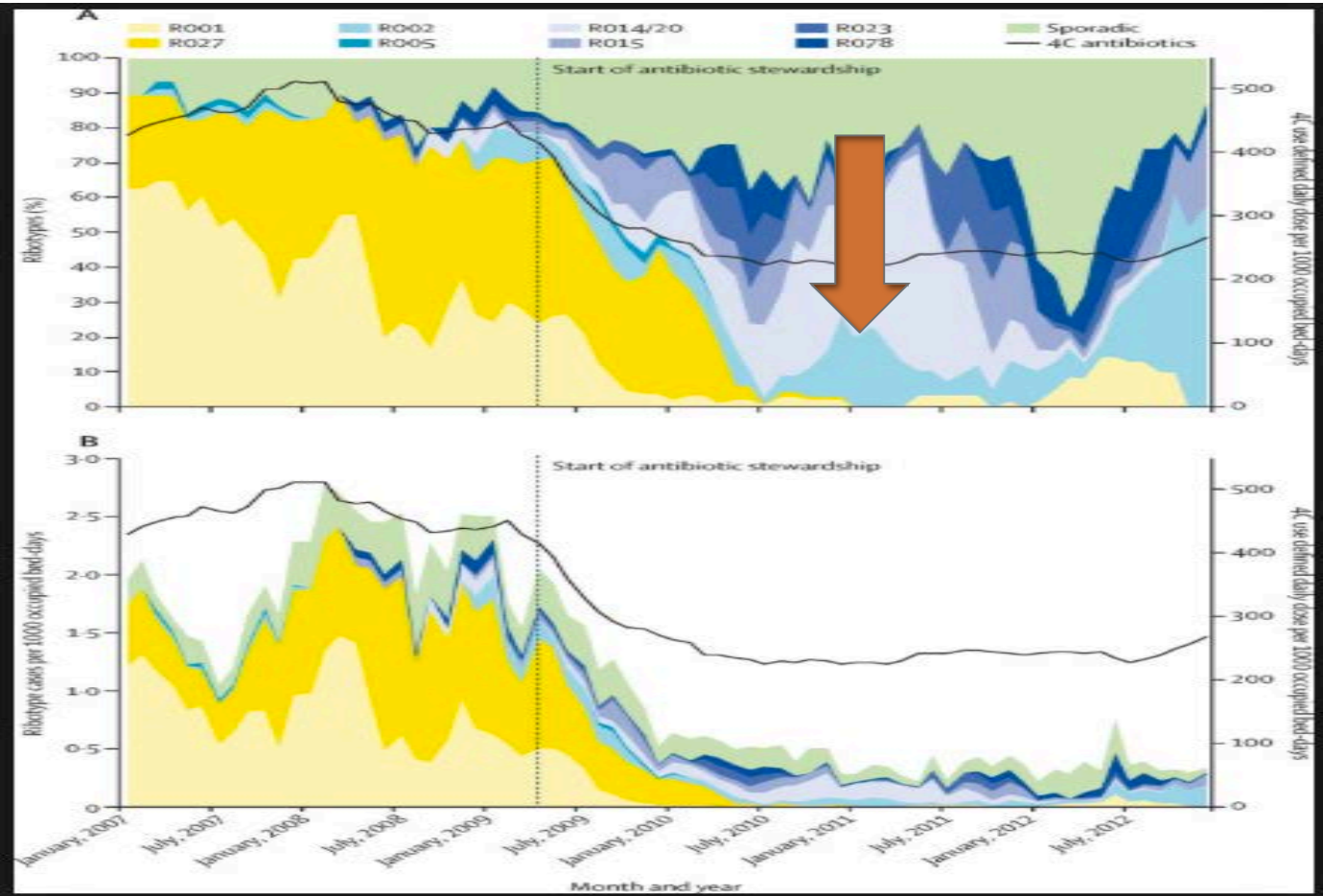
Effect of a national 4C antibiotic stewardship intervention on the clinical and molecular epidemiology of *Clostridium difficile* infections in a region of Scotland: a non-linear time-series analysis

Lancet Infect Dis 2017; 17: 194–206

Timothy Lawes, José-María Lopez-Lozano, Cesar A Nebot, Gillian Macartney, Rashmi Subbarao-Sharma, Karen D Wares, Carolyn Sinclair, Ian M Gould

Desirable outcome :

Outcomes



Changes in resistance among coliform bacteraemia associated with a primary care antimicrobial stewardship intervention: A population-based interrupted time series study

Virginia Hernandez-Santiago[1], Peter G. Davey[2], Dilip Nathwani[3], Charis A. Marwick[2*], Bruce Guthrie[4]

Citation: Hernandez-Santiago V, Davey PG, Nathwani D, Marwick CA, Guthrie B (2019) Changes in resistance among coliform bacteraemia associated with a primary care antimicrobial stewardship intervention: A population-based interrupted time series study. PLoS Med 16(6): e1002825. https://doi.org/10.1371/journal.pmed.1002825

- We conducted segmented regression analyses of interrupted time series data on community prescribing of fluoroquinolones, cephalosporins, and co-amoxiclav between 2005 and 2012 and on resistance to the same antimicrobials among common gram-negative bloodstream infections (*E. coli*, *Klebsiella spp.*, and *Proteus spp.*) identified on admission to hospital. We modelled immediate changes in rates and in trends associated with the stewardship intervention and estimated changes in prescribing (compared to predicted rates if the intervention had not occurred) 1 and 3 years later, and in resistance 1.5 and 3.5 years later (incorporating a prespecified expected 6-month delay between changes in prescribing and changes in resistance).

- We found large and sustained reductions in prescribing of all three antimicrobials associated with implementation of the stewardship intervention.
- We found reductions in coliform bacteraemia resistance rates associated with the intervention that were significant for fluoroquinolones and cephalosporins by 3.5 years but not for co-amoxiclav. The reductions in resistance took much longer than reductions in prescribing to become evident, and relative reductions were more modest. The overall pattern was of flattening rather than reversal of previously rising resistance rates.

COMMUNICATION METHODS: USING DATA EFFECTIVELY

The Stewardship Audience

Perceived Most Important by Position

Outcome	Hospital Administrator	Pharmacy Director	P&T Committee	ID Physician
Antibiotic Use	1 (2)	9 (22)	13 (32)	1 (2)
Antibiotic Cost	17 (42)	23 (56)	6 (15)	0 (0)
Appropriateness	2 (5)	2 (5)	6 (15)	11 (27)
Infection-related mortality	1 (2)	2 (5)	1 (2)	15 (37)
Infection or antibiotic-related length of stay	2 (5)	0 (0)	1 (2)	3 (7)

Bumpass JB et al. *Clin Infect Dis* 2014;59(S3):S108-11

Utilizing Data

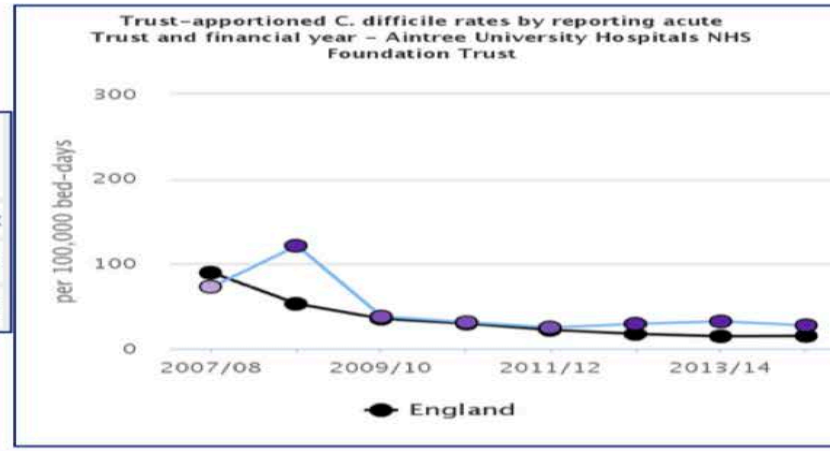
1. Define your goal for communicating
2. Determine your target audience
3. Choose the communication method(s)
4. Adopt good communication principles
5. Communicate numbers effectively
6. Provide a take home message

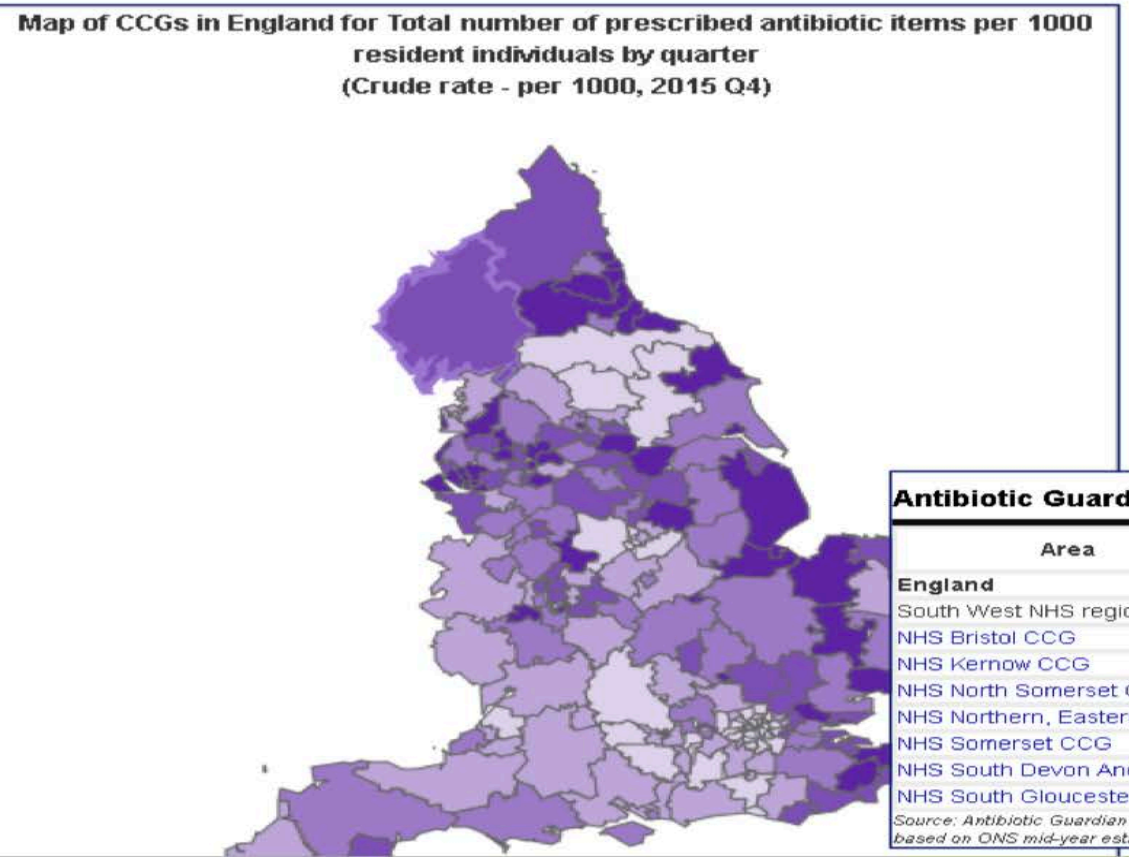
- Measure the impact of your stewardship program
- Choose structure, process and outcome measures
- Feasibility should be a main consideration
- Regularly assess and validate your data
- Communicate your findings, tailor your message
- Consider different approaches for displaying antibiotic use data

Public Health England

http://fingertips.phe.org.uk/

Indicator	Period	Aintree University Hospitals		England			
		Count	Value	Value	Lowest	Range	Highest
All C. difficile rates by reporting acute Trust and financial year	2014/15	134	57.6	41.0	0.0		114.4
Trust-apportioned C. difficile rates by reporting acute Trust and financial year	2014/15	64	27.5	15.1	0.0		62.2





Indicator	Period	England	London NHS region	NHS Barking And D.	NHS Barnet CCG	NHS Bexley CCG	NHS Brent CCG	NHS Bromley CCG	NHS Camden CCG	NHS Central London	NHS City And Hackn	NHS Croydon CCG	NHS Ealing CCG	NHS Enfield CCG	NHS Greenwich CC
Percentage of E. coli blood specimens with susceptibility tests to a carbapenem; 2015 by Quarter <70% 70% to 100% ≥100%	2015 Q4	97.5	94.2	100.0	59.2	100.0	45.5	100.0	97.4	100.0	100.0	100.0	65.5	95.4	97.9

Antibiotic Guardians per 100,000 population per calendar year by CCGs 2015 Crude rate - per 100

Area	Count	Value	95% Lower CI	95% Upper CI
England	10,598	19.5	19.1	1
South West NHS region	545	17.2	15.8	1
NHS Bristol CCG	111	25.1	20.6	3
NHS Kernow CCG	84	15.3	12.2	1
NHS North Somerset CCG	60	28.8	22.0	3
NHS Northern, Eastern And...	136	15.4	12.9	1
NHS Somerset CCG	88	16.2	13.0	2
NHS South Devon And Torba...	39	14.1	10.0	1
NHS South Gloucestershire...	27	9.9	6.6	1

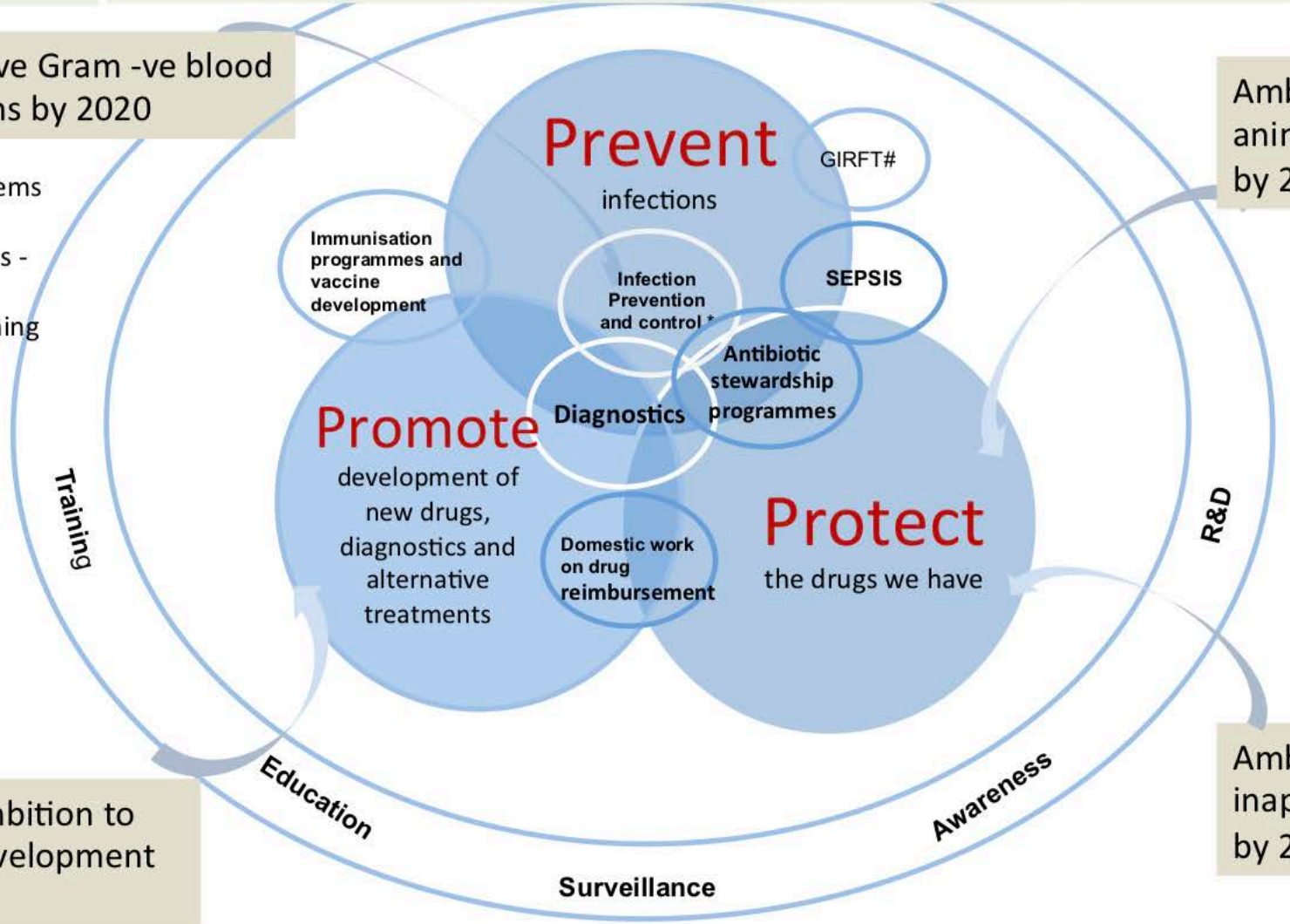
Source: Antibiotic Guardian counts and postcodes are extracted from www.antibioticguardian.com and include all healthcare professional, public and education sector pledges. Population estimates a based on ONS mid-year estimates.

Tackling AMR 2017 onwards

The three main principles - prevent, protect and promote - apply to humans, animals, agriculture and the environment. This One-Health approach applies in the UK and globally. The diagram identifies the components that address AMR and shows how the UK strategy maps to those components.

Ambition to halve Gram -ve blood stream infections by 2020

* IPC – a whole systems approach includes standard precautions - hand hygiene, environmental cleaning and instrument decontamination.



Ambition to reduce animal use to 50mg/kg by 2018

GIRFT - Getting it right first time
www.gettingitrightfirsttime.co.uk

Ambition to halve inappropriate prescribing by 2020

International ambition to promote the development of antibiotics

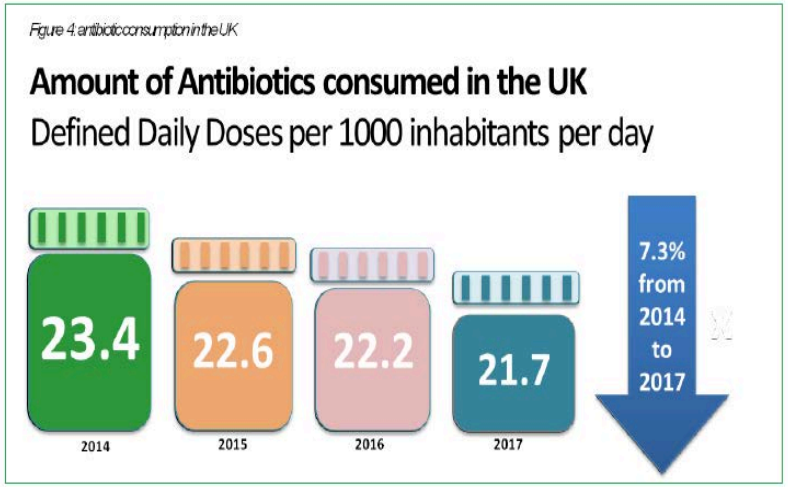
HM Government

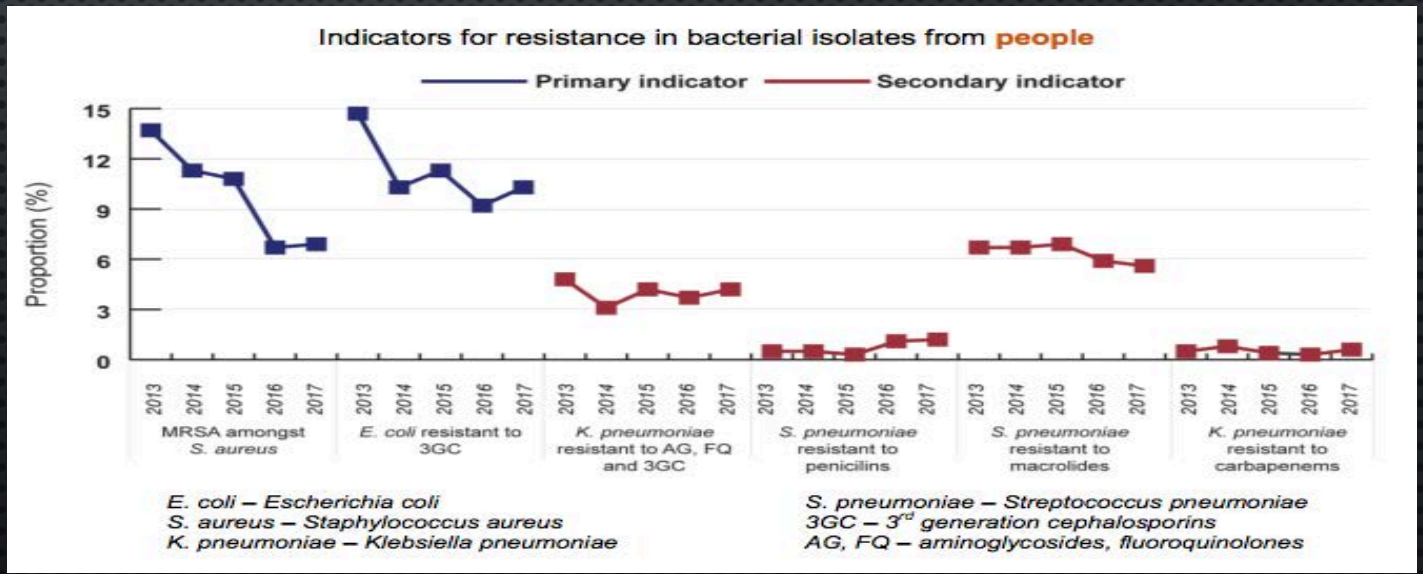
UK One Health Report

Joint report on antibiotic use and antibiotic resistance, 2013–2017

Published: 31 January 2019

[1] For the human sector, use data include all publicly funded prescriptions in primary and secondary care, but not from the private sector. Therefore, this figure does not cover all human use as there is no method to collect private prescriptions.





FINAL THOUGHTS….. & CHALLENGES

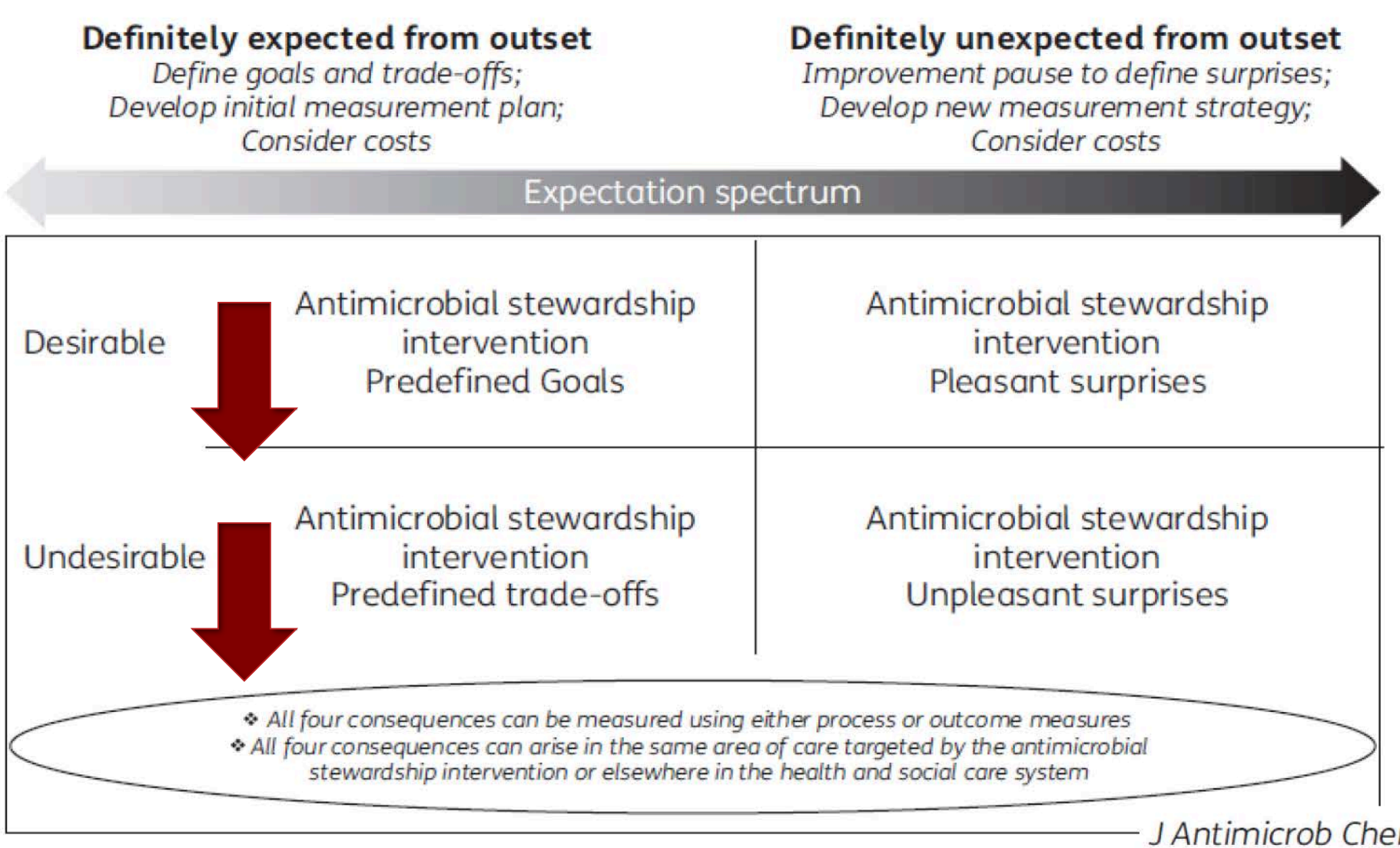
1. IMPACT OF AMS, AMS INTERVENTIONS
2. NATIONAL AMS APPROACHES
3. DEVELOPING AN ACTION PLAN FOR UK AND SCOTLAND
4. IMPLEMENTATION FOCUSED APPROACH IN SCOTLAND- DEVOLVED ADMINISTRATION
5. IMPACT
6. LESSONS LEARNT

A framework for ensuring a balanced accounting of the impact of antimicrobial stewardship interventions

Madalina Toma[1], Peter G. Davey[2], Charis A. Marwick[2] and Bruce Guthrie[1,2,*]

The law of unintended consequences is the only real law of history.

— Niall Ferguson —



J Antimicrob Chemother 2017; **72**: 3223–3231

Public Health England

CQUIN 2017/19

Aim	Deliverable
Improve detection and treatment of sepsis	• Timely identification of sepsis in EDs and acute inpatient settings • Timely treatment (% of patients with sepsis who received IV antibiotics within 1 hour) • Antibiotic review within 24-72 hours

Improve antibiotic prescribing	• Reduction in antibiotic consumption per 1,000 admissions
	  • Total antibiotic usage
	  • Carbapenem usage
	  • Pip/tazobactam usage

Public Health England

Quality Premium 2017/19

Aim	Deliverable

Improve antibiotic prescribing	• Sustained reduction of inappropriate antibiotic prescribing in primary care
	  • Items/STAR-PU equal to or below England 2013/14 mean value
	• Reduction of inappropriate antibiotic prescribing in UTI in primary care
	  • 10% reduction in Trimethoprim/Nitrofurantoin prescribing ratio
	  • 10% reduction in trimethoprim items for patients aged 70 years or more

Reduce Gram-ve BSIs across whole health economy	• Reduction of 10% in all *E. coli* BSI reported at CCG level independent of time of onset • Collect and report a core primary care data set for all *E. coli* BSI in Q2-4 2017/18

Range of process & outcome measures
For primary and secondary care - linked to financial incentives

Public Health England

Financial incentives or indicators

- Incentives can be effective while in place

QP 2017-19
? NHS contract
?Improvement visits

Decreasing the number of *E. coli* BSI

Increasing prescribing in line with guidance

Undesirable

Antimicrobial stewardship intervention
Predefined trade-offs

Antimicrobial stewardship intervention
Unpleasant surprises

DOES MORE TIMELY TREATMENT WITH ANTIBIOTICS OFFERS REDUCED MORTALITY IN SEPSIS & SEPTIC SHOCK ?

- N = ~85000, HOSPITALIZED, US RETROSPECTIVE DATA BASE [1,2]
- ONLY BENEFICIAL DIFFERENCE IN MORTALITY IN PATIENTS WITH **SEPTIC SHOCK**

- N=2018, PRE-HOSPITAL V EM, NETHERLANDS, >95% OF PATIENTS NO SEPTIC SHOCK [3]
- 96 MINS MEDIAN EARLIER TIME TO ADMINISTRATION OF ANTIBIOTICS
- **NO DIFFERENCE IS MORTALITY** IN THOSE WITHOUT SEPTIC SHOCK
  - 1. SEYMOUT CW ET AL NEJM 2017; 376: 2235-2244; 2. LIU VX ET AL AM J RESP CRIT CARE MED 2017; 196(7): 856-863
  - 3. ALAM N ET AL. LANCET RESP MED 2018; 6(1): 40-50

- **ANTIBIOTIC MAY BEING USED WITHOUT CARE AND CAUSING HARM**

Sepsis is medicine's last remaining preserve for unrestrained antibiotic prescribing. The Surviving Sepsis Campaign guidelines recommend empirical broad-spectrum therapy within one hour of triage for both sepsis and septic shock.[1] This recommendation, and mandates that compel it, encourage clinicians to adopt an approach of "treat first, ask questions later" for patients with any possibility of serious infection. This approach fails to account for the difficulties clinicians face with diagnosing infection, especially when patients initially present to care, and the high rate of overdiagnosis of sepsis, and thus risks promoting excess antibiotic use and causing unintended harm.

Antibiotics for Sepsis—Finding the Equilibrium

The time has come to balance the recommendation for early and aggressive antibiotics for all patients with possible sepsis with the diagnostic uncertainty regarding sepsis and the possible harm associated with unnecessary antibiotics.

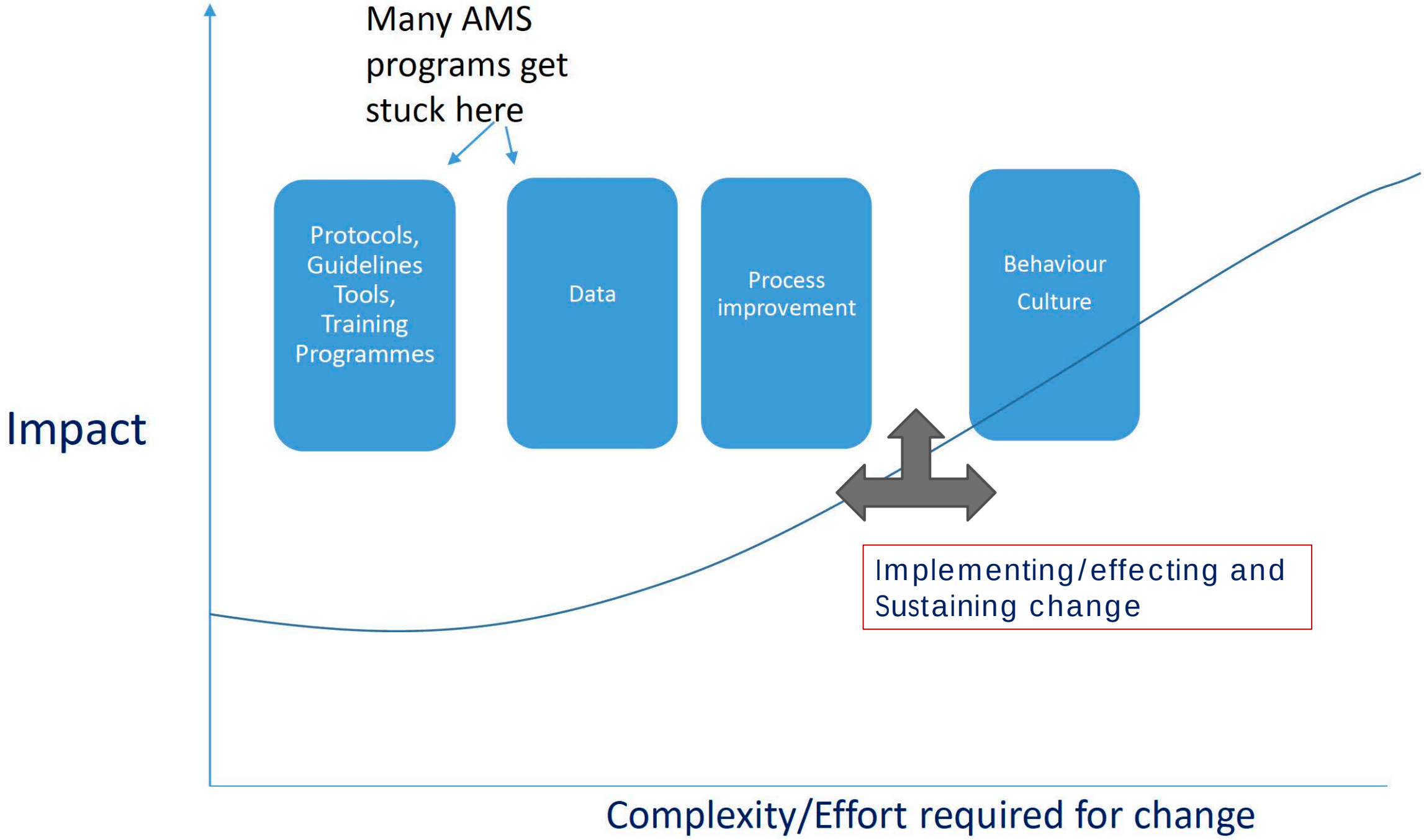
JAMA October 9, 2018 Volume 320, Number 14

Sepsis hysteria: excess hype and unrealistic expectations

www.thelancet.com Vol 394 October 26, 2019

has shown outcome benefit. Antibiotic use in emergency departments in English hospitals has doubled since 2015 (Howard P, Rx-Info Define, personal communication), coinciding with the introduction of the Commissioning for Quality and Innovation quality improvement initiative mandating antibiotic prescription within 1 h of presentation, yet no clear effect on mortality has been shown.

A spike in sepsis-coded deaths coincided with the implementation in April, 2017, of new NHS Digital Coding Guidance[2] and with financial incentives to code a patient's diagnosis as sepsis. A similar effect has been noted in the USA.[17] Furthermore, up to 40% of patients initially diagnosed as having sepsis were later judged as not likely to be infected.[18]


Many AMS programs get stuck here
Protocols, Guidelines Tools, Training Programmes
Data
Process improvement
Behaviour Culture
Impact
Implementing/effecting and Sustaining change
Complexity/Effort required for change

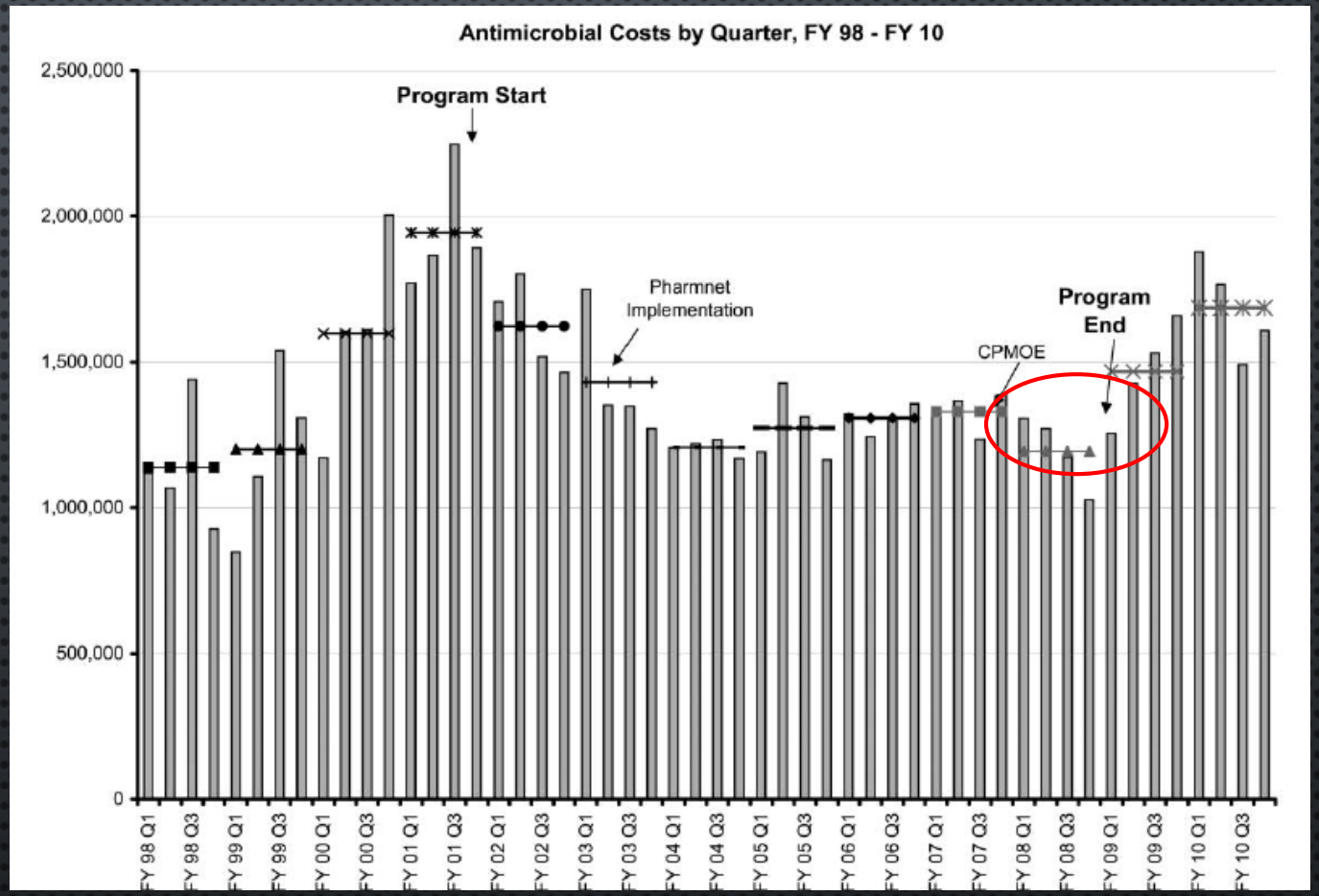
AN IMPORTANT LESSON

INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY APRIL 2012, VOL. 33, NO. 4

ORIGINAL ARTICLE

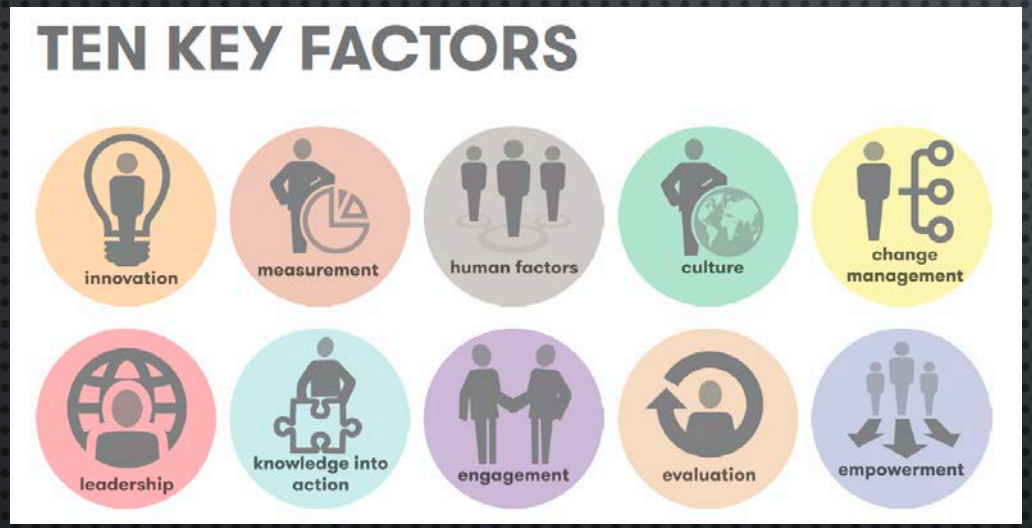
Antimicrobial Stewardship at a Large Tertiary Care Academic Medical Center: Cost Analysis Before, During, and After a 7-Year Program

SUSTAINABLE IMPACT OF AMS PROGRAMMES



- We need to teach prescribers to make changes without constant prompting from the stewardship team
- We cannot be in all places at all times

Standiford HC et al. Infect Control Hosp Epidemiol. 2012; 33:338.



Spread is 'when best practice is disseminated consistently and reliably across a whole system and involves the implementation of proven interventions in each applicable care setting[4]'.

Sustainability is 'when new ways of working and improved outcomes become the norm.' In other words, it is when an improvement has become an integrated and the mainstream way of working. It should withstand challenge and variation over time, through a process of continuous improvement[3].

KEY MESSAGES

1. IMPACT OF AMS, AMS INTERVENTIONS
2. NATIONAL AMS APPROACHES
3. DEVELOPING AN ACTION PLAN FOR UK AND SCOTLAND
4. IMPLEMENTATION FOCUSED APPROACH IN SCOTLAND- DEVOLVED ADMINISTRATION
5. IMPACT
6. LESSONS LEARNT

Antimicrobial Stewardship

The Communicable and Infectious Disease Steering Committee Task Group on Antimicrobial Use Stewardship

Final Report to the Public Health Network Council
April 2016

KEY EMERGING THEME TO SUSTAINED SUCCESS OF ASP's

- **Leadership**: successful stewardship undertakings are grounded in accountability, appropriate and sustained resources and expertise, adequate support, and training and involve specialists in an interdisciplinary manner.
- **Interventions**: effective stewardship interventions are multi-pronged and comprehensive. They consist of awareness, education, and guidance and include diagnostic and other types of tools, providing evidence-based timely information, and engage multiple target groups for maximum effect.
- **Monitoring and Evaluation**: the literature consistently identifies the critical role of benchmarks, audit and evaluation systems to establish the appropriate use of antimicrobials.
- **Knowledge Creation, Translation and Mobilization**: expertise from across research disciplines must be leveraged in order to address information gaps, and ensure that evidence is available and applied for greatest impact.

Facilitators and barriers to implementing antimicrobial stewardship strategies: Results from a qualitative study

A.L. Pakyz et al. / American Journal of Infection Control 42 (2014) S257-S263

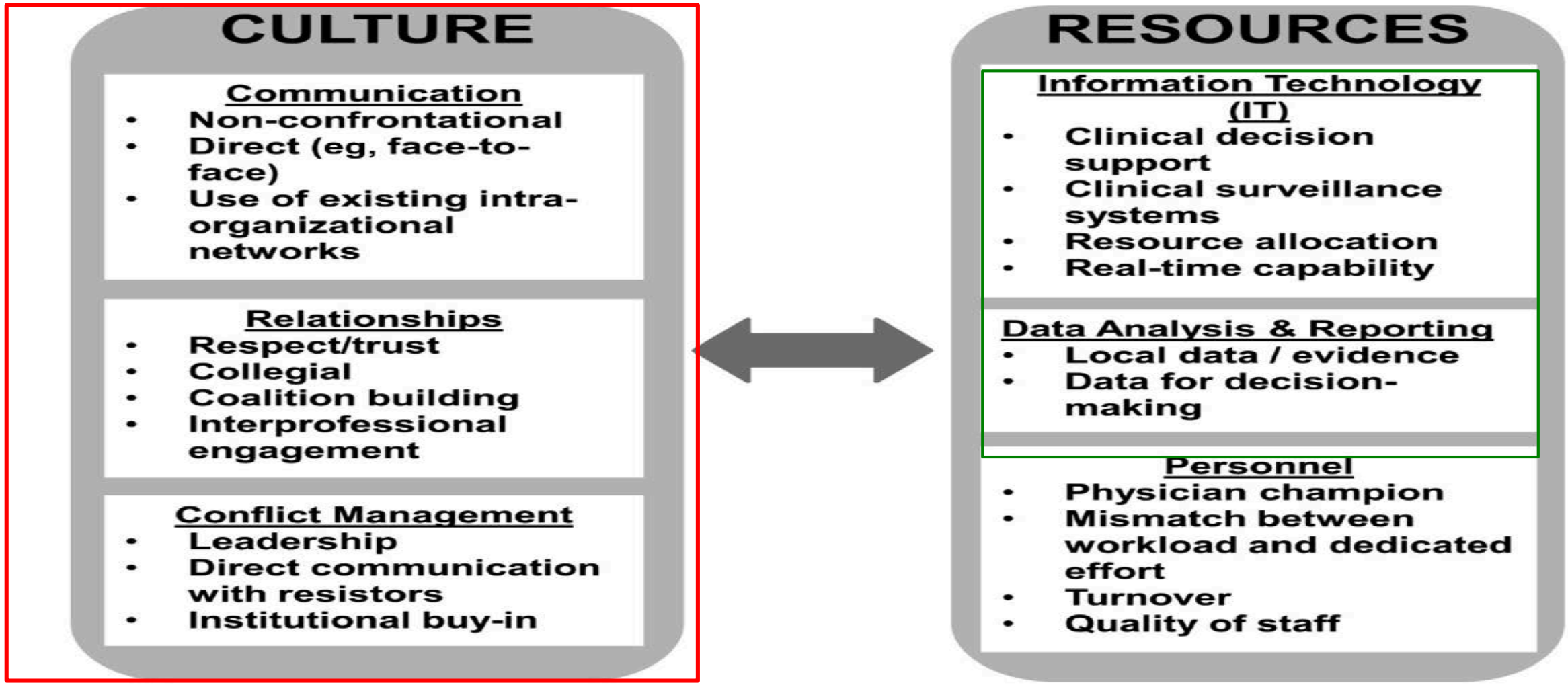


Fig 1. Factors related to implementation of antimicrobial stewardship program strategies.

DEVELOPING, IMPLEMENTING AND EVALUATING AMS PROGRAMS

Antimicrobial stewardship programs; a two-part narrative review of step-wise design and issues of controversy

Part I: step-wise design of an antimicrobial stewardship program

Fredrik Resman

Ther Adv Infectious Dis

2020, Vol. 7: 1–26

DOI: 10.1177/
2049936120933187

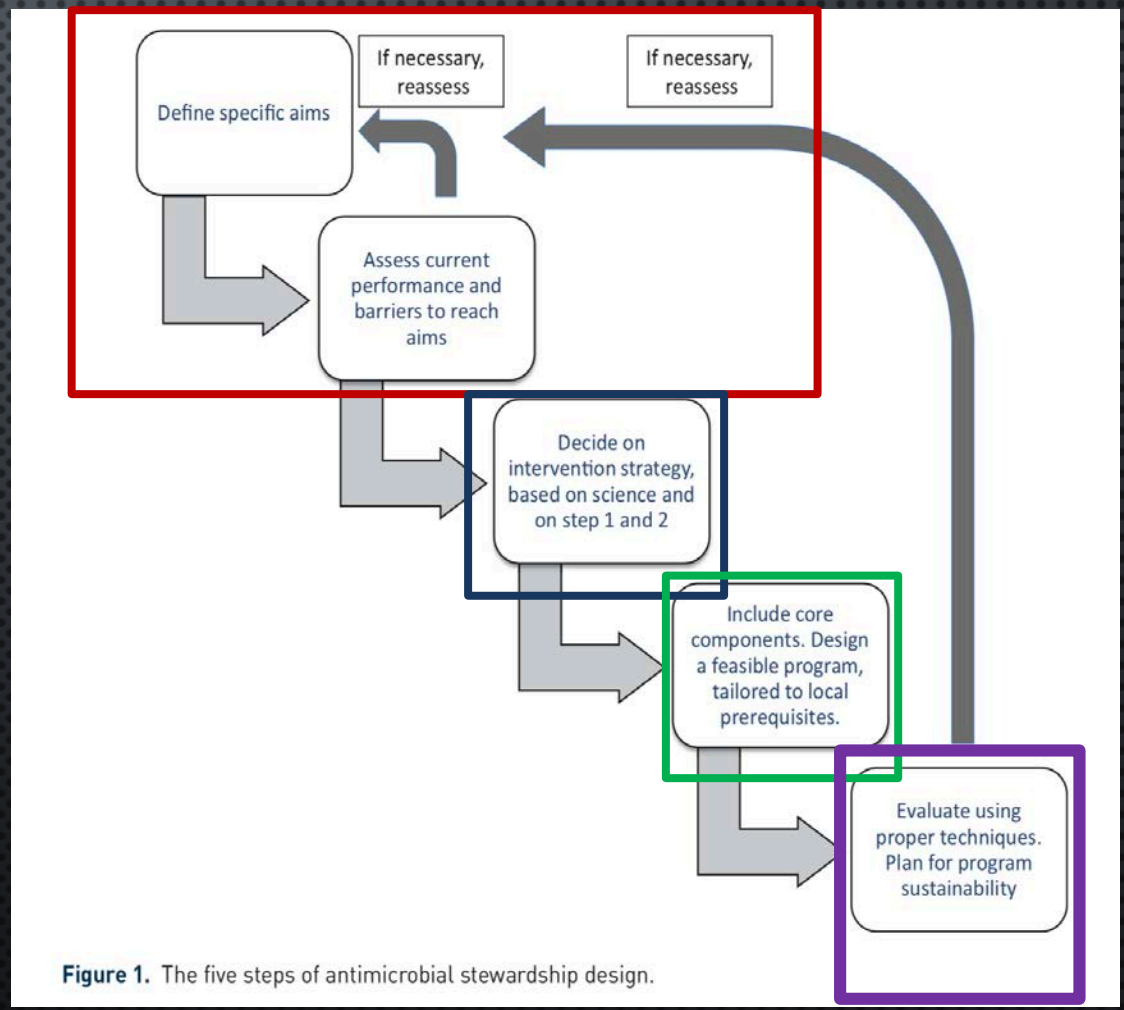


Figure 1. The five steps of antimicrobial stewardship design.

Scottish Antimicrobial Prescribing Group

+ many many more