

Antimicrobial Stewardship
Menino Osbert Cotta, University of Melbourne, Australia
A Webber Training Teleclass

Antimicrobial Stewardship

Menino Osbert Cotta
Research Fellow and PhD Candidate
Department of Medicine
University of Melbourne

Hosted by Jane Barnett
jane@webbertraining.com



www.webbertraining.com

October 21, 2015

Objectives

- * Appreciate the immediate threat of antimicrobial resistance and the importance of antimicrobial stewardship
- * Outline the main principles for good stewardship of antimicrobials
- * Describe practical strategies and activities that form the basis of a hospital's antimicrobial stewardship program
- * Formulate an antimicrobial stewardship implementation plan for healthcare facilities

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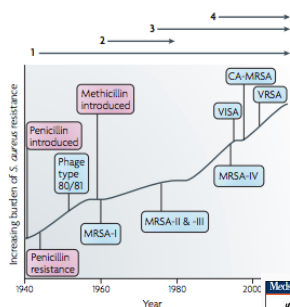
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Antimicrobial resistance

- WHO has identified antimicrobial resistance to be one of five major global threats to mankind
 1. Microbial resistance to current antimicrobial artillery is growing at an alarming rate: **MRSA, VRE, CRES**
 2. Dwindling novel antimicrobial agents in the development pipeline

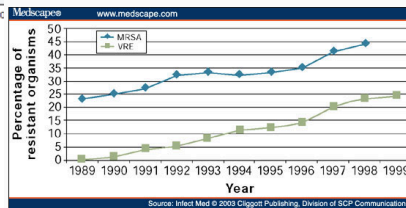
World Health Organization. *The Evolving Threat of Antimicrobial Resistance: Options for Action*; 2012.

Antimicrobial resistance: *Staphylococcus aureus* and VRE



Waves of Resistance: *Staphylococcus aureus* in the Antibiotic Era
 Henry F. Chambers and Frank R. DeLeo. *Nat Rev Microbiol.* 2009 Sep; 7(9): 629–641.

National Nosocomial Infections Surveillance (NNIS) System. NNIS System report, data summary from January 1990-May 1999
 issued June 1999. *Am J Infect Control.* 1999;27:520-532.



Percentages of *Staphylococcus aureus* and *Enterococcus* isolates reported as resistant to methicillin and vancomycin, respectively, in US hospital ICUs, 1989-1999 [1] (MRSA, methicillin-resistant *Staphylococcus aureus*; VRE, vancomycin-resistant *Enterococcus*.)

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Antimicrobial resistance: Carbapenem resistant Enterobacteriaceae



Gram-negative resistance: can we combat the coming of a new “Red Plague”?

Coordinated action is urgently needed to tackle a looming public health crisis

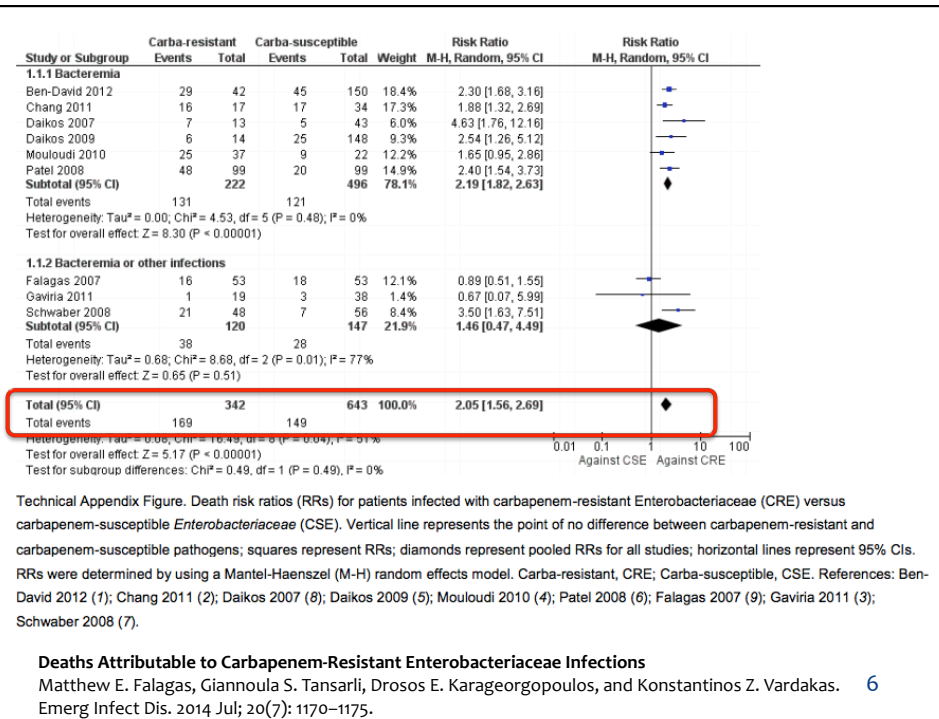
David F M Looke, Thomas Gottlieb, Cheryl A Jones and David L Paterson. Med J Aust 2013; 198 (5): 243-244.

Dissemination of NDM-1 positive bacteria in the New Delhi environment and its implications for human health: an environmental point prevalence study.
Walsh TR, Weeks J, Livermore DM, Toleman MA. Lancet Infect Dis. 2011 May;11(5):355-62.



Figure 1
Map of NDM-1-positive samples from New Delhi centre and surrounding areas

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Deaths Attributable to Carbapenem-Resistant Enterobacteriaceae Infections
Matthew E. Falagas, Giannoula S. Tansarli, Drosos E. Karageorgopoulos, and Konstantinos Z. Vardakas. Emerg Infect Dis. 2014 Jul; 20(7): 1170–1175.

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Antimicrobial Stewardship

- * Antimicrobial Stewardship (AMS) term coined in 1997
- “help optimise therapy;
- ensuring the best clinical outcome for the patient (right choice of antibiotic at the right dose)
 - while endeavouring to lower the risk of subsequent development of antimicrobial resistance”

Society for Healthcare Epidemiology of America and Infectious Diseases Society of America Joint Committee on the Prevention of Antimicrobial Resistance: guidelines for the prevention of antimicrobial resistance in hospitals. Shlaes DM, Gerding DN, John JF, et al. Clin Infect Dis. 1997;25(3):584-99.

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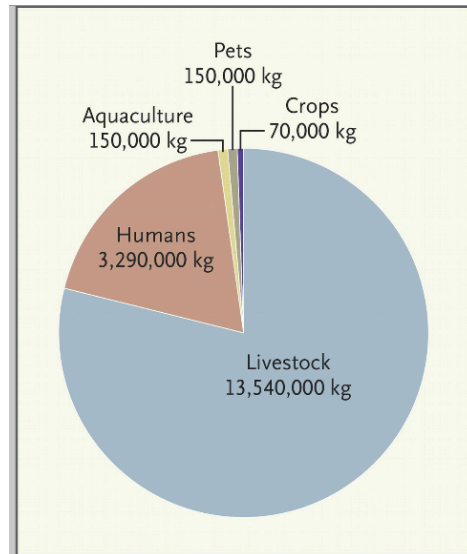
- * Simple definition, however --> complex and broad issue

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Estimated Annual Antibiotic Use in the United States.

Preserving antibiotics, rationally.
Hollis A, Ahmed Z. N Engl J Med. 2013 Dec 26;369(26):2474-6.

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Antimicrobial Stewardship in Hospitals

- * Hospitals: up to 59% of patients are prescribed antimicrobials at any one time.

The European surveillance of antimicrobial consumption (ESAC) point-prevalence survey of antibacterial use in 20 European hospitals in 2006.
Ansari F, Erntell M, Goossens H, Davey P. Clin Infect Dis 2009; 49: 1496–504.

- * Studies in the hospital setting estimate that up to 40% of these drugs may be inappropriate.

Antimicrobial stewardship. Fishman, N Am J Med 2006; 119: S53–61; discussion S62.

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Antimicrobial Stewardship in Hospitals

Table 2 Appropriateness of treatment and surgical antibiotic prophylaxis (SAP) prescriptions

Treatment prescriptions	Total (n = 683)	
	n (%)	Range (%)
Treatment prescriptions assessed as appropriate	549 (80.4)	(68.2–95.2)
Treatment prescriptions assessed as inappropriate	99 (14.5)	(6.0–27.3)
Treatment prescriptions that could not be assessed	35 (5.1)	(0.0–14.8)
SAP prescriptions	Total (n = 471)	
	n (%)	Range (%)
SAP prescriptions assessed as appropriate	191 (40.6)	(23.5–100)
SAP prescriptions where indication was documented	204 (43.3)	(8.3–100)

Using periodic point-prevalence surveys to assess appropriateness of antimicrobial prescribing in Australian private hospitals.

Cotta MO, Robertson MS, Upjohn LM, Marshall C, Liew D, Buising KL. Intern Med J. 2014 Mar;44(3): 240-6.

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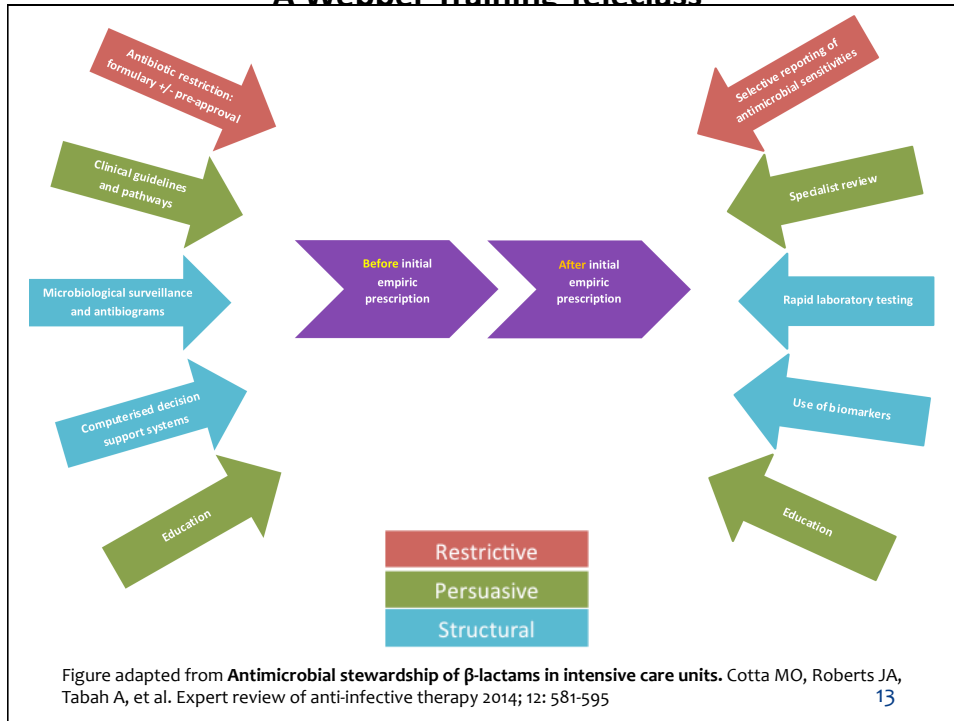
Principles of AMS

Therapeutic Guidelines: Antibiotic (Antibiotic Expert Group 2006)

- M** Microbiology guides therapy wherever possible
- I** Indications should be evidence based
- N** Narrowest spectrum required
- D** Dosage appropriate to the site and type of infection
- M** Minimise duration of therapy
- E** Ensure monotherapy in most situations

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Persuasive AMS strategies: formulation of guidelines

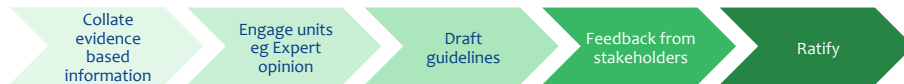
- * Based on national guidelines.
 - * eg in Australia *Therapeutic Guidelines: Antibiotic*
- * Local Guidelines may be adapted from these
 - * Incorporating local susceptibility data eg hospital antibiograms
- * Specialist unit protocols: eg Haematology, Transplant unit etc.
- * Surgical prophylaxis
- * 'Consultant/specialist based protocols'

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Guideline formulation/revision



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Examples of Guidelines

Vancomycin dosing and monitoring Guidelines
Gentamicin usage Guidelines
Community Acquired Pneumonia Guidelines
Febrile Neutropenia Guidelines
Surgical Prophylaxis Guidelines
Epidural Abscess Management
Pyelonephritis Guidelines
Management of cellulitis

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Persuasive AMS strategies: Post prescription review

- * Review of antimicrobial prescriptions by an experienced assessor
 - * eg Infectious Diseases physician, Clinical microbiologist, Pharmacist with experience in AMS/Infectious Diseases
- * Some national consensus statements have recommended an '**AMT**' - Multi-disciplinary team consisting of an ID physician or clinical microbiologist/ specialist ID pharmacist

Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America guidelines for developing an institutional program to enhance antimicrobial stewardship. Dellit TH, Owens RC, McGowan JE et al. Clin Infect Dis 2007; 44: 159-77.

Antimicrobial Stewardship in Australian Hospitals. Duguid M, Cruickshank M. ACSQHC, Sydney; 2011. [http://www.safetyandquality.gov.au/internet/safety/publishing.nsf/Content/985EF00802E4E735CA25786A00223EAA/\\$File/44471-Antimicrobial Stewardship_2011.pdf](http://www.safetyandquality.gov.au/internet/safety/publishing.nsf/Content/985EF00802E4E735CA25786A00223EAA/$File/44471-Antimicrobial%20Stewardship_2011.pdf) 17

Persuasive AMS strategies: Post prescription review

- * Feedback directly to prescribers (preferably face-to-face).
 - * Provides a mechanism of dialogue with opportunity for 'academic detailing'
 - * May lead to a reduction of unnecessary antimicrobial use

Academic detailing to improve use of broad-spectrum antibiotics at an academic medical center. Solomon DH, Van Houten L, Glynn RJ, Baden L, Curtis K, Schragger H, Avorn J. Arch Intern Med. 2001 Aug 13-27;161(15):1897-902.


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Antimicrobial Management Team

Date: _____
Pharmacist: _____
Dr: _____

Round Sheet

Pt Name: _____
LR: _____
Location: _____
Unit: _____
Allergies:
NKDA

Presenting Complaint + Indication for Antibiotics: _____

Medical History: _____

	Therapy on referral appropriate? (Y/N)	Referred to ID? (Y/N)	Recommend change in therapy? (Y/N)	Recommendations* (0-6)	Recommendations accepted? (Y/N)	Extend Approval? (Y/N)	How long? (days)
Antimicrobial 1:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
Start date:							
Indication:							
Antimicrobial 2:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
Start date:							
Indication:							
Antimicrobial 3:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
Start date:							
Indication:							
Antimicrobial 4:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
Start date:							
Indication:							
Antimicrobial 5:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
Start date:							
Indication:							

Crystalline / CrCL:
Dosage adjustment: None Yes

Microbiology Investigations:
(include sample type, organisms, sensitivities, reference no's) Final Interim

Other: _____

***RECOMMENDATIONS**
 0 – CEASE ANTIMICROBIAL
 1 – DECREASE COVER
 2 – INCREASE COVER
 3 – CHANGE DOSES
 4 – CHANGE THERAPY DUE TO SAFETY
 5 – SWITCH TO ORAL
 6 – INVESTIGATION SUGGESTED

AMT Recommendations – data from my hospital for first 6 months

- 22% of therapy was judged to be inappropriate by AMT

Recommendations were made in 104 referrals_(n=405) with 86% of recommendations accepted by the parent unit

Cease antimicrobial	28%
Decrease spectrum of cover	24%
Increase spectrum of cover	17%
Change therapy due to safety	5%
Dosage change	10%
Switch to oral	23%
Further investigation required	3%

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Restrictive AMS strategies: antimicrobial formulary

- * Closed antimicrobial formulary that is regulated by a governing body --> eg Drugs and Therapeutics Committee
- * Some antimicrobials are completely restricted and require pre-approval from expert group within the hospital eg Infectious Diseases Unit
- * Others may have duration and/or indication restrictions (+/- exemptions)
- * Should be well communicated to all prescribers and AMS stakeholders --> perhaps use visual queues

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StV Antimicrobial Formulary Guide

	Unrestricted – therapy can be initiated without ID notification/ authorisation 'GREEN'	Restricted – Guidance DS approval / alert required when initiating therapy 'AMBER'	Highly restricted – Infectious Diseases unit to initiate / authorise (note exemptions) 'RED'
Antibiotics	Amoxicillin Amoxicillin-clavulanate Ampicillin Benzylpenicillin Cefaclor Cefadroxil Cefepime Cefotaxime Cefprozil Cefuroxime Clindamycin (oral) Dicloxacillin Doxycycline Erythromycin Nafcillin Nitrofurantoin Nizoral Piperacillin-tazobactam Ticarcillin-clavulanate Vancomycin	Azithromycin Cefepime Cefotaxime Ceftriaxone Cefuroxime Ciprofloxacin Clindamycin (IV) Entropenem Imipenem Meropenem Moxifloxacin Piperacillin-tazobactam Ticarcillin-clavulanate Vancomycin	Amikacin Aztreonam Chloramphenicol (IV) Colistin Daptomycin Fusidic acid Gentamicin > 2 days (notify ID via Guidance DS) Linezolid Fidaxomicin Chaperitelin-dalopristin Rifampicin (except for respiratory use when initiating TB therapy) Rifabutin Teicoplanin Tigecycline Tobramycin Antibiotics for tuberculosis such as Ethambutol, Isoniazid Pyrazinamide (except for respiratory use when initiating TB therapy)
Antifungals	Nystatin Micronazole	Ravuconazole Itraconazole	Caspofungin Posaconazole (except for prophylaxis in high risk Hematological patients) Liposomal amphotericin (except for prophylaxis in high risk Hematological patients) Voriconazole (except for prophylaxis in high risk Hematological patients)
Antivirals	Aciclovir (oral)	Aciclovir (IV) Famciclovir Valaciclovir Oseltamivir (oral)	Ribavirin Zalcitabine (IV) Ganciclovir (except for Renal transplant patients) Zidovudine (IV) Valproic acid (except for Renal transplant patients) Antiretrovirals initiated for HIV therapy

(Reviewed and endorsed by St Vincent's Antimicrobial Stewardship Committee May 2011)

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Restrictive AMS strategies: pre-approval systems

- * Surveillance
 - Concordant with Guidelines
- * Education
 - Algorithm based advice
 - Linked to Local and National Guidelines
- * Phone, Paper or Electronic based



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Hospital Antimicrobial Stewardship Programs

- * Cochrane Collaboration review supports ‘restrictive’ for immediate impact, however

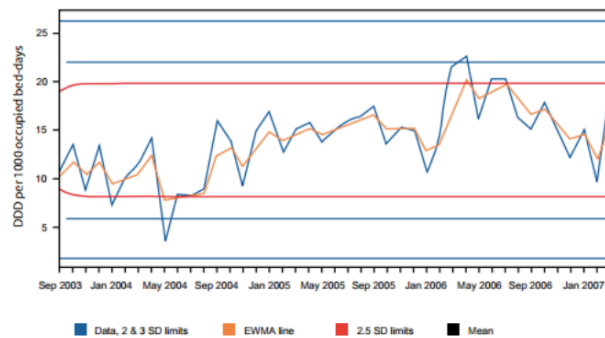
Persuasive \approx Restrictive
Time

- * Diversity in AMS programs reported in literature
 - * Hospitals adopt a combination of different types of strategies

Interventions to improve antibiotic prescribing practices for hospital inpatients. Davey P, Brown E, Charani E, et al. Cochrane Database Syst Rev 2013;(4) 25

Key performance indicators

- * **Process measures**
 - * Antimicrobial consumption



Antimicrobial Stewardship in Australian Hospitals. Duguid M, Cruickshank M. ACSQHC, Sydney; 2011. [http://www.safetyandquality.gov.au/internet/safety/publishing.nsf/Content/985EF00802E4E735CA25786A00223EAA/\\$File/44471-Antimicrobial Stewardship_2011.pdf](http://www.safetyandquality.gov.au/internet/safety/publishing.nsf/Content/985EF00802E4E735CA25786A00223EAA/$File/44471-Antimicrobial%20Stewardship_2011.pdf)

DDD = defined daily dose; EWMA = exponentially weighted moving average; SD = standard deviation

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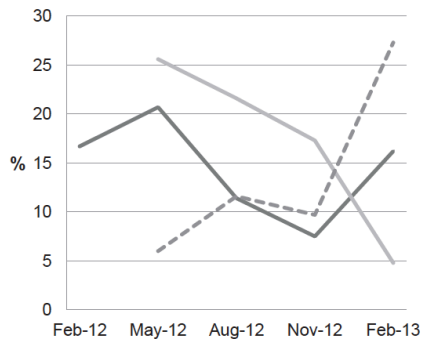
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Key performance indicators

* Process measures

* Periodic point-prevalence surveys



Using periodic point-prevalence surveys to assess appropriateness of antimicrobial prescribing in Australian private hospitals.

Cotta MO, Robertson MS, Upjohn LM, Marshall C, Liew D, Buising KL. Intern Med J. 2014 Mar;44(3): 240-6.

Figure 1 Inappropriateness over time: treatment prescriptions. (—), Hospital A; (---), hospital B; (- - -), hospital C.

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Key performance indicators

* Structural indicators

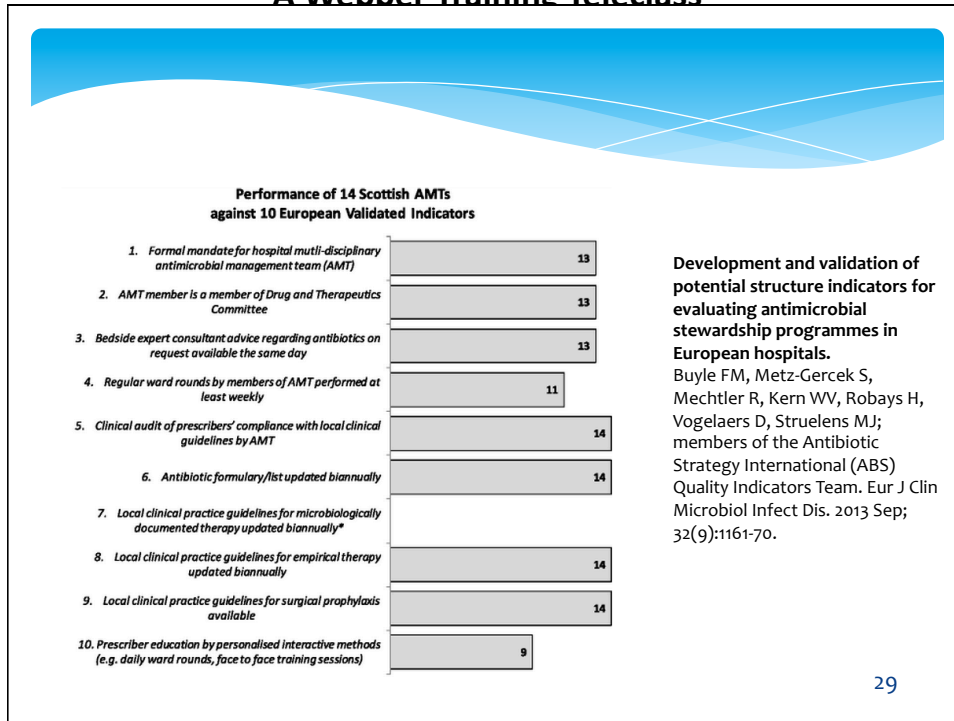
- * Can be a simple checklist and allow AMS personnel to ensure that 'the basics' of the stewardship program are in place
- * Use validated indicators rather than reinventing!

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Key performance indicators

- * **Outcome indicators**
 - * **Perhaps the most difficult to quantify and attribute (given the potential confounders)**

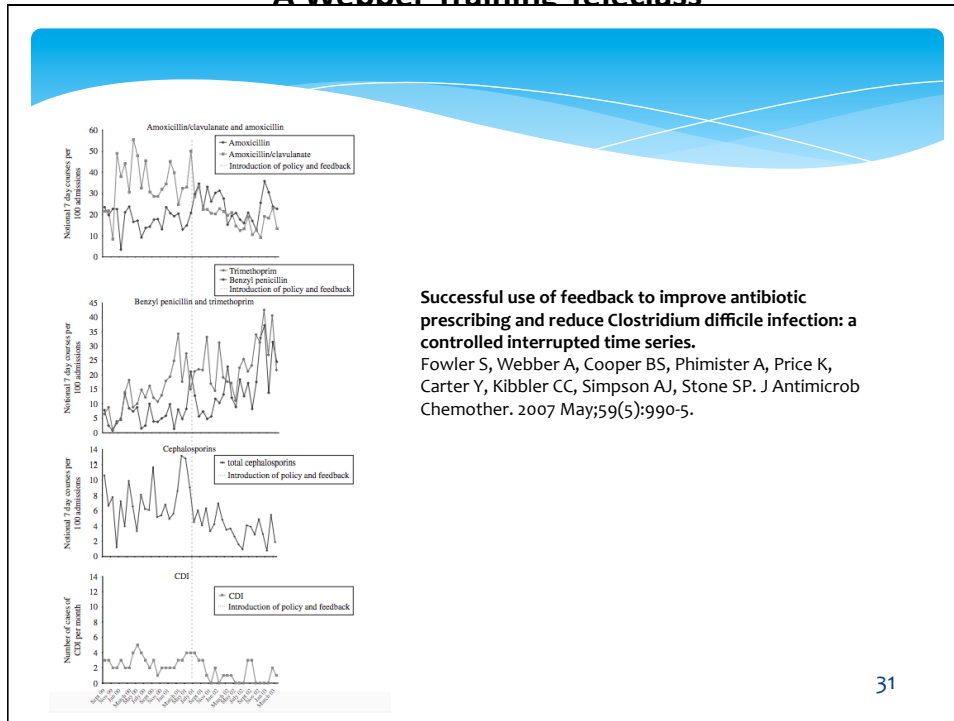
eg Hospital mortality, readmission rates and length of hospital stay may be too indirectly related to appropriate antimicrobial prescribing to be an accurate reflection of the performance of AMS programs.

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AMS implementation plan for hospitals

- * Essential elements for AMS 'naïve' facilities

WHERE SHOULD THEY START??

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Establish sustainable governance structures through a dedicated committee that oversees AMS throughout the hospital (and is formally endorsed by hospital administrators).

Endorse a hospital-wide antimicrobial prescribing policy and ensure prescribers acknowledge their awareness of and commitment to these at the time of giving or renewing patient admitting rights.

Introduce a hospital-wide antimicrobial formulary that includes criteria for which antimicrobials may be prescribed and for what indication.

Recruit 'AMS champions' from core medical and surgical specialities and nursing groups who are leaders among their peers.

Nominate experts to provide individual pre- or post-prescription advice to ensure appropriate oversight.

Prioritise regular assessment of antimicrobial use. This will identify areas that may benefit from interventions, and assess the impact of implementing an AMS program.

Integrate nurses into the AMS program through targeted awareness campaign and provide education regarding their role.

Use multi-faceted education strategies for prescribers, pharmacists and nurses. Strategies should be both visual and electronic and suggestions include emails, webinars, online learning modules and face-to-face meetings.

Market the benefit of AMS in improving patient care to all health professionals in the hospital.

Antimicrobial Stewardship in Private Hospitals. Cotta MO, Buising KL. In Duguid & Cruickshank (Eds.) (In press): Antimicrobial Stewardship in Australian Hospitals, 2nd Edition. Australian Commission on Safety and Quality in Healthcare. Sydney, Australia.

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Thank you

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Coming Soon

October 29 **AIR TRAVEL AND INFECTION TRANSMISSION**

Dr. Paul Edelson, CDC JFK Quarantine Station, New York
Sponsored by GOJO (www.gojo.com)

November 5 (Free Teleclass)

DEMYSTIFYING THE CIC® CERTIFICATION EXAMINATION

Roy Boukidjian, Northridge Hospital Medical Center
Linda Goss, Nurse Practitioner, Global Health Center

November 12 **SALMONELLA - TRENDS, PREVALENCE AND CONTROL**

Prof. Keith Warriner, Guelph University, Canada

November 17 (*FREE British Teleclass ... Denver Russell Memorial Teleclass Lecture*)

**THE ROLE OF WATER AS A VECTOR IN THE TRANSMISSION OF
INFECTIONS IN HOSPITALS**

Dr. Jimmy Walker, Public Health England, Biosafety Unit

November 19 **CLOSTRIDIUM DIFFICILE INFECTION IN RURAL HOSPITALS**

Dr. Nasia Safdar, University of Wisconsin

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