Educational interventions in antimicrobial stewardship

Dilip Nathwani
Ninewells Hospital and Medical School
Dundee, UK
The challenges of education about prudent prescribing

"A mind is like a parachute.
It doesn't work if it is not open."

-Frank Zappa
Batalden PB, Davidoff F. What is “quality improvement” and how can it transform healthcare? *Qual Saf Health Care* 2007;16:2-3
Changing Clinician Behaviour
The Tool Box

• **Education** [adult learning theory]
  • Best if real-time, leadership-endorsed, repeated/sustained over time
• **Feedback** [social cognitive theory]
• **Participation** [management theory]
• **Administrative changes** [misanthropy]
• **Incentives**
• **Penalties**

Eisenberg... Medical Care 1985;23:461–483.
Why Is Educating Healthcare Professionals Complex?

3 Incident analysis framework*

Latent factors
Organisational processes — workload, handwritten prescriptions
Management decisions — staffing levels, culture of lack of support for interns

Error-producing factors
Environmental — busy ward, interruptions
Team — lack of supervision
Individual — limited knowledge
Task — repetitions, poor medication chart design
Patient — complex, communication difficulties

Active failures
Error — slip, lapse
Violation

Defences
Inadequate — AMH confusing
Missing — no pharmacist

AMH = Australian medicines handbook.
* Adapted from Reason’s model of accident causation, with permission.

Coombes et al Why do interns make prescribing errors? MJA 2008; 188: 89-
Quotes to illustrate RQ1 and RQ3.

<table>
<thead>
<tr>
<th>Quote</th>
<th>Participant</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;I remember prescribing amoxicillin for a penicillin allergic patient because it was on a surgical ward round that you don't have time to write in the notes and so they are so rushed out there like on surgical wards it's so quick if you are too slow the registrars often are like three patients ahead of you so I didn't look at the front of the Kardex and she [the patient] ended up getting the drug but she didn't have any reaction whatsoever [laughs] so it was okay in the end but erm yes I remember that.&quot;</td>
<td>Female FY1 Location 1</td>
</tr>
<tr>
<td>&quot;Gentamicin and vancomycin are two toxic antibiotics they can give you both permanent deafness and also renal failure erm they have to be dosed very according to very strict protocols and there are various ways of dosing these things. But also one way and then each hospital takes up their own dosing schedule where are several blood tests involved depending on what level of renal failure is it to determine how many times a day his patient, so every patient is individual and when you are on a busy ward round looking after thirty patients having to go at a particular time to do blood test, getting that blood test and then adjusting the dose from that level is pretty complicated and the registrars have difficulty doing it so, often it's often left to the FY1 to do...&quot;</td>
<td>Male FY1 Location 1</td>
</tr>
<tr>
<td>&quot;The situation I had recently in surgery was that I had actually got my consultant out of theatre walk him down to the gastroenterology and get him [the consultant] to explain to them why they [the surgical team] wanted to do this procedure because I explained to them [the gastroenterology team] that's what he [the consultant] wanted and he [the gastroenterologist] didn't want to do it and he [the gastroenterologist] said &quot;no&quot; he wanted to speak with the consultant.&quot;</td>
<td>Male FY1 Location 1</td>
</tr>
<tr>
<td>&quot;Our job was to manage the more medical side of things and his job was the surgery... it's not like that all in the medical side of the hospital... I think probably half of them [the junior doctors] are expect the FY staff to do that kind of thing like prescribing antibiotics and that kind of thing so they don't need keep up-to-date with it all and because they are so much more time consuming than trying to treat things with medications they seem to be a bit out of sight.&quot;</td>
<td>Female FY2 Location 1</td>
</tr>
<tr>
<td>&quot;I went to the registrar who was also a junior doctor he was the registrar on-call overnight and I didn't know he had asked me to phone the microbiologist on-call and this was at about 5am in the morning and so I had a double check for half an hour and made sure there was nothing in there [the BNF and guidelines] and eventually phoned the microbiologist and I think that she was incredibly angry with me over the phone about me the most junior member of the team was calling her at 5.30 in the morning to ask advice.&quot;</td>
<td>Female FY2 Location 1</td>
</tr>
<tr>
<td>&quot;Umm well I felt like it a [the error] could have been avoided maybe if our handover was much better at that time because it was the Friday and I think cos she [the patient] was reviewed over the weekend by one of the registrars but it [the error] wasn't just picked up about the level so I was just wondering if it [the error] could have been avoided.&quot;</td>
<td>Female FY1 Location 2</td>
</tr>
<tr>
<td>&quot;It's frustrating it's stressful erm I get angry about it... It's just a waste of time when you know we are... waking up the corridor back to get to my consultant and walking around the ward round doing other jobs and I just go back and forth and like you know taking like hours to organise tests and stuff it's not a good use of my time you know the trust are paying like you know quite substantial amounts of money and I'm just doing like what a secretary would do you know.&quot;</td>
<td>Male FY1 Location 1</td>
</tr>
</tbody>
</table>

Mattick K et al. J. Antimicrob. Chemother. 2014;jac.dku093
Greater Understanding Antimicrobial Prescribing Behaviours

1. Non-interference 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 recognises the autonomous decision making process of prescribing.

2. Accepted non-compliance to policy: Deviations from policy recommendations are tolerated and put in the context of the prescriber’s experience, expertise and the specific clinical scenario. This leads to hierarchy and expertise, and not policy as determinants of prescribing practice behaviours.

3. Hierarchy of prescribing: Prescribing as an activity is performed by junior doctors. But it is the senior doctors who decide what is prescribed.
Exemplar narrative to illustrate RQ2.

Mattick K et al. J. Antimicrob. Chemother. 2014;jac.dku093
The Prescribing Team
# Antimicrobial stewardship: the role of the nurse


<table>
<thead>
<tr>
<th><strong>Aspects of antimicrobial management and nurses’ potential contribution</strong></th>
<th><strong>Associated risk</strong></th>
<th><strong>Nurse contribution</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Antimicrobial management</strong></td>
<td><strong>Prescribing in line with recommended guidelines</strong></td>
<td>Use of broad-spectrum antibiotics is a major contributory factor in developing <em>Clostridium difficile</em> infection (CDI) and antimicrobial resistance (AMR), and these antibiotics should be avoided where possible.</td>
</tr>
<tr>
<td></td>
<td><strong>Duration of treatment</strong></td>
<td>Prolonged duration of antimicrobial treatment is a risk factor for the development of CDI and may increase AMR.</td>
</tr>
<tr>
<td></td>
<td><strong>Route of administration</strong></td>
<td>Delayed switching from intravenous antimicrobial therapy to oral treatment may increase length of hospital stay, risk of AMR, nurses’ workload and risk of catheter-related infection.</td>
</tr>
<tr>
<td></td>
<td><strong>Surgical prophylaxis</strong></td>
<td>Timing of administration and duration of surgical prophylaxis often occurs outside best-practice guidelines, decreasing the effect on post-surgical infections and increasing AMR.</td>
</tr>
<tr>
<td></td>
<td><strong>Timing of antimicrobial administration</strong></td>
<td>Delayed administration of antimicrobials may be associated with decreased survival rates.</td>
</tr>
<tr>
<td></td>
<td><strong>Therapeutic drug monitoring</strong></td>
<td>Suboptimal antibiotic concentrations contribute to the development of AMR. Excessive antibiotic concentrations may lead to drug-related toxicity.</td>
</tr>
<tr>
<td></td>
<td><strong>Confirmation of allergy status</strong></td>
<td>Estimates of the prevalence of antibiotic allergy vary, but are associated with substantial morbidity, mortality and increased healthcare costs.</td>
</tr>
<tr>
<td></td>
<td><strong>Outpatient parenteral antimicrobial therapy (OPAT)</strong></td>
<td>Prolonged hospitalisation increases risk of developing healthcare-associated infections and increases associated costs.</td>
</tr>
</tbody>
</table>

(Adapted from Edwards et al 2011)
Evidence to support effectiveness of educational interventions
## Systematic Review of Clinical Education Interventions: SHEA policy Report 2011

[http://www.shea-online.org/Portals/0/Policy_Brief_11.pdf](http://www.shea-online.org/Portals/0/Policy_Brief_11.pdf)

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Number of education studies</th>
<th>Setting</th>
<th>% change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arnold &amp; Strauss</td>
<td>2005</td>
<td>23</td>
<td>AC</td>
<td>Nil</td>
</tr>
<tr>
<td>Forsetlund et al</td>
<td>2009</td>
<td>81</td>
<td>AC&amp;HC</td>
<td>6</td>
</tr>
<tr>
<td>ARHQ</td>
<td>2006</td>
<td>34</td>
<td>AC</td>
<td>10.6</td>
</tr>
<tr>
<td>Davey et al</td>
<td>2005</td>
<td>36</td>
<td>HC</td>
<td>8-69</td>
</tr>
<tr>
<td>Mansouri &amp; Lockyer</td>
<td>2007</td>
<td>31</td>
<td>AC&amp;HC</td>
<td>33</td>
</tr>
<tr>
<td>O’Brien et al</td>
<td>2007</td>
<td>69</td>
<td>AC&amp;HC</td>
<td>5.6</td>
</tr>
<tr>
<td>Ranji et al</td>
<td>2008</td>
<td>30</td>
<td>AC</td>
<td>9.7</td>
</tr>
</tbody>
</table>

Educational interventions to improve prescribing competency: a systematic review

Gritt Kamarudin, Jonathan Penn, Betty Chaar, Rebekah Moles

ABSTRACT
Objective: To review the literature on educational interventions to improve prescribing and identify educational methods that improve prescribing competency in both medical and non-medical prescribers.

Design: A systematic review was conducted. The databases Medline, International Pharmaceutical Abstracts (IPA), EMBASE and CINAHL were searched for articles in English published between January 1990 and July 2012.

Setting: Primary and secondary care.

Participants: Medical and non-medical prescribers.

Intervention: Education-based interventions to aid improvement in prescribing competency.

Primary outcome: Improvements in prescribing competency (knows how) or performance (shows how) as defined by Miller's competency model. This was primarily demonstrated through prescribing examinations, changes in prescribing habits or adherence to guidelines.

Results: A total of 47 studies met the inclusion criteria and were included in the systematic review. Studies were categorised by their method of assessment, with 20 studies assessing prescribing competence and 27 assessing prescribing performance. A wide variety of educational interventions were employed, with different outcome measures and methods of assessments. In particular, six studies demonstrated that specific prescribing training using the WHO Guide to Good Prescribing increased prescribing competency in a wide variety of settings. Continuing medical education in the form of academic detailing and personalised prescriber feedback also yielded positive results. Only four studies evaluated educational interventions targeted at non-medical prescribers, highlighting that further research is needed in this area.

Conclusions: A broad range of educational interventions have been conducted to improve...
WHO PRESCRIBING GUIDE
The process of Rational Prescribing

1. Define the patient’s problem
2. Specify the therapeutic objective
3. Select a P-drug on the basis of comparative efficacy, safety, cost and suitability
4. Write a correct prescription
5. Counsel the patient on appropriate use of the medicine
6. Make appropriate arrangements for follow-up
Types of educational interventions and what are the most effective
Adult Learning

- Learn throughout their lives
- Transitional stages – cause for learning
- **Diverse learning approaches**
- **Problem-centered and relevant**
- Immediacy of application [real time]
- **leadership-endorsed, repeated/sustained over time**
- Past experiences
- Self-concept
- Self-directed
LITTLE OR NO EFFECT

- **Educational materials** - Distribution of recommendations for clinical care, including clinical practice guidelines, audiovisual materials, and electronic publications. (May be justification if small effect / low cost. Research needed).

- **Didactic educational meetings** - Lectures conferences (if no explicit effort re practice change). Workshops - include practice rehearsal & reinforcement *can* effect change.
Variable effectiveness:

- **Audit and feedback** - clinical performance observations, medical records or patient feedback.

- **The use of local opinion leaders** - Practitioners identified by their colleagues as influential in modelling and transmission of norms.

- **Local consensus processes** - Health providers in discussions designed to reach consensus on appropriate management strategies for specific health problems.

- **Patient mediated interventions** - Intervention designed to change the performance of healthcare providers for which specific information was sought from or given to patients (such as clinical information collected directly from patients).
Is Physician Education Effective in Promoting Antibiotic Stewardship?

http://www.shea-online.org/Portals/0/Policy_Brief_11.pdf

<table>
<thead>
<tr>
<th>Category</th>
<th>Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passive</td>
<td>Printed educational materials delivered to clinician by mail or electronically.</td>
</tr>
<tr>
<td></td>
<td>Clinical practice guidelines handed out by hospital.</td>
</tr>
<tr>
<td></td>
<td>Traditional continuing medical education (formal didactic lectures, seminars, and conferences)</td>
</tr>
<tr>
<td></td>
<td>Educational courses</td>
</tr>
<tr>
<td>Active</td>
<td>Discussion groups for health professionals working in same facility.</td>
</tr>
<tr>
<td></td>
<td>Personal visit by trained health professional (educational outreach visits and academic detailing).</td>
</tr>
<tr>
<td></td>
<td>Interactive role-playing hands-on-training, problem and case solving, and, educational workshops or conferences outside provider’s setting.</td>
</tr>
<tr>
<td></td>
<td>Sequenced education sessions (learn-work-learn).</td>
</tr>
</tbody>
</table>

A meta-analysis of the effectiveness of continuing medical education (CME) showed that active methods had a medium effect on prescribing behavior (r = 0.33) while passive methods had a small effect (r = 0.20) (Mansouri and Lockyer 2007). A review of studies testing interventions that changed the proportion of visits at which patients were prescribed antibiotics in ambulatory care showed a median effect of 12.9 percent (interquartile range 8.1–19.2 percent) for active education interventions versus 7.0 percent (interquartile range 5.0–16.1 percent) for passive education interventions (Kahll et al. 2008). Other reviews, however, found that passive education interventions had no effect (Arnold and Straus 2005; Satterlee et al. 2008). r = correlation (Pearson correlation effect sizes: 0.10 = small, 0.24 = medium, and 0.37 = large)
EFFECTIVE STRATEGIES

- **Educational outreach visits** *(academic detailing)* - trained personnel visit providers in their practice settings - information / support.

- **Interactive educational sessions** *(adult learning principles)* - health care providers participating in interactive learning sessions (eg. problem-based learning or discussing practice issues in small groups).

- **Decision support and reminder systems** *(automated or manual prompts to perform clinical tasks)*

- **Multifaceted interventions** *(any combination of audit & feedback, reminders, local consensus processes, clinical performance observations, reflection etc)*
Hybrid/Blended Learning

- Face-to-Face (F2F)
- Online Learning/prepared material
- Move to 7 X 24 learning experience
- Structured discussions supplement class session
- Encourages quiet students/trainee/clinician to participate
- Opportunity for reflection
- Build & apply knowledge incrementally

SciRAP IS AN EXAMPLE
SAPG/SPAA Event March 2012
Stemming the Tide of antibiotic resistance (STAR)


A blended learning programme addressing appropriate antibiotic prescribing in general practice.

Reduction of 4.2% (95% CI=0.6%, 7.7%) in total oral antibiotic dispensing in the intervention group compared to the control group

Largest reductions in penicillin V and macrolides (p = 0.02)

No significant difference in hospitalisations or re-consultations
Effectiveness of multifaceted educational programme to reduce antibiotic dispensing in primary care: practice based randomised controlled trial

STAR

BMJ FEB 2012
Scottish Reduction in Antibiotic Prescribing (ScRAP) Programme

Electronic links to resources for facilitators

The ScRAP Programme - Electronic links to resources for facilitators

As facilitators for the ScRAP Programme, you may wish to access a number of the resources referred to in the facilitator pack. This pdf provides you with a number of electronic links to do so easily and efficiently. Also provided are exemplar copies of information about the pre-event learning which is suggested for prescribers (and how to access Learnpro), CPD forms and links to the GP Antibiotic Audit Tool.
Scottish Reduction in Antimicrobial Prescribing (ScRAP) Programme

**DISCIPLINE:** Pharmacy  
**THEME:** Workforce development  
**CAREER STAGE:** Practitioner

**OVERVIEW:** The ScRAP Programme, was launched in October 2013, and is an educational toolkit to help prescribers to reduce unnecessary prescribing of antibiotics, and also to support NHS Boards in delivering the level 3 HEAT target on antibiotic volume. It was developed by NES (Pharmacy and HAI) in conjunction with the Scottish Antimicrobial Prescribing Group (SAPG).

**CONTACT:** Valerie Inglis

How is the resource for the ScRAP Programme presented?
ScARP – what is the ‘educational resource’?

Provided to prescribing support teams / AMTs in pilot boards
Made available to all boards after pilot

Pack – similar to NES pharmacy distance learning pack

Facilitator guide
   Key reference documents for background
   60-minute learning event guide (where to pause / suggestion questions to engage delegates on)

Delegate pre-reading materials
   NES HAI rxing vinegettes / RCGP resource

60-minute learning event DVD
   Intended to be played by the facilitator
   Presents the information direct to delegates allowing facilitator to focus on delegate engagement as opposed to imparting information
ScRAP – How will it work?

Facilitated session between primary care prescribers in GP practice and a prescribing support practitioner in a 60-minute learning event.
Myth busters – preventative value of antibiotics in RTI

Sore throat and quinsy

Peterson et al. Protective Effects of antibiotics. BMJ 2007;335:982-984


- Overall NNT > 4000 to prevent one case of quinsy
  Centor score of 3 or 4 = 1:60 chance of quinsy

- Centor criteria:
  - Tonsillar exudate
  - Tender anterior cervical lymphadenopathy
  - History of fever
  - Absence of cough
Scottish Quality and Outcomes Framework 2013/2014

Guidance for NHS Boards and GP practices

1 May 2013

**Medicines management (MM)**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>MM001(S). The practice meets with the NHS Board prescribing adviser at least annually and agrees 3 actions related to prescribing.</td>
<td>4</td>
</tr>
<tr>
<td>MM002(S). The practice meets with the NHS Board prescribing adviser, has agreed 3 actions related to prescribing and subsequently provided evidence of change. The practice should undertake an audit of an area of prescribing that is a clinical issue that has been agreed with the NHS Board prescribing adviser.</td>
<td>9</td>
</tr>
<tr>
<td>MM003(S). A medication review is recorded in the notes in the preceding 12 months for all patients being prescribed 4 or more repeat medicines. Standard 80 per cent.</td>
<td>10</td>
</tr>
</tbody>
</table>
Confidence in different areas of antibiotic prescribing (n=286).

- Making an accurate diagnosis of infection/sepsis
- Interpreting microbiological results
- Choosing between intravenous and oral administration
- Choosing the correct antibiotic
- Planning to streamline/stop the antibiotic treatment according to clinical evaluation and investigations
- Planning the duration of the antibiotic treatment
- Deciding not to prescribe an antibiotic if the patient has fever, but no severity criteria, and if you are not sure about your diagnosis
- Choosing the correct dose and interval of administration
- Using a combination therapy if appropriate

How to educate prescribers in antimicrobial stewardship practices

Céline Pulcini¹² and Inge C. Gyssens³⁴,*

¹Service d’Infectiologie; CHU de Nice; Nice, France; ²Faculté de Médecine; Université Nice-Sophia Antipolis; Nice, France; ³Radboud University Nijmegen Medical Centre and Canisius Wilhelmina Hospital; Nijmegen, The Netherlands; ⁴Hasselt University; Hasselt, Belgium

Keywords: antibiotic prescribing, antimicrobial stewardship, antibiotic policies, undergraduate curriculum, postgraduate education, clinical practice guidelines, intervention strategies, implementation

Abbreviations: BSAC, British Society for Antimicrobial Chemotherapy; CDC, Center for Disease Control and Prevention; DOTS, Directly Observed Treatment Short-course
# EDUCATION THEME AND COMPETENCY

<table>
<thead>
<tr>
<th>Topic</th>
<th>Concept, understanding</th>
<th>Field, discipline</th>
<th>Principal learning outcomes, competencies*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bacterial resistance</strong></td>
<td>Selection, mutation</td>
<td>(Micro) biology, genetics</td>
<td>- Extent, causes of bacterial resistance in pathogens (low antibiotic concentration; prolonged exposure of microorganisms to antibiotics is driving resistance)</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>- Extent, causes of bacterial resistance in commensals and the phenomenon of overgrowth (e.g., <em>Clostridium difficile</em> infection, yeast infection)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Epidemiology</td>
<td>- Epidemiology of resistance, accounting for local variations and importance of surveillance (differences between wards, countries...)</td>
</tr>
<tr>
<td></td>
<td>Hygiene</td>
<td></td>
<td>- Spread of resistant organisms</td>
</tr>
<tr>
<td><strong>Antibiotics</strong></td>
<td>Mechanisms of action of antibiotics/resistance</td>
<td>Pharmacology</td>
<td>- Broad vs. narrow-spectrum antibiotics, preferred choice of narrow-spectrum drugs</td>
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<td>- Combination therapy (synergy, limiting emergence of resistance, broadening the spectrum)</td>
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<td></td>
<td>- Collateral damage of antibiotic use (toxicity, cost)</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>- Consequences of bacterial resistance</td>
</tr>
<tr>
<td></td>
<td>Costs</td>
<td>Ethical, public health, pharmaco...</td>
<td>- Interpretation of clinical and laboratory biological markers</td>
</tr>
<tr>
<td><strong>Diagnosis of infection</strong></td>
<td>Isolation, identification of bacteria, viruses and fungi</td>
<td>(Micro) biology, infectious diseases</td>
<td>- Interpretation of clinical and laboratory biological markers</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Interpretation of basic microbiological investigations (Gram stain, culture, PCR, serology...)</td>
</tr>
<tr>
<td><strong>Sustainability to antibiotics</strong></td>
<td></td>
<td></td>
<td>- Practical use of point-of-care tests (e.g., urine dipstick, streptococcal rapid antigen diagnostic test in tonsillitis...)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Importance of taking microbiological samples for culture before starting antibiotic therapy</td>
</tr>
<tr>
<td><strong>Treatment of infection</strong></td>
<td>Indication for ant...</td>
<td>Clinical microbiology/ infectious diseases</td>
<td>- Clinical situations when not to prescribe an antibiotic</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Colonization vs. infection (e.g., asymptomatic bacteriuria)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Viral infections (e.g., acute bronchitis, influenza)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Infection vs. infection (e.g., fever without a definite diagnosis in a patient with no severity criteria)</td>
</tr>
<tr>
<td><strong>Prevention of infection</strong></td>
<td></td>
<td>Pharmacotherapy, surgery, anesthesia, clinical microbiology/ infectious diseases</td>
<td>- Surgical antibiotic prophylaxis: indication, choice, duration (short, timed)</td>
</tr>
<tr>
<td><strong>Medical record keeping</strong></td>
<td>Choice</td>
<td>Clinical medicine</td>
<td>- Documentation of antimicrobial indication in clinical notes</td>
</tr>
<tr>
<td></td>
<td>Duration</td>
<td></td>
<td>- Recording (planned) duration or stop date</td>
</tr>
<tr>
<td></td>
<td>Timing</td>
<td></td>
<td>- Best bacteriological guess for empiric therapy</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Choice in case of prior use of antibiotics when selecting an antibiotic for empiric therapy</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Choosing the dose and interval of administration (basic principles of PK/PD)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Estimating the shortest possible adequate duration</td>
</tr>
<tr>
<td><strong>Prescribing antibiotics:</strong></td>
<td>Empiric therapy (local guide, antibiotic booklet...)</td>
<td>Clinical microbiology/ infectious diseases/ organ specialists</td>
<td>- Reassessment of the antibiotic prescription around day 3</td>
</tr>
<tr>
<td>Initially</td>
<td>Diagnostic uncertainty</td>
<td></td>
<td>- Streamlining/de-escalation once microbiological results are known</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- IV/oral switch (bioavailability of antibiotic)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Therapeutic drug monitoring to ensure adequate drug levels (e.g., vancomycin)</td>
</tr>
</tbody>
</table>
| **Prescribing antibiotics:** | Communication with the microbiology laboratory | Clinical microbiology/ infectious diseases/ organ specialists | /* A competency is a quality or characteristic of a person that is related to effective performance. Competencies can be described as a combination of...
LEARNING OUTCOMES OF STEWARDSHIP WORKSHOPS

Table 2. Main learning outcomes used to design antibiotic stewardship workshops

| Measuring antibiotic use | • Identify sources of data and understand how to measure antimicrobial use in the community and in hospitals  
|                          | • Select proper measurement units to describe the volume of antimicrobial use  
|                          | • Interpret antimicrobial use data locally and within a multicenter network (benchmarking)  
|                          | • Choose and apply a method to study the relationship between antimicrobial prescribing and bacterial resistance |
| Auditing antibiotic use  | • Choose and apply an audit methodology for monitoring the quality of antimicrobial prescriptions |
| Improving antibiotic use | • Identify the steps and sources for evidence-based guideline development  
|                          | • Describe the elements needed to launch a stewardship program in hospitals  
|                          | • Identify barriers encountered in Antimicrobial Stewardship programs and how to overcome them  
|                          | • Make sense of interpersonal aspects of implementing change  
|                          | • Identify possible intervention strategies (and their relative advantages and disadvantages) which could be implemented in a hospital  
|                          | • Identify the electronic antimicrobial drug prescribing aids and their advantages and disadvantages  
|                          | • Build national and international support for Antimicrobial Stewardship programs  
|                          | • Select a proper method to study the effect of interventions in hospitals  
|                          | • Describe how an individual hospital can determine if its antimicrobial management program was economically successful and if it had an impact on bacterial resistance |
GOOD PRESCRIBING

The Consultation

Prescribing effectively

Prescribing in context

Knowledge

Options

Shared decision making

Self and others

Information

The Healthcare system

Always improving

Safe

Professional
Antimicrobial prescribing and stewardship competencies

d. Continue and review again at 72 hours.
e. Outpatient Parenteral Antibiotic Therapy (OPAT).
A systematic review of educational interventions to change behaviour of prescribers in hospital settings, with a particular emphasis on new prescribers

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<table>
<thead>
<tr>
<th>Type of Intervention</th>
<th>Number of Interventions</th>
<th>%</th>
</tr>
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<tr>
<td>Educational materials: Distribution of published or printed recommendations for clinical care, including clinical practice guidelines, audiovisual materials and electronic publications</td>
<td>44</td>
<td>28</td>
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<td>Conferences and training: Participation of health care providers in conferences, lectures, workshops or traineeships outside their practice settings. Practice settings are defined as on the ward or in their office. But could be taking place in a room on the hospital site.</td>
<td>36</td>
<td>23</td>
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<td>Audit and feedback: Any summary of clinical performance of health care over a specified period, with or without recommendations for clinical action. The information can have been obtained from medical records, computerised databases or patients or by observation including a knowledge test.</td>
<td>27</td>
<td>17</td>
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<td>Outreach visits: Use of a trained person who meets with providers in their practice settings to provide information. The information given may include feedback on the providers performance. Practice settings are defined as on the ward or in their office. But could be taking place in a room on the hospital site.</td>
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<td>Reminders: Any Intervention (manual or computerised) that prompts the health care provider to perform a clinical action. Examples include concurrent or inter-visit reminders to professionals about desired actions such as screening or other preventative services, enhanced laboratory reports or administrative support (e.g. follow-up appointment systems or stickers on charts, order forms or physician order entry systems).</td>
<td>24</td>
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<tr>
<td>Marketing: Use of personal interviewing, group discussion (focus groups) or a survey of targeted providers to identify barriers to change and the subsequent design of an intervention and refinement.</td>
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<td>6</td>
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<td>Patient-mediated interventions: Any Intervention aimed at changing the performance of health care providers for which information was sought from or given directly to patients by others (e.g. direct mailings to patients, patient counselling delivered by others or clinical information collected directly from patients and given to the provider)</td>
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<td>1</td>
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<td>Local opinion leader: Use of providers explicitly nominated by their colleagues to be educationally influential</td>
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<td>1</td>
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<tr>
<td><strong>Total</strong></td>
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EFFECTIVE EDUCATIONAL INTERVENTIONS, NEW PRESCRIBERS

METHODS
Embase, Medline, SIGLE, Cinahl and PsychINFO were searched for relevant studies published 1994–2010. Studies describing interventions to change the behaviour of prescribers in hospital settings were included, with an emphasis on new prescribers. The bibliographies of included papers were also searched for relevant studies. Interventions and effectiveness were classified using existing frameworks and the quality of studies was assessed, using a validated instrument.

RESULTS
Sixty-four studies were included in the review. Only 13% of interventions specifically targeted new prescribers. Most interventions (72%) were deemed effective in changing behaviour but no particular type stood out as most effective.

CONCLUSION
Very few studies have tailored educational interventions to meet needs of new prescribers, or distinguished between new and experienced prescribers. Educational development and research will be required to improve this important aspect of early clinical practice.
Junior doctors are just the same as other young people!

Average age 27yrs

80% use Google to answer clinical queries

26 % use Wikipedia to answer clinical queries

What is E-Learning?

“Learning experiences enabled or enhanced by technological resources that support the development, exchange, and application of knowledge, skills, attitudes, aspirations, or behaviours for the purpose of improving teaching and increasing student achievement.”

National Staff Development Council
Welcome to the Pause Website

The aim of the Pause Website is to ensure that medical practitioners will be prudent prescribers of antibiotics and will promote prudent use of antibiotics in whatever clinical context they are working in.

The objectives of the Pause website are to:

1. Construct a framework of learning outcomes that defines a prudent prescriber.
2. Promote reflective learning to ensure practitioners maintain and develop their expertise in prudent prescribing.
3. Provide flexible web-based learning resources and assessments that will enable undergraduate medical students to achieve clearly defined learning outcomes in prudent prescribing, for their level of expertise.
4. Create a collaborative web-based forum for sharing experience and learning resources between providers of education in the context of prudent prescribing.
5. Provide an exemplary learning platform in prudent antibiotic prescribing for the development of other healthcare professionals.

Why Are Antibiotics Making Us Ill??

Standard Competency Headings

1. Consider diagnosis
2. Assess severity
3. Initiate investigations
4. Consider infection control
5. Assess need for antimicrobials
6. Consider other aspects of management
PowerPoint presentations provide a structured discussion session for each standard patient vignette topic. The focus of the content presented in a patient context. The slides can guide discussion around the patient focusing on the areas appropriate to student needs, rather than simply holding a question and answer session. The patient master cards can be provided at a later time to assist the student in reviewing the knowledge they have gained. It is useful to build on the students own clinical experience of a similar case.

Each vignette comprises:
- Session and Master Cards
- Preparation Vignette
- Multiple Choice Questions and Assessment Materials.

Each vignette has three versions:
- PowerPoint presentation
- PowerPoint Web version
- Word document version

<table>
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<tr>
<th>Vignette</th>
<th>Web</th>
<th>PowerPoint</th>
<th>Word</th>
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<td>001 - Pneumonia</td>
<td></td>
<td></td>
<td></td>
<td>1, 4, 7</td>
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<td>002 - Septic Shock</td>
<td></td>
<td></td>
<td></td>
<td>1 - 12 (all)</td>
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<tr>
<td>003 - Cellulitis</td>
<td></td>
<td></td>
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<td>N/A</td>
</tr>
<tr>
<td>004 - Infective Endocarditis</td>
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<td></td>
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<td>1 - 12 (all)</td>
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<td>005 - UTI Pyelonephritis</td>
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<td>1 - 12 (all)</td>
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<td>006 - UTI in Pregnancy</td>
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<td>007 - UTI in the Elderly</td>
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<td>008 - Pyelonephritis</td>
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<td>009 - Catheter Associated Infection</td>
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<td>010 - Tuberculosis</td>
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<td>1, 4, 7</td>
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<td>011 - Pancreatitis</td>
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Navigating the Web in Search of Resources on Antimicrobial Stewardship in Health Care Institutions

Leonardo Pagani, Inge C. Gyssens, Benedikt Huttner, Dilip Nathwani, and Stephan Harbarth

1Division of Infectious Diseases, Bolzano Central Hospital, Bolzano, Italy; 2Nijmegen University Center for Infectious Diseases and Radboud University and 3Canisius-Wilhelmina Hospital, Nijmegen, The Netherlands; 4Geneva University Hospitals and Medical School, Geneva, Switzerland; and 5Ninewells Hospital and Medical

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<td>Prudent Antibiotic User Website</td>
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<td>Agency for Healthcare Research and Quality</td>
<td><a href="http://www.ahrq.gov/downloads/pub/evidence/pdf/medgap/medgap.pdf">http://www.ahrq.gov/downloads/pub/evidence/pdf/medgap/medgap.pdf</a></td>
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<td>Academy for Infection Management</td>
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<td>Premier Inc.</td>
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<td>Bugs and Drugs—Antimicrobial Reference Book</td>
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<td>American Society of Health-System Pharmacists</td>
<td><a href="http://www.ashp.org/s_ashp/index.asp">http://www.ashp.org/s_ashp/index.asp</a></td>
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<td>Yes</td>
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<th>Name of site or sponsor</th>
<th>URL</th>
<th>Ease of navigation</th>
<th>Practical information for professionals</th>
<th>Amount and scope of information</th>
<th>Teaching material to download</th>
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<td>Centers for Disease Control and Prevention</td>
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<td>The Public Health Agency of Canada</td>
<td><a href="http://www.phac-aspc.gc.ca/tpars-picsa/links-links_e.html">http://www.phac-aspc.gc.ca/tpars-picsa/links-links_e.html</a></td>
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<td>Average</td>
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<td>Healthcare Information Control Special Interest Group</td>
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<td>DeBug Infection Prevention Program</td>
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<td>Antibiotic Resistance Alliance Education Wisconsin</td>
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<td>European Project Group “ABS International”</td>
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<td>The Scottish Government– Health and Community Care</td>
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<td>Yes</td>
<td>Large</td>
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<td>Appropriate Antibiotic Prescribing</td>
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<td>Yes</td>
<td>Large</td>
<td>Yes</td>
<td>No</td>
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<td>National Resource for Infection Control</td>
<td><a href="http://www.nric.org.uk/IntegratedCRD.nsf/NRIC_Policy_AntimicrobialPrescribing?OpenForm">http://www.nric.org.uk/IntegratedCRD.nsf/NRIC_Policy_AntimicrobialPrescribing?OpenForm</a></td>
<td>Excellent</td>
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<td>The Dutch Working Party on Antibiotic Policy</td>
<td><a href="http://www.swab.nl/swab/swabcms.nsf/showP_foreign">http://www.swab.nl/swab/swabcms.nsf/showP_foreign</a></td>
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<td>Average</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
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</tbody>
</table>

WEB BASED RESOURCE: CRITIQUE

Mainly limited to hospital stewardship

Good educational resource for teaching and link to guidelines

Need more based in the community

Primarily developed world based and in English language

Generally free but lack of transparency and update in many

Some industry sponsored

Limited ability to discuss or feedback

Little ability to undertake reflection or assessment: need to consider how it can support work based assessment

Need to consider larger scale of educational delivery that encompasses key components of educational delivery e.g MOOCS
Literature Pearls of Antimicrobial Stewardship

(Journal Watch)

By ESGAP-OVLC admin | 16 April 2014 | No Comments

By Céline Pulcini


- Final-year students at seven European medical schools were surveyed on behalf of ESGAP in 2012.
- Most students declared that they wanted more education on antibiotics. Gaps in knowledge regarding bacterial resistance and areas of non-confidence regarding antibiotic prescribing were identified. Students overestimated the current burden of resistant bacteria and were unaware of successes in reducing MRSA infections.
- These findings argue for reinforced training in these areas, and for designing a European framework defining an undergraduate curriculum regarding prudent antibiotic prescribing teaching.
BSAC: Due 2014
ARC – Antimicrobial Resource Centre

Overarching education portal for stewardship as a whole
Will be a repository for e-learning vignettes, case studies, presentations, abstracts, tools (such as NAS-PPS) and services (incl. meetings) relating to Antimicrobial stewardship
Launched through BSAC ARC will have European and Global impact as a central learning resource
What is a MOOC?

**Massive** - some have 10,000s registered.

**Open** = free

anyone can register

**Online** although many have a parallel blended incarnation

**Course** - that runs at a given time with a given cohort

(but not necessarily accredited for anything)

Different to OERs
Most Courses consist of

• Many short videos
  • Some talking heads
  • Some “worked examples”
  • Some experiments etc.
• On-line papers etc.
• Discussion forums
• On-line activities
• Formative assessments

Assessment (and feedback) will need to be
• Objective (multiple choice etc.)
• Peer review
• Self evaluation

Learning Design Workflow and Learning Analytics are central
The emphasis must be on the student as a self-motivated learner.
Motivations for making MOOCs

• enhance reputation
• boost recruitment
• provide a public service
• create more flexible routes for entry
• explore new markets
• support collaborative provision
• improve on-line capability
• enable us to become more agile and flexible
ANTIMICROBIAL STEWARDSHIP: OPTIMIZATION OF ANTIBIOTIC PRACTICES (CME)

This course will offer a practical approach to prescribing antibiotic therapy and development of antimicrobial stewardship across all specialties and settings.

Antibiotics are among the most frequently prescribed classes of drugs and it is estimated that approximately 50% of antibiotic use, in both the outpatient and inpatient settings, is inappropriate. At the same time, in contrast to any other class of drugs, every antibiotic use has a potential public health consequence – inappropriate use may not harm only the individual patient, but contributes to societal harm by exerting an unnecessary selective pressure that may lead to antibiotic resistance among bacteria. This course will offer a number of illustrative cases, recognizable to the practicing physician in his or her practice to engage the learners in the thought processes that lead to optimal decision making, improved outcomes of individual patients, and harm reduction vis-a-vis the bacterial ecology.

Learning Objectives

- Develop skills to apply IDSA guidelines in treating infections such as acute rhino-sinusitis, and acute bronchitis.
Online Spaced Education (SE) is a novel, evidence-based form of online education that has been demonstrated in randomised trials to improve knowledge acquisition, boost retention and change behaviour.

SE involves participants receiving short, case-based multiple-choice questions and feedback via e-mail in a reinforcing pattern over a number of weeks.

The methodology is based on two core psychological research findings: the spacing and testing effects.

The **spacing effect** refers to the finding that educational encounters that are repeated over time increase the acquisition and retention of knowledge.

The **testing effect** refers to the finding that the process of testing does not merely measure knowledge, but actually alters the learning process itself to significantly improve knowledge retention.
ANTIBIOTIC PRESCRIBING EDUCATION

- Evidence supports the value of education but must be supported by systems support and understanding of human factors AND context
- Adult learning theory supports a diverse range of effective measures to learn; less is known about which interventions lead to behaviour change
- Learning about prescribing needs to be structured within a framework of competencies & outcomes
- Blended & E-learning is increasingly used & Spaced education may support long term retention and improved performance
- Increasing web based resource but of variable quality
- The infection community need to engage with and develop innovative & large scale methods for educational delivery e.g MOOCS