Professional education on antimicrobial prescribing: a report from the Specialist Advisory Committee on Antimicrobial Resistance (SACAR) Professional Education Subgroup

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There is growing concern about the quality and safety of prescribing in the UK. Added to the increasing prevalence of antimicrobial resistance, this makes a persuasive case for improving education about antimicrobials within a broader programme of education about prescribing. Moreover, the need for education is not confined to the professionals who prescribe antimicrobials, it extends to all the professionals who are involved in the patient’s journey from presentation to outcome. The work of the Specialist Advisory Committee on Antimicrobial Resistance Professional Education Committee has focused on two areas. First, we have worked with professional societies on regional workshops that translate evidence into improvement in practice. Second, we have explored mechanisms for interdisciplinary collaboration on education between the professions involved in the management of infection. Our recommendation is that this work needs to be continued through an initiative that will ensure UK collaboration on defining learning outcomes for prudent antimicrobial use for all health professionals.

Keywords: undergraduate and postgraduate training, medical school curricula, patient group directions

Background

On 18 February 2007, the front page headline for The Sunday Times in Scotland was ‘Junior doctors “risk lives with prescriptions”’. The story was a response to research from the University of Aberdeen, which found that one-third of recently qualified doctors had a poor or worse grasp of how to administer the drugs most commonly used in hospitals. However, the problem is not confined to Scotland. In the same article, Professor David Webb from the University of Edinburgh described a survey that showed similar shortcomings in knowledge about drugs amongst doctors across the UK. Professor Webb said ‘There is no longer an identifiable examination of doctors’ ability to understand the science which underpins prescribing. We feel there needs to be much greater focus on drugs training’. Even before the results of these studies were announced, the General Medical Council was under pressure to show that medical graduates are competent to prescribe medicines. Reflecting on these general concerns about prescribing safety, it is perhaps not surprising that, even in the face of increasing worldwide antimicrobial resistance, educational standards with respect to antimicrobial usage and microbiology are falling short because antibiotics continue to be used inappropriately and unnecessarily.

To rein in the impact of poor prescribing on antimicrobial resistance, significant educational change is required. This need was recognized by the Department of Health (DH) in its UK Antimicrobial Resistance Strategy and Action Plan, which outlined specific objectives to promote prudent antimicrobial use in humans (Action Area 3.1). These were:

- To take the lead in continuing to press for greater coverage of prudent antimicrobial use in undergraduate and postgraduate curricula (medicine, dental, nursing and pharmacy).
- To take the lead in continuing professional development, through the General Medical Council, the Royal Colleges, Nursing Boards and the NHS, and for better integration of antimicrobial teaching into teaching about the infections for which they are to be used.

The Strategy was produced in 2000, yet it has not been implemented and the Specialist Advisory Committee on Antimicrobial Resistance (SACAR) and its Subgroups continue to identify significant problems that could be addressed through appropriate training in antimicrobial prescribing, policy and practice. Evaluation of education needs to address its impact on professional behaviour and not just on knowledge or expressed attitudes. The current public concern about the competencies of prescribers can only be addressed by measures that demonstrate the impact of education on professional behaviour and ultimately on the outcomes of infection.

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Why all healthcare professionals need to be educated about antimicrobials

Health professionals regularly have to make complex decisions about antimicrobial use, balancing the benefits of effective treatment against the risks to individual patients and public health from overuse of antimicrobials. Not surprisingly, they are confused by conflicting messages about how resistance should influence their prescribing and how their prescribing influences resistance. Clearly, prudent antimicrobial prescribing is an important issue in its own right but it is also a core topic that links prescribing quality improvement to patient safety and continuing professional development.

So far, most of the focus has been on improving doctors’ prescribing as they prescribe the majority of antibiotics. However, dentists make a significant contribution to antibiotic prescribing in primary care. Moreover, the profile of the antimicrobial prescriber is changing because recent legislation has extended prescribing responsibilities to other health professionals (Figure 1). In addition, Patient Group Directions (PGDs) provide another mechanism permitting wider supply of antimicrobials by registered (or equivalent) healthcare practitioners and non-NHS organizations. A PGD is a specific written direction that allows a named healthcare professional to supply and/or administer prescription-only medicines directly to a patient who fits pre-specified criteria. The DH guidance states that inclusion of antimicrobials in a PGD should only be considered where absolutely necessary and justifiable, and where measures to combat resistance will not be compromised. A local microbiologist should be involved in the drawing-up of a PGD involving any antimicrobials and the PGD should be regularly audited. However, despite these warnings, SACAR is concerned that the use of PGDs to supply antimicrobials is widespread and not audited, with no statistics available.

Recent government strategy has also focused on making medicines more widely available to patients. This includes encouraging the reclassification of medicines from prescription-only to pharmacy where it is safe to do so. It is inevitable that some antimicrobials will be eligible for reclassification thus widening their availability.

It is clear that the number of professionals who are able to prescribe antibiotics either independently or dependently is going to increase. However, we believe that the key issue is not who prescribes an antimicrobial. Instead of focusing on which health professional writes the prescription, we need to develop a coherent multi-disciplinary approach to the entire process from patients presenting with a problem, through diagnosis, prescribing, dispensing and administration of an antimicrobial (when necessary) to assessment of the patient’s outcome. Antimicrobial management requires effective teamwork between all of the health professions, regardless of who writes the prescription. Therefore, effective education is required for all healthcare professionals to ensure prudent use of antimicrobials and reduce resistance.

Teaching prudent antimicrobial prescribing

The SACAR Professional Education Subgroup adopted the definition of prudent prescribing proposed by a multi-disciplinary Clinical Prescribing Subgroup convened by the DH. Prudent antimicrobial prescribing is defined as: ‘The use of antimicrobials in the most appropriate way for the treatment, or prevention, of human infectious diseases having regard to the diagnosis...’

![Figure 1. Summary of how patients can receive antimicrobials.](https://academic.oup.com/jac/article-abstract/60/suppl_1/i27/999077)
(or presumed diagnosis), evidence of clinical effectiveness, likely benefits, safety, cost (in comparison with relevant alternative choices) and propensity for the emergence of resistance. The most appropriate way implies that the indication and, if needed, choice of drug, route, dosage, frequency and duration of administration have been rigorously determined. This definition identifies the behaviours that are expected of a prudent antimicrobial prescriber and hence starts to define the criteria that should be used to evaluate the impact of education on behaviour. The next step is to identify detailed learning outcomes under the headings of knowledge, attitudes and behaviour. There is increasing emphasis on competencies in medical education, which can be defined as learning outcomes described as knowledge, skills and attitudes that are assessed in the workplace.

**Evaluation of educational tools for improving antimicrobial prescribing**

**Kirkpatrick’s evaluation of education**

Kirkpatrick described a four-level hierarchy for evaluation of education:

(i) Evaluation of reaction (satisfaction or happiness).
(ii) Evaluation of learning (knowledge or skills acquired).
(iii) Evaluation of behaviour (transfer of learning to workplace).
(iv) Evaluation of results (transfer or impact on society).

Complexity of behavioural change increases as evaluation of intervention ascends the hierarchy. Medical education strategies should aim not only to increase knowledge (stage 2), but also to change behaviour (stage 3) and improve patient outcomes (stage 4). This is obviously more difficult to achieve as shown by Kirkpatrick’s diagram, which is constructed as a pyramid with impact on society at the apex. According to this model of education, the ultimate evaluation of professional education about antimicrobial prescribing should be its impact on antimicrobial resistance and clinical outcomes such as *Clostridium difficile* associated diarrhoea. Two systematic reviews provide evidence to show that these outcomes can be improved by interventions to improve antimicrobial prescribing or infection control. The obvious question is would we be able to measure the impact on the same outcomes of educational interventions in the UK? Recent experience at the Royal Free Hospital showed that an intervention to improve antibiotic prescribing was associated with significant reduction in *C. difficile* infection.

The Institute for Healthcare Improvement’s Collaborative model

The Institute for Healthcare Improvement (IHI) is a not-for-profit organization leading the improvement of healthcare throughout the world. IHI was founded in 1991 and is based in Cambridge, MA, USA. One of IHI’s key drivers for improvement has been their Collaborative model (Figure 2). A Collaborative is a short-term (6–18 month) learning system that brings together teams from hospitals or clinics to focus on improvement in one specific topic area. Since 1995, IHI has sponsored over 50 such Collaborative projects ranging in size from 12 to 160 teams. Each team typically sends three of its members to attend Learning Sessions (three face-to-face meetings over the course of the Collaborative), with additional members working on improvements in the local organization (Figure 2).

There are two key differences between the Collaborative model and traditional didactic education. First, the Collaborative combines subject matter experts in specific clinical areas with experts in bringing about change in frontline care. Second, although the Learning Sessions include didactic teaching, this is embedded within a commitment to change that starts with measurement of current practice. Measurement and the development of measures for improvement are an integral part of the work that teams have to do before each Learning Session.

![Figure 2](https://academic.oup.com/jac/article-abstract/60/suppl_1/i27/999077)
and teams have to make regular reports about their progress with testing change (Figure 2). Although the basic Collaborative model has not changed since its introduction in 1995, the detail has been continuously refined to accelerate participant teams’ progress. Examples include asking participants to collect baseline data before the first Learning Session, involving organizational leaders in the teams and using more frequent (now monthly) but less-detailed reports to monitor progress. Evaluation of the model has included measurement of impact on outcomes, most notably in the recent 100 000 Lives Campaign.

**SACAR’s Professional education activities**

The SACAR Professional Education Subgroup was set up as a multi-disciplinary group to consider both undergraduate and postgraduate training. To date, the Subgroup have completed two major pieces of work:

(i) A series of regional workshops on translating evidence into changes in practice (2004–7).
(ii) An initiative to coordinate the definition of learning outcomes across all professions and the four health administrations of the United Kingdom (2006–7).

**Regional workshops**

In 2004, SACAR planned a series of workshops in conjunction with members of several professional societies: Association of Medical Microbiologists, British Society for Antimicrobial Chemotherapy (BSAC), Hospital Infection Society, Infection Control Nurses Association and the UK Clinical Pharmacy Association. The aim of the workshops was to promote good practice in evaluating the effectiveness of interventions for infection control or prescribing that are intended to reduce the incidence of methicillin-resistant *Staphylococcus aureus* (MRSA) or other healthcare-associated infections (HAIs).

In 2005, 10 workshops were held across the UK, which were attended by 330 doctors, laboratory scientists, managers, nurses and pharmacists. All of the workshop materials are publicly available on the BSAC website.

The workshops had five learning objectives:

(i) Understand the key elements that should be included in a report of an intervention to change practice.
(ii) Be aware of common threats to the validity of an evaluation and how they can be minimized.
(iii) Understand the importance of graphical presentation of data for interpreting and communicating the effects of an intervention.
(iv) Understand the quality criteria for reporting time series data about the effects of interventions.
(v) Apply these principles to critical appraisal of study results (‘your own or other peoples’).

Feedback from the workshops was very encouraging: 249 questionnaires were returned, a 75% response rate; 80% of respondents rated the workshop as excellent or good and 78% would be interested in a follow-up session. Two clear messages emerged:

(i) The key to accurate measurement of either MRSA or *C. difficile* infections or any healthcare-associated infection is a consistent case definition.
(ii) Although case definitions have been provided in national guidelines for both infections, there is considerable variation in the application of these definitions in clinical practice in the UK.

The main problem is confusion between the application of a case definition for surveillance versus the criteria that are used to diagnose and manage clinical infection. No surveillance system, no matter how resource intensive, would be capable of measuring any HAI with 100% accuracy, some cases would be bound to be included erroneously and some excluded erroneously. While this might be unacceptable for the clinical management of an individual patient, it is acceptable, within limits, for a surveillance system. Describing a system of surveillance for *C. difficile*, Riley observed that ‘Definitions are for the purposes of surveillance and not designed to identify every infection. It is better to be approximately right most of the time rather than completely right occasionally’.

The main recommendation to emerge from the workshops was to provide more regional support by establishing multi-disciplinary regional educational networks that will link up new information about infection control or prevention with education about changing professional behaviour.

**Strategies for improving antimicrobial prescribing**

SACAR established a larger steering group (see Appendix 1) that met on two occasions in 2005/6 to formulate a strategy to ensure that all healthcare professionals received adequate education about antimicrobial prescribing. The key stakeholders were identified and invited to a workshop held on 7 June 2006. The workshop aims were to ensure co-ordination at UK level, obtain endorsement of the initiative by stakeholders and share knowledge of current arrangements. The objectives were to identify existing resources, avoid duplication of effort or production of conflicting resources and identify gaps in current arrangements.

The original tool identified for improving prescribing was the development of specific antimicrobial prescribing competency frameworks at a UK level (i.e. across England, Scotland, Wales and Northern Ireland) and for all prescribing professions. However, attendees at the workshop undertook a SWOT analysis (Strengths, Weaknesses, Opportunities and Threats) of this proposal, which indicated that a competency-based approach might not be appropriate because it was too didactic and may conflict with existing work that is being undertaken on prescribing generally.

The proposal has therefore been modified to focus on the development of learning outcomes, which are statements that indicate what a student should know, understand and be able to do by the end of an educational programme. This would provide a robust and transparent framework for curriculum development at all stages. Subsequently, the learning outcomes could be translated into competencies by the appropriate bodies.
The learning outcomes will also be a platform for the development of training resources.

An outcome-based approach would retain the strengths and opportunities from multi-disciplinary work across the UK without taking the controversial next step of trying to achieve consensus on assessment and competencies. In addition, learning outcomes for prescribers of antibiotics in humans can be adapted to develop resources for veterinarians or the public, whereas competencies are not so flexible.

Stakeholders also recommended including knowledge about antimicrobial resistance as one of the outcomes of education about antimicrobial prescribing. First, everybody will agree that information about resistance does influence prescribing and that many prescribers or patients are confused about resistance. Second, this will make it clear that learning about antimicrobial prescribing must be connected clearly with infection control and microbiology. Finally, the workshop concluded that the initiative will need an action plan that ensures that adequate resources are devoted to the work.

Ongoing activities

Regional workshops

SACAR/BSAC has started the process for the 2007 Workshops with a planning meeting in London on 15 January 2007 for Workshops that will occur in autumn 2007. The 2007 Workshops will be organized with the same professional societies but in collaboration with the Health Foundation, a charity that is focused on improving quality and safety in healthcare (www.health.org.uk). Over the past 4 years, the Health Foundation has been building capacity for quality improvement in the UK through programmes such as Leaders for Change, Quality Improvement Fellowships and the Safer Patients Initiative.

The focus of the 2007 workshops will be on changing practice to reduce C. difficile associated diarrhoea. The workshops will also be the first step in establishing a network for improvement across the UK using the Institute for Healthcare Improvement’s Collaborative model (Figure 2). We will identify people with expertise in quality improvement to work with the teams in each of the regions. Before the Workshops, two hospitals in each region will collect surveillance information about the prevalence of C. difficile infections, adherence to high-impact interventions to reduce risk of infection and barriers to change (the pre-work for Learning Session 1, Figure 2). The Workshops will be Learning Session 1 and will be followed by two more Learning Sessions to share the results of work completed during the intervening Action Periods (Figure 2). The principal mechanism for bringing about change is to use repeated, rapid small tests of change, called PDSA (Plan, Do, Study, Act) cycles. This collaborative will establish the regional networks for improving Healthcare Associated Infection that were the main recommendations from the 2005 Regional Workshops.

A UK multi-disciplinary antimicrobial educational initiative

The aim is to develop antimicrobial learning outcomes that are endorsed and implemented by all human prescribing professions (medicine, dental, nursing and pharmacy) across the UK (England, Scotland, Wales and Northern Ireland). The objectives of the initiative are:

(i) To establish a UK-wide multi-disciplinary network with one lead from each of the four professions in each UK administration.
(ii) To identify existing mechanisms for development of the content of educational curricula.
(iii) Using the network, to develop a set of learning outcomes to ensure prudent antimicrobial prescribing.
(iv) Develop educational resources to support the implementation of the learning outcomes and ensure that these are made available across the UK.
(v) Communicate with the Royal Colleges, governing professional bodies and statutory organizations (National Prescribing Centre, NHS Education Scotland) to ensure that learning outcomes are aligned with existing or emerging generic prescribing competencies.

Action Plan

It is proposed that the work is funded jointly by the four UK administrations, starting with identification of representatives for four meetings, one in each of the four nations. Each administration will host one meeting and fund attendance by their representatives at the other three meetings.

Each of the four UK administrations will appoint a professional lead from each of the four human prescribing disciplines. These 16 individuals will form the network and will be responsible for liaising with their professional bodies and ensuring the implementation of their strategy. The BSAC has agreed to form a project team, to coordinate the meetings.

At the first meeting of the network, the leads will be asked to report on existing arrangements for defining and assessing generic prescribing skills in their discipline. Key priorities for the SACAR initiative will be developed by identification of gaps and opportunities in the current arrangements. At the second meeting, the network will further develop multi-disciplinary learning outcomes using the same consensus process as in the meeting in June 2006. The third and fourth meetings will be used to review progress with dissemination of learning outcomes, estimate the resources required to bridge gaps in educational resources and secure funding/partnerships for the development of educational resources.

Conclusions

There is clear evidence that much antimicrobial prescribing continues to be inappropriate. This is of concern as antimicrobial resistance continues to pose a major public health threat and access to antimicrobials is becoming easier due to changes designed to improve patients’ access to healthcare. Strategies to combat resistance and halt the spread of infectious diseases therefore need to take new NHS arrangements into account. The regional workshops on MRSA and HAI clearly showed that hospitals across the UK are using different methods to define the numerator and denominator of existing surveillance measures. However, they are eager to collaborate on testing and development of common case definitions and minimum data sets for surveillance of infections, prescribing and resistance as a
starting point for bringing about the changes in practice that will result in improvement. The SACAR Initiative has established a framework for UK collaboration on multi-disciplinary education that will define learning outcomes for all health professionals.

Transparency declarations

None to declare.

References