

Combating antimicrobial resistance

Educational approaches for the responsible prescribing of antimicrobials

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Foreword

The potential impact of antimicrobial resistance on society cannot be underestimated – indeed it could be argued that there are few public health issues of greater importance. It is a sobering but very real thought that more and more cases are being identified of infections that do not respond to treatment with antibiotics. Although antimicrobial resistance cannot be eliminated, we can work together to limit its risk to the public and minimise its impact.

Reducing infections in the NHS is a [national priority](#), and the Government has outlined its desire to halve both healthcare associated Gram-negative bloodstream infections and inappropriate antibiotic prescribing in England by 2020. Together, we want to be a world leader in reducing prescribing of antibiotics by 2020.

As outlined in our [Mandate](#), we have been asked to develop and promote resources that support antimicrobial stewardship and good infection, prevention and control practices. Improving professional education to improve clinical practice and promote wider understanding of the need for more sustainable use of antibiotics is a key activity in the [UK Government's five year strategy for tackling antimicrobial resistance](#).

To begin this work, [last year we asked higher education institutions](#) about the extent to which the [antimicrobial prescribing and stewardship competences](#) developed by Public Health England and the Government's advisory committee on antimicrobial resistance and healthcare associated infection (ARHAI) have been embedded into their curricula. We also agreed that we needed to identify whether there are any gap areas in the educational resources that are available to support current prescribers with the prescribing of antimicrobials.

This report outlines the outcomes of the work focussed on current prescribers and provides recommendations for further action, to us and partners. This report explores

- the approaches the system has used to improve prescriber education,
- the education of other health workers on antimicrobial resistance and stewardship, and
- solutions available to organisations and system leaders to help further improve this.

Antimicrobials are prescribed for a wide number of infective states, by a wide variety of clinical prescribers that includes both medical and non-medical prescribers. It is vital that prescribers have the right knowledge and skills, to ensure that prescribing interventions are safe and that they deliver the best outcomes for their patients. This work is an important milestone in achieving this goal, and we look forward to taking the recommendations forward, to help manage and reduce the risks of antimicrobial resistance.



Professor Ged Byrne, Director of Education and Quality, Health Education England working across the North



Professor Lisa Bayliss-Pratt, Director of Nursing, Health Education England

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Introduction

We have an obligation within our [Mandate](#) to mitigate the risk of antimicrobial resistance as set out in the [UK Antimicrobial Resistance \(AMR\) Strategy](#), by continuing cross-system work to develop and promote resources to support antimicrobial stewardship and good infection prevention and control practices. As part of our work, we investigated whether there were any gap areas in relation to educational resources available to support current prescribers responsibly prescribing antimicrobials, and makes recommendations to address these gaps, if necessary.

Background

Clinicians involved in prescribing are expected to remain up to date with emerging evidence on resistance and appropriate antibiotic usage. This can be through appropriate continuing professional development and wider use of resources such as the '[Start Smart-Then Focus](#)' guidance on antibiotic stewardship in hospitals and '[TARGET](#)' produced for GPs amongst others.

The context for this work includes:

- actions identified within the [UK AMR strategy 2013-2018](#),
- recommendations of the Specialist Advisory Committee on Antimicrobial Resistance (SACAR) Professional Education Subgroup that looked at the role of competencies of prescribers and the impact of education on professional behaviour (Davey et al [2007](#)),
- the development of antimicrobial prescribing and stewardship competences by Public Health England's (PHE) expert group on Antimicrobial Resistance and Healthcare Associated Infections (ARHAI) (PHE [2013](#)),
- the Health and Social Care Act 2008 code of practice on the prevention and control of infections and related guidance (DH [2015](#)) which states that providers should ensure that all prescribers receive induction and training in prudent antimicrobial use and are familiar with the antimicrobial resistance and stewardship competencies,
- recommendations that there should be mandatory core training in prudent antibiotic use for doctors, pharmacists and nurses, in addition to an introductory session on each induction programme and that this should be repeated every three years, with particular emphasis on those antibiotics that provoke C. difficile infection (CDI) (PHE & DH [2008](#); PHE [2011](#)).

Key issues

This report comes at a time of increasing concerns about the threats posed by antimicrobial resistance to the future of modern day medicine. The very real threat of having no suitable antibiotics to treat infection has been highlighted in the Chief Medical Officer's report ([2013](#)), and could result in minor surgery and routine operations becoming high risk procedures.

The government commissioned review on antimicrobial resistance ([2014](#)) mentions the already manifesting damaging effects that currently claim at least 50,000 lives each year across Europe and the US alone. The review states that the threat of antimicrobial resistance might seem distant and an abstract risk to some, if it is known at all, and highlights the considerable human and economic cost that could result from any inaction ([2014](#)).

More recently the government has launched new plans to reduce infections in the NHS by halving the number of healthcare associated Gram-negative bloodstream infections by 2020 and halving inappropriate antibiotic prescribing by the same date, with the aim of being a world leader in reducing antibiotic prescribing by 2020 (DH [2016](#)). Plans are therefore underway to improve training and information sharing so NHS staff can learn from the best in cutting infection rates (DH [2016a](#)). System wide engagement and action will be needed to reduce the threat posed by antimicrobial resistance, and the workforce needs to be adequately equipped to help tackle this threat.

Methods

The objective of this survey was to identify what learning materials and resources are currently available to support prescribers with learning and education around AMR and antimicrobial prescribing. This information was captured using a questionnaire with an aim to identify any gaps, perceived or otherwise in the education and training of prescribers in this area, to enable us make recommendations to address these. We also wanted to explore whether NHS organisations provided mandatory core training in prudent antibiotic use for doctors, pharmacists and nurses, as part of induction programmes and whether this was repeated every three years post-registration as recommended by national guidelines (PHE & DH [2008](#); PHE [2011](#)).

The questionnaire was devised by HEE in consultation with national leads from PHE and NHS Improvement and a researcher from Cardiff University. It was then piloted for use in two trusts by antimicrobial pharmacists.

The questionnaire was disseminated by HEE's Director of Education and Quality for the North, Professor Ged Byrne, to chief pharmacists of NHS organisations and CCGs (via the Chief Pharmacist for England), antimicrobial pharmacists (via the UKCPA infection management group), prescribing advisors (via Primary Care Pharmacy Association and Primary and Community Care Pharmacy Network), royal colleges, professional bodies and organisations, academic health science network, HEE local offices and HEE post-graduate deans.

Respondents were asked if they had developed, supported, commissioned, delivered or recommended any educational / training resources for prescribers or trainee prescribers on antimicrobial resistance; and if so the formats these were available in. They were also asked to

state which professional group(s) the learning resources were targeted at. Evidence of the effectiveness of these resources in changing antimicrobial prescribing behaviour and/or practice was explored, with respondents asked to provide details on any evidence of other interventions that have resulted in a change in behaviour such as improvement in audit results, consumption data, resistance rates etc. Respondents were also asked to provide data regarding the number of healthcare professionals that have used each resource in the last 12 months.

Questions were also asked on whether the resources made reference to specific national recommendations and guidance, whether respondents were aware of any gaps in the educational / training material currently available for prescribers on antimicrobial resistance and, if so, how they felt these could be addressed. Finally, there was an opportunity for respondents to provide any other information or resource links that they felt may be useful for prescribers to use.

CCGs and NHS trusts / organisations were asked additional questions that explored the training of staff in including prescribers. We asked if all prescribers within their organisation received induction and training in correct antimicrobial use and if these sessions covered specific national recommendations.

Findings

We received 72 responses from various organisations with more than half confirming they had developed, supported, commissioned, delivered or recommended any educational or training resources for prescribers or trainee prescribers on antimicrobial resistance. The most popular formats of these resources were training workshops. Videos were the least popular method. More than 75% of the resources were targeted towards the training of medical prescribers (of all grades in both primary and secondary care including dentists) whilst more than 50% of the resources targeted the training of non-medical prescribers (in both primary and secondary care and all professional groups). An average of 50% of these resources included information on national recommendations on infection management and antimicrobial prescribing and stewardship for training prescribers. More than half of CCGs and NHS trusts/organisations provided training covering mandatory core requirements for prudent antibiotic use, in addition to introductory sessions on each induction to all prescribers (both medical and non-medical).

Less than half of CCGs and trusts said they provided this to medical prescribers only. Fewer said that they extended this training to cover groups of staff such as pharmacists, all clinical staff, all staff, nurses or all allied health professionals. Less than half of CCGs and NHS trusts/organisations were able to confirm that prescribers within their organisations were familiar with and/or provide training that covers the [PHE/ARHAI antimicrobial resistance and stewardship competencies](#).

Further details on this and the full responses we received on the following can be found below:

A survey of prescriber education and training on antimicrobial resistance

- the training of prescribers within organisations (page 7),
- compliance of these resources with national recommendations (page 9),
- thoughts on perceived gaps in educational / training material (page 10),
- evidence of outcomes from training in addition to examples of good practice in all settings (page 11), and
- examples of available training modules and sessions on antimicrobial prescribing and stewardship (page 17).

Responses on available resources and formats

We received 72 responses from:

- 34 Acute NHS Hospitals,
- 9 Primary Care Service Providers,
- 9 Clinical Commissioning Groups,
- 8 HEE Local Offices,
- 6 Other,
- 2 Professional bodies,
- 1 Mental Health NHS Hospitals,
- 1 National Lead Body,
- 1 Community NHS Hospital,
- and 1 Academic Health Science Network.

47 (65%) organisations confirmed they had developed, supported, commissioned, delivered or recommended educational / training resources for prescribers or trainee prescribers on antimicrobial resistance.

37 (51%) organisations provided information about the format of these resources: (33%) were delivered as training workshops; 36 (32%) were classed as other; 18 (16%) as leaflets; 11 (10%) as distance learning (online); 6 (5%) as e-learning; and 6 (5%) as videos.

Of these resources 91 (80%) were targeted at trainee medical prescribers [MP] (of all grades in both primary and secondary care including dentists) and 77 (68%) at trainee of non-medical prescribers (NMP) covering all professional groups in both primary and secondary care.

Data regarding the number of healthcare professionals that have used each resource in the last 12 months ranged from 10% to 100% of medical prescribers (of all grades in both primary and secondary care and includes dentists) and non-medical prescribers (in both primary and secondary care and all professional groups).

Training of prescribers within organisations

26 organisations (61%) confirmed that all prescribers within their organisation receive induction and training in prudent antimicrobial use, 14 (33%) replied that they did not provide this whilst 3 (7%) responded with “other”.

Some of the reasons provided by respondents are summarised below:

- “antimicrobial usage is directed by the microbiology team within strict guidelines”;
- “I am not sure although I think this may be covered in infection control training during induction”; “not all staff do i.e. FY1 and FY2 do but we do not get access to staff levels above this”;
- “each GP practice has its own induction plan for GPs and advanced nurse practitioners”;
- “probably not specific training given although updates and information issued to prescribers”.

CCGs and NHS trusts/organisations were also asked whether these sessions were repeated every three years and whether they covered those antibiotics that provoke Clostridium Difficile Infection (CDI). 13 organisations (30%) confirmed these sessions were repeated every three years and covered those antibiotics that provoke CDI, 21 organisations (49%) replied they did not provide this whilst 7 organisations (16%) responded with “other”.

Some of the reasons provided by respondents are set out below:

- “e-learning will be mandated 3 yearly but this is not yet rolled out”;
- “they are repeated more frequently than 3 yearly”;
- “not monitored by CCG, it is the responsibility of each practitioner and their practice”;
- “support is given by medicines management”;
- “the e-learning module is mandatory for all doctors on induction & for their annual mandatory update”;
- “not done as formal training sessions, more ad hoc - recognise that it would be best to repeat as above”;
- “no idea”;
- “annually”.

Mandatory core training in prudent antibiotic use for staff within CCGs and NHS trusts/ organisations was explored and responses tabulated below:

Group	Do you provide mandatory core training in prudent antibiotic use for doctors, pharmacists and nurses in addition to an introductory session on each induction?	Is this repeated every three years and specifically covers those antibiotics that provoke CDI?
All staff	6 (14% of CCGs and trusts)	3 (7% of CCGs and trusts)
Clinical staff only	12 (28% of CCGs and trusts)	8 (19% of CCGs and trusts)
All Prescribers (both medical and non-medical)	26 (61% of CCGs and trusts)	8 (19% of CCGs and trusts)
Medical prescribers only	17 (40% of CCGs and trusts)	7 (16% of CCGs and trusts)
Pharmacists	13 (30% of CCGs and trusts)	2 (5% of CCGs and trusts)
Nurses	6 (14% of CCGs and trusts)	2 (5% of CCGs and trusts)
Allied Health Professionals	4 (9% of CCGs and trusts)	3 (7% of CCGs and trusts)

Resources and national recommendations

When probed about the resources that take into account national recommendations, respondents confirmed that 58 (51%) included [NICE guidance on antimicrobial stewardship](#), 57 (50%) included information from [C.Diff how to deal with the problem](#), 55 (48%) included the [PHE/ARHAI antimicrobial prescribing and stewardship competencies](#), 53 (46%) included guidance on '[Start Smart then focus](#)' and 48 (42%) included [PHE guidance on managing common infections: guidance for primary care](#) and/or [TARGET clinical toolkit](#).

CCGs and NHS Trusts/Organisations were asked if the sessions that are provided as part of induction are delivered either as part of antimicrobial prescribing and stewardship training or infection prevention and control training and whether they covered national recommendations.

National Recommendations	Antimicrobial prescribing and stewardship training	Infection prevention and control training
C.Diff how to deal with the problem	26 (61%)	25 (58%)
Start Smart then focus'	24 (56%)	12 (28%)
PHE/ARHAI prescribing competencies	18 (42%)	6 (14%)
NICE guidance on antimicrobial stewardship	24 (56%)	9 (21%)
PHE guidance for primary care and/or TARGET clinical toolkit .	15 (35%)	5 (12%)

CCGs and NHS trusts/organisations were asked if prescribers within their organisations were familiar with and/or provide training that covers the [PHE/ARHAI antimicrobial resistance and stewardship competencies](#). 17 organisations (40%) confirmed prescribers are familiar with and/or given these competencies and 26 organisations (60%) stated they were not.

They were also asked if these competencies are used as a point of reference for portfolio writing and agreeing goals for personal development plans and individual appraisals. 3 organisations (7%) confirmed that these are used as a point of reference whilst 24 organisations (56%) stated they were not.

When further probed on how else they have used the [PHE/ARHAI antimicrobial prescribing and stewardship competencies](#) within their organisations (e.g. when developing training materials, on prescriber induction, as part of 360^o feedback for prescribers etc.), the responses received were as follows:

- “used in e-learning and training materials”;
- “CCG does not employ staff therefore it is advised but we cannot force action”;
- “we haven't used them at all”;
- “developing training materials, for examinations i.e. Objective Structured Clinical Examinations (OSCE)”;
- “I don't know”;
- “only used for own personal reference”;
- “made available on the intranet”;
- “when developing training materials”;
- “conifer it as our guideline to prescribe”;
- “discussed in details in CPD”;
- “prescriber induction, point-prevalence survey audits, developing training”;
- “they are given to non-medical prescribers as part of the reading list for the stewardship teaching”; “not given to medics currently”
- “on training packages”.

Gaps in educational / training material

When asked about gaps in the educational / training material currently available for prescribers on antimicrobial resistance, 38 respondents (53%) were of the opinion that there are gaps and 34 (47%) felt there weren't any.

In terms of gap areas the themes that emerged included (further details can be found in Appendix 2):

- organisational AMR culture and behaviour
- senior clinician AMR leadership and training
- socio-cultural interactions aspects of prescribing
- locally mandated and implemented training for staff on AMR
- AMR included in job descriptions
- AMR training for all clinical staff, specialties and grades
- AMR importance in general practice
- focused AMR training for undergraduates especially for prescribing professions

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- research on AMR prescribing decisions
- role of non-medical prescribers in AMR
- nationally available online resources e.g. e-learning
- locally mandated and implemented AMR training
- standardisation of teaching material
- learning resources need to be useful, relevant and practical
- linking teaching to local resistance patterns
- protected learning time
- postgraduate AMR education gap
- behaviour change techniques to support AMR learning
- targets should focus on learning and behaviour change
- education on AMR risks
- stronger AMR emphasis in undergraduate and post-graduate for all professional curricula
- linking online AMR training to curricula; formal AMR teaching sessions
- linking training and education to outcomes and gaps e.g. audit results, resistance patterns, antimicrobial consumption etc.
- microbiologist input and training
- education on appropriate prescribing and not just AMR
- integrating AMR training within all clinical specialties
- online AMR training for prescribers
- link learning to available drug-bug resistance data
- standardised and commonly agreed AMR competences in curricula
- access for AMR training at staff induction
- NICE AMR guidance awareness
- encouraging uptake of resources
- and short induction resource.

Evidence of outcomes and examples of good practice

16 respondents (22%) confirmed they could provide evidence of the effectiveness of these resources in changing antimicrobial prescribing behaviour and/or practice whilst 32 respondents (44%) stated that they could not (further details can be found in Appendix 3).

Respondents were asked to provide more details on “other” type of resources, who these are targeted towards and details on any evidence of other interventions that have resulted in a change in behaviour for example any improvement in audit results, consumption data, resistance rates etc. and includes (further details can be found in Appendix 4).

The themes that emerged are as follows:

i) General organisational approaches:

- Locally developed e-learning for prescribers, administrators and dispensers of antimicrobials.
- Locally relevant presentations, quizzes and role-play simulation, workshops, leaflets and in-house learning materials, classroom lecture as part of non-medical prescribing (NMP) course, and continual professional development (CPD) session on antimicrobial use e.g. to medical meetings / grand rounds.
- Bulletins, short talks, smartphone and website apps, feedback sessions, guidelines and pharmacy team alerts.
- Mandatory antimicrobial prescribing training.
- Return to prescribing training for those who have been out of prescribing practice for a year or more.
- Teaching underpinned by antibiotic audits and C.Diff data analysis.
- Distance learning through [Future Learn](#) and the e-learning through [TARGET](#) on the RCGP website.
- Training sessions for everyone involved with medications.
- Newsletters, communications and weekly surveillance.
- [SCRIPT](#) variants covering foundation medical and dental, undergraduate, non-medical prescribers, nurses, pharmacists, GPs.
- Training resources created after identifying problems via audits and root cause analysis (RCA). Surveillance involves comparison and benchmarking to previous years' data.
- Lecture/seminar delivered by an external specialist antimicrobial pharmacist and external expert university lecturer.
- Teaching sessions on antimicrobial stewardship are altered depending on the audience.
- One to one teaching in clinical settings with case studies on antibiotic prescribing, delivered as a workshop format with discussions.
- Individual trust-led campaigns.
- Communication and dissemination of information.
- Prescribing app.
- Audit pack with accompanying tools.
- Multi-professional sessions.
- [English surveillance programme for antimicrobial utilisation and resistance \(ESPAUR\)](#) data presentation.

MicroGuide™ Prescribing App¹

[MicroGuide™](#) was developed in conjunction with University Hospital Southampton NHS Foundation Trust to improve and support antimicrobial stewardship. The issue at Southampton, in common within many acute trusts, was that whilst over 30% of patients were being prescribed antibiotics, for existing infectious diseases, or as prophylaxis, the trusts' antimicrobial guidelines were not regularly being accessed via the intranet or in booklets distributed to junior doctors. There was therefore a tendency for them to prescribe broad spectrum antibiotics. This behaviour can lead to increased antimicrobial resistance and increases the chances of the spread of healthcare-associated infections (HAIs).

The MicroGuide™ service enables organisations to publish antimicrobial guidance that is made available via the trust's intranet, but more importantly via clinicians' mobile devices. Any updates made to the guidance are automatically updated on the intranet and the mobile device, therefore ensuring that the latest guidance is always available at the point of care. After implementing the MicroGuide™ Prescribing App, University Hospital Southampton NHS Foundation Trust observed a sustained reduction in prescribing of high-risk broad-spectrum antibiotics from 40% to 28%, and a fall in clostridium difficile infections from 60 a month to less than 10 (UHS, [2015](#)).

The app was formally launched in 2013 and is now being used in half of all acute trusts in the UK, as well as in six overseas hospitals. There are over 100,000 clinicians using the MicroGuide™ mobile app and reports show that it is accessed and used on a daily basis around the world. The app has won several awards, including the Novartis Antimicrobial Award, the infection control prize at the annual NHS Innovation Challenge Awards and the E-Health Insider (EHI) Award for Best Mobile Healthcare Application.

The next phase is to incorporate evidence statements and a decision-support module that will go even further to promote safe and effective prescribing.

ii) Primary care approaches:

- TARGET [workshop](#) is used to promote resources and has reduced prescribing in intervention practices.
- Outcomes like reported pledges to change behaviour i.e. use nitrofurantoin first line, adopt use of patient information leaflets e.g. TARGET treating your infection [patient leaflet](#), request for prescribing data following [BGPert](#) educational event, and reduction in practice prescribing [AMR indicator](#).
- Audit a 10 point [action plan](#) largely based on TARGET toolkit resources and examples of best practice with an antimicrobial resistance update.
- Peer support network for NMPs in GP practices and within this deliver educational content including antimicrobial stewardship, where NMPs had an AMR update and discussed their actual prescribing data.

¹ *More information can be obtained from: Dr Kieran Hand Consultant Pharmacist Anti-Infectives, University Hospital Southampton NHS Foundation Trust.*

- Strategy to share prescribing data with practice that includes guidance on where and how this can be improved.
- Training package for all practices.
- Sharing information on AMR from [PrescQIPP](#).
- '[Top Tips for Antimicrobial Prescribing NHS Calderdale Clinical Commissioning Group](#)'.

Ten top tips on communication with patients about prescribing antibiotics in primary care²

1. Explain the expected duration of illness so that the patient understands how long they can expect it to last.
2. Convey that antibiotic resistant infections are carried silently by healthy people and spread very easily between them.
3. As resistance is increasing always give out safety netting advice – explaining to the patient when they should get help.
4. Increase your use of back-up antibiotic prescriptions in respiratory tract infections with shared decision making about their necessity. These can help reduce antibiotic use by up to 30%.
5. If antibiotics are necessary, advise the patient to take them as prescribed (lower concentrations at the site of infection encourage resistant bacteria).
6. Advise the patient to never share antibiotics, and return any leftovers to their pharmacist (use of leftovers is especially common in younger patients).
7. Advise the patient on strategies for self-care – e.g. have plenty of rest, drink fluids, ask their local pharmacist to recommend medicines to help relieve discomfort or pain, use paracetamol or ibuprofen if uncomfortable as a result of fever.
8. Using a clinical scoring system such as [Feverpain](#) when deciding whether to prescribe antibiotics for acute sore throat can help reduce unnecessary antibiotics.
9. You can use an Electronic Prescription Service (EPS) token for back-up antibiotic prescriptions, so patients can come back and collect their prescription from the receptionists. Alternatively use the EPS to postdate the prescription by at least 24 hours, which will prevent patients going next door to a pharmacy to pick it up immediately.
10. Lastly, use the TARGET '[Treating your infection](#)' leaflet in every consultation. It provides an easy to understand, personalised guide to all of the above points. It is a great way to facilitate the consultation and has been shown to reduce re-attendance.

² More information can be obtained from: Dr Clodna McNulty, Head of Primary Care Unit, Public Health England.

iii) Secondary care approaches:

- Changes in prescribing guidance available via the intranet and app, an antibiotic specific section on the drug chart, audits to measure practice and peer review of prescribing.
- Antimicrobial prescribing teaching sessions as part of mandatory training for Foundation Year (FY1 and FY2) doctors.
- Signposted external e-learning and on line learning via the trust antimicrobial guidelines site (e.g. "[RxGuidelines Portal](#)").
- Promotion of [antibiotic guardian](#) and [European Antibiotic Awareness Day \(EAAD\) resources](#) by way of screen savers and displays.
- Medical and healthcare student teaching - tutorials during hospital based practice placements.
- Training is provided from modules available from the Centre for Pharmacy Postgraduate Education ([CPPE](#)) website.
- Outcomes are monitored via PHE's '[fingertips](#)' data.
- Antimicrobial page on the trust intranet and use of facebook & twitter.
- Trust online induction for new doctors/annual update for infection prevention and control that includes slides on antimicrobial stewardship.
- All FY1s do a four month post in acute medicine with daily microbiology ward rounds Monday to Friday to discuss and review antibiotic use, with much discussion on good antibiotic guardianship. Their acute medicine team teaching includes teaching on antibiotic guardianship, with FY1s encouraged to make a pledge as [antibiotic guardians](#).
- Direct feedback provided to medical microbiology prescribers three times per week as part of AMR stewardship rounds.
- Monthly stewardship audits reported to directorates with actions to improve for poor performers.
- Link audits and ward rounds to teaching.

A targeted campaign to help improve compliance to an antimicrobial stewardship programme³

The antimicrobial management team at South Tees Hospitals NHS Foundation Trust observed poor compliance to elements of '[Start Smart then Focus](#)' toolkit via antibiotic audit data. Therefore, in early 2014, the antimicrobial pharmacy team explored initiatives from other trusts on ideas for what may work. They used these to explore how best to improve prescribers knowledge on points to consider when initiating antibiotics. They were particularly interested in poster campaigns that others had used, and used this to form their own acronym called "[SPARED](#)" which stands for samples, policy, allergies, reason, end/review date and daily

More information can be obtained from Debbie Lockwood, Advanced Clinical Pharmacist – Antimicrobials and Dr Richard Bellamy Infection Disease Physician, South Tees Hospitals NHS Foundation Trust.

review. An acronym was soon developed too for nurses administering antibiotics called “[ERA](#)” which stands for end/review date, reason (indication) and allergy to help them check the information was on prescription charts. This initiative was also reported as part of the patient safety agenda via the chief executive’s report to the trust board ([2014](#)). Both of these campaigns were spearheaded by a slogan “if we improve antibiotic prescribing patients will be SPARED from HCAs and antibiotics will be saved for a new ERA”.

The trust’s graphic designer was engaged to develop eye-catching posters to display in all inpatient wards along with prompt cards attached to medical notes trolleys and medicines trolleys/drug cupboards. As part of the launch, the antimicrobial pharmacy team promoted awareness via stands at doctor education events within the trust. In time, the “SPARED” and “ERA” campaign was added to the trust screensavers and additional promotional materials such as pens, ID badge holders and post-it notes were made and circulated. The campaign is often promoted on the stands the Trust has for its annual [European Antibiotic Awareness Day](#) and World Antibiotic Awareness Week events. It has also been the inside back cover of the trust’s “Antimicrobial Drugs Guide” for several years.

A regular monthly “A RED” antibiotic audit programme checking on the final four aspects of “SPARED” was conducted for just over a year throughout the whole trust, and this now continues on a quarterly basis. The audit reports are RAG-rated (red,amber,green) by ward, centre and consultant speciality and shared widely throughout the organisation. The latest results are often discussed at the monthly Infection Prevention Action Group with senior staff where they are made aware of which of their wards/centres/specialities need to improve. Concerns from these meetings are escalated to the Trust board and include elements of antimicrobial prescribing. Recently in view of the AMR Commissioning for Quality and Innovation (CQUIN) [16-17](#), the “D” in the acronym “SPARED” has been amended from daily review to “reviewed within 72 hours”. They also engaged one of the renal physicians who became the organisations main antibiotic champion and has encouraged other consultants (both medical and surgical) to become involved in antibiotic audits and awareness using “SPARED” and “A RED”.

iv) Development of training guides:

- A guide for prescribers from all professions in how to use the [prescribing competency framework](#) as a learning needs assessment tool which signposts resources that will help to address identified learning needs
- A guide book internal learning resources
- Maintaining competence and confidence in prescribing guide.

v) Outcomes from antimicrobial prescribing training:

- Prescribers who have attended learning sessions are more likely to contact microbiologist or the infection prevention nurses for advice prior to prescribing

- Training has resulted in an improvement in the organisations 'Safe Prescribing' indicators and improved antibiotic audit results
- Training presentation targeted at GPs and non-medical prescribers in GP practices that has resulted in improved audit results and reduced consumption
- Tailoring training sessions to the audience has resulted in improvements in the annual prescribing audit and monthly prescribing audits.

vi) Patient education approaches:

- Leaflet for patients
- Explore patients' expectations and experiences in health professionals' management of infections, examine whether patient expectations for antibiotics affect the likelihood of receiving them, and understand factors influencing patient satisfaction with specific infections
- Peer education resources for medical/healthcare university students to deliver in schools.

Examples of training modules and sessions currently available to the system on antimicrobial prescribing and stewardship

1. e-Learning for Health (eLfH)

e-Learning for Health (eLfH) is a Health Education England programme, run in partnership with the NHS and professional bodies. It provides high quality content free of charge for the training of the NHS workforce across the UK, and all staff with NHSmail email accounts can register including those with an [OpenAthens](#) account.

The online training sessions enhance traditional learning, support existing teaching methods and provide a valuable reference point. They are designed and built to be engaging and interactive, using quality images, video, audio and animation to help trainees learn and retain knowledge. Content is presented using various templates such as 'real-life' scenarios, case studies and 'knowledge bites'.

Examples of sessions that can be used to improve the knowledge of different groups of staff can be found below. Professional leads may wish to explore the role of making these mandatory for different grades of staff as part of their learning around antimicrobial prescribing and stewardship. The antimicrobial management team should include these sessions as part of their resource list for staff and/or as part of their organisation's antimicrobial stewardship education strategy.

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Session	Learning Outcomes
Reducing Antimicrobial Resistance: An Introduction	<ul style="list-style-type: none"> - Discuss why there is such a concern about misuse of antibiotics and antimicrobial resistance - List the key risks for development of antimicrobial resistance - Identify your role in tackling antimicrobial resistance
Principles of Antibiotic Use	<ul style="list-style-type: none"> - Define antibiotics - Describe how antibiotics may be classified according to their chemical group and mechanism of action - Explain how to make a rational choice of antibiotic based on its spectrum of antimicrobial activity - Describe the significance of resistance to antibiotics - Appreciate the problem of nosocomial infection, illustrated by clostridium difficile infection - Describe the importance of seeking expert advice from a microbiologist - Describe non-antibiotic aspects of infection prevention and control
Antimicrobial Agents	<ul style="list-style-type: none"> - Define the classification of bacteria - Describe the mechanism of action of antibacterials - Be familiar with the major groups of antibacterials and the differences between them - Describe which antibacterial would be chosen to treat typical infections.
Antimicrobial agents MCQs	<ul style="list-style-type: none"> - This session will present you with a series of 10 MCQ questions
Antibiotic Policies	<ul style="list-style-type: none"> - Describe the incidence and importance of antimicrobial resistance in hospital practice and the factors contributing to it - Discuss the aetiology, diagnosis and therapy of clostridium difficile associated diarrhoea - Classify the use of antimicrobial agents based on the therapeutic aims - Classify surgical procedures according to their risk of microbial contamination - Discuss the appropriate use of perioperative (surgical) antibiotic prophylaxis - Define the role of antibiotic policies in optimizing antibiotic therapy episodes and describe an appropriate empirical antibiotic approach to common infections
Prudent Use of Antibiotics (Part 1)	<ul style="list-style-type: none"> - List the principles of rational, safe and effective use of anti-infective drugs - Select the most appropriate route of administration of antibiotics. - Apply basic pharmacokinetic principles to monitoring of gentamicin and vancomycin serum drug levels.
Prudent Use of Antibiotics (Part 2)	<ul style="list-style-type: none"> - Recognise which antibiotics are contraindicated in patients known to be allergic to penicillin - Take an accurate allergy history from a patient

	- Identify antibiotics contraindicated in patients with penicillin allergy.
Prudent Use of Antibiotics (Part 3)	- Identify how to diagnose, treat and control Clostridium difficile infection
Antimicrobial Prophylaxis	- Describe the aim of surgical antibiotic prophylaxis - Recognise the benefits and risks for surgical antibiotic prophylaxis - Identify when and how to administer surgical antibiotic prophylaxis - Explain which factors influence the choice of surgical antibiotic prophylaxis
Post-operative Antibiotic Prescribing	- Describe the sequelae of surgical site infections - Explain principles of empirical regimens based upon likely pathogen in antimicrobial therapy - Identify principles for use of alternative antibiotics for antimicrobial therapy in case of penicillin allergy - Identify principles of targeted antimicrobial therapy according to culture results - Describe principles of duration and route of administration of antimicrobial therapy
Routes of Transmission of Infectious Disease	- Define the different routes of transmission for infectious disease - Describe examples of disease transmission by each route

2. Standardised Computerised Revalidation Instrument for Prescribing and Therapeutics ([SCRIPT](#))

The Standardised Computerised Revalidation Instrument for Prescribing and Therapeutics ([SCRIPT](#)) includes 47 individual e-learning modules comprising the core SCRIPT catalogue referred to as 'SCRIPT Foundation'. This is designed for medical students, foundation doctors, doctors and non-medical prescribers and includes sessions on prescribing in infection, infection in secondary care, drug allergy and anaphylaxis, and sepsis. There are further SCRIPT variants i.e. dental (7 modules), paediatrics (25 modules), nursing (17 modules) and general practice (12 modules for delivery April 2017) and the latter will include 'infection in primary care'.

As of April 2017 SCRIPT foundation will be available to all foundation doctors through their local foundation schools. 10 medical schools currently use SCRIPT Foundation and this will be actively promoted to the remaining medical schools this coming year; SCRIPT dental is currently provided to all Foundation Dentists; SCRIPT nursing is targeted towards NHS trusts as well as the care home sector; and SCRIPT general practice – in development, but CCGs will be the primary target. There are plans to modify the SCRIPT catalogue to assign it across medical student years 3,4,5 and FY1/FY2 so that there is a clear learning pathway across the years.

The [SCRIPT sessions and the learning outcomes](#) are as follows:

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Session	Learning Outcomes
Principles of Prescribing in Infection	<ul style="list-style-type: none"> - Describe the different classes of antibacterials available and their site of action on a microorganism - Describe how bacteria can be resistant to antibacterials - Explain why certain antimicrobials might be restricted in a trust, and how access to them could be obtained - Know where to look for guidelines on treating infections and why adherence is important.
Infection in Secondary Care	<ul style="list-style-type: none"> - Select the most appropriate drug, dose, route and duration of treatment for commonly encountered infections in secondary care - Describe which antibacterials are contraindicated in patients who are pregnant or breastfeeding, or who have hepatic or renal dysfunction - Recall the common drug-drug interactions encountered when prescribing in infection - Explain when to consult senior clinical advice - Explain how and why to monitor and review treatment - Describe where to look for information regarding the safe and effective management of infection, both locally and nationally.
Sepsis	<ul style="list-style-type: none"> - Discuss the spectrum of infection and continuum of sepsis - Use evidence-based reputable action tools to help you screen patients for their risk of sepsis - Recognise the signs of sepsis and identify whether the patient is at high or moderate risk of sepsis - List situations where patients may not manifest the traditional signs and symptoms of sepsis - Discuss the factors to consider when prescribing for the patient with sepsis - List the six elements of the Sepsis Six[®] Care bundle and the timeframe in which these should be administered - Discuss good antimicrobial stewardship relating to the management of sepsis - Discuss the ongoing management of the patient with sepsis, including the importance of source control
Drug Allergy and Anaphylaxis	<ul style="list-style-type: none"> - Take an accurate history of any previous reactions to drugs, medicinal and related products and non-drug allergies - Examine a drug chart, and decide which drugs might pose a risk to the patient in light of known allergies - Recognise the signs and symptoms of allergic reactions to drugs - Distinguish allergic reactions from other adverse drug reactions - Manage acute allergic reactions to drugs - Arrange appropriate follow up in cases of suspected drug reactions
Infection in	<ul style="list-style-type: none"> - Prescribe appropriate immunisation and prophylaxis to prevent disease

Primary Care	<ul style="list-style-type: none">- List the notifiable diseases and how to inform Public Health England- Describe how bacteria can develop resistance to antimicrobials, the factors that contribute to resistance, and how you can help prevent it- Explain antimicrobial stewardship and how this should be reflected in your prescribing- Discuss the common consultations where a prescription for an antimicrobial may not be an appropriate treatment option, and how to counsel patients regarding this- Consult reputable sources of information to guide the appropriate selection of an antimicrobial treatment regimen for a patient and indication- Discuss the importance of monitoring and timely review of treatment.
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3. The Prescribing Safety Assessment (PSA)

The [Prescribing Safety Assessment \(PSA\)](#) is required for all foundation entrants whether from UK medical schools or overseas. This has stimulated better recognition on the importance of prescribing education throughout UK undergraduate medical education. At the moment, overseas entrants take the PSA just before they begin work in August although in future there will be the opportunity to deliver earlier given that this is an online assessment. Anyone who fails is given support and access to additional learning resources provided by the foundation school. They are then required to retake the assessment. Entrants to training in all the home nations are covered. Over 40,000 students and doctors have now benefited from taking part in both the assessment and associated training materials.

At the moment, 400 question items out of a total of around 3,000 (13%) cover antimicrobial drugs and their usage. This number and proportion is set to grow in the next year as more questions have been commissioned in this area, given the importance of rational antimicrobial prescribing within the NHS.

4. Treat Antibiotics Responsibly, Guidance, Education, Tools (TARGET)

Treat Antibiotics Responsibly, Guidance, Education, Tools (TARGET) has been developed by the Public Health England (PHE) Primary Care Unit, the Royal College of General Practitioners (RCGP) and the Antimicrobial Stewardship in primary care group and consists of various resources such as a [toolkit](#) and [training](#) resources. TARGET is the central resource to help prescribers and commissioning organisations improve antibiotic prescribing in primary care. As such, it facilitates progress towards delivering quality improvement programmes to increase responsible antibiotic prescribing. Using the TARGET resources primary care organisations will be able demonstrate compliance with the Health and Social Care Act 2008: Code of Practice on the prevention and control of infections and related guidance. The TARGET resources can be used to support prescribers' and patients' responsible antibiotic use, helping to fulfil CPD and revalidation requirements. The resources are free to all primary healthcare professionals in the

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UK including medical students, physician assistants, practice nurses and non-medical prescribers.

Examples of learning sessions include:

Session	Objectives
TARGET Antibiotic Resistance in Primary Care online course	<ul style="list-style-type: none"> - This course will assist you in identifying the need for optimised antibiotic prescribing, as well as equipping you with tools for improving your antibiotic prescribing - Evidence showing the link between prescribing and resistance rates in GP patients is explored and useful resources to use in your surgery are included
TARGET Group Presentation: <ul style="list-style-type: none"> - Introduction - Presentation template - Workshop self-assessment and evaluation form 	<ul style="list-style-type: none"> - This presentation through clinical cases aims to provide up to date evidence to primary care clinicians about why optimising antibiotic prescribing is important and how this can be achieved - The presentation lasts 60 minutes and includes slide notes and references. It can also be modified. It may be given by GPs, microbiologists or medicine managers with an interest in antibiotic use; It can be used by less experienced presenters or within a GP practice
TARGET Antibiotic Training webinar series	<ul style="list-style-type: none"> - Seven free TARGET learning resources highlighting key easy actions individuals can take to help improve antibiotic prescribing, the patient journey and self-care and reducing future consultations - These are available as un-facilitated learning courses, each containing PowerPoint presentations, recorded panel discussions and a host of referenced material and learning resources - The webinars are accredited for CPD by the Royal College of General Practitioners - The individual session webpages mention the learning outcomes and are as follows: introductory case studies webinar; assessing the need for antibiotics webinar; managing patient expectations webinar; back-up prescriptions webinar; prescribing in UTI webinar; antibiotics for children webinar; and common practice approach webinar.

5. Stemming the tide of antibiotic resistance (STAR):

[STAR](#) is a blended learning programme addressing appropriate antibiotic prescribing in general practice. It has been developed by Cardiff University as a training intervention that focuses on two related topics: antibiotic resistance (and its link with practice prescribing) and practical techniques for improving consultations for common infections.

The purpose of this programme is to engage medical practitioners in the concept of antibiotic resistance by:

- reinforcing the importance of resistance as a public health issue,
- presenting evidence of the link between prescribing and resistance,
- considering their current practice,
- improving communication with patients about antibiotics, in order to reduce unnecessary prescribing of antibiotics and instigate behaviour change,
- encouraging reflection about the potential of communication styles to enhance confidence to succeed.

This learning session is freely available on '[Healthcare CPD](#)' although learners have to purchase a subscription to obtain a verifiable CPD certificate.

6. Health and Education Co-operative

Developed by higher education institutions in the North West the aim of the co-operative is to provide [online e-learning courses](#) to non-medical prescribers on a range of topics. The modules are currently used as part of a blended learning process by non-medical prescribing students and can only be accessed for free via higher education institutions in the North West. A section on antibiotics can be found under Public Health > Specific Prescribing Issues.

7. Learning Industries e-learning module on antibiotic use

[Learning Industries](#) is a private company that has developed an e-learning module to help improve understanding of antibiotics entitled "Understanding Antibiotics" with a group of antimicrobial pharmacists based in the South of England. The development was a collaboration between hospital trusts in Southampton, Portsmouth, Winchester/Basingstoke and Chichester. The module highlights the importance of the link between pathogens and correct antibiotic treatment. The increasing problem of antibiotic resistance, the important role of normal flora and the need for prudent prescribing has also been covered. This module has been installed at Southampton University Hospital's Virtual Learning Environment (VLE) and it has been designed to be integrated to standard VLE platforms in NHS hospitals.

The e-learning aims to ensure that prescribers are better equipped to: identify and treat severe illness such as sepsis; confidently choose narrow spectrum antibiotics to treat symptoms; monitor and adjust antibiotic treatment according to emerging test results; and withhold antibiotic treatment when appropriate. This module is not publically available to all learners (locally available to selected hospitals in the South) and can be [accessed or installed via individual organisations for a fee](#).

8. NHS Education for Scotland

A range of educational resources to support antimicrobial prescribing and resistance have been produced in Scotland that educators and clinical trainers may wish to access and adapt to their own settings in England. The sessions below are open access and freely available to download:

Session	Objectives
Antimicrobials in Clinical Practice	<ul style="list-style-type: none"> - This resource is designed for local trainers to support practitioners who are involved in the prescribing, monitoring and administration of antibiotics in their early stages of clinical practice. The training pack can be used by trainers for two purposes; early induction training of Foundation Year doctors to provide essential information required before starting to prescribe antibiotics in the ward setting, or for more detailed training on all aspects of antimicrobial use for those involved in administration, monitoring or prescribing roles. The course has been split into short sections suitable for one-to-one teaching or small group sessions: <ul style="list-style-type: none"> - Policy context: national and local strategic approaches - Diagnosis of infection and clinical decision making - Prudent antimicrobial prescribing - Antimicrobial use in hospital - Antimicrobial use in primary care - Nurses' role in antimicrobial management - Each section can be delivered individually or can be combined into a longer teaching session. Each slide is accompanied by trainers' notes to facilitate delivery of the material and suggest points for discussion.
Scottish Reduction in Antimicrobial Prescribing (ScRAP) Programme	<p>The ScRAP Programme is an educational toolkit to help prescribers to reduce unnecessary prescribing of antibiotics. It consists of:</p> <ul style="list-style-type: none"> - A pre-recorded presentation that can be streamed online - Icebreaker video - Patient Consultation video
Antimicrobial Stewardship Workbook	<p>This workbook is suitable for all registered nurses and midwives to learn about the nursing/midwifery role in Antimicrobial Stewardship. The resource will be beneficial to nurses and midwives who have a role in the administration, prescribing or education of antimicrobial therapy.</p>

9. Other primary care targeted learning sessions.

Antibiotics [e-learning](#) to help primary care prescribers has been developed by the North of England Commissioning Support (NECS) Medicines Optimisation Team, using best practice guidance and evidence based reviews across 11 CCGs in the North East and Cumbria. The programme is designed to help primary care prescribers consider the strategies to help optimise

the appropriate prescribing of antibiotics, and why antimicrobial stewardship is important at a personal, local and global level.

The session aims to improve the quality of antibiotic prescribing and awareness of antimicrobial stewardship amongst clinicians. Its objectives are:

- For clinicians to develop a strategy to reduce inappropriate prescribing of antibiotics, including a delayed/ back-up prescription, or no prescribing strategy.
- To demonstrate local implementation of NICE guidance.
- To improve accessibility to educational resources for antibiotic prescribing.
- To raise awareness of the wider national and international issues surrounding the misuse of antibiotics.

The session can be accessed for free by registering on the NECS learning [webpage](#).

10. Other antimicrobial stewardship learning sessions.

Free online [MOOC](#) (massive open online course) on “Antimicrobial Stewardship: Managing Antibiotic Resistance” developed by the University of Dundee and British Society for Antimicrobial Chemotherapy (BSAC). It aims to help learners understand antibiotic resistance, and how antimicrobial stewardship can slow down or reduce it, enabling healthcare professionals to understand what stewardship is and how it can be applied in practice. Participants will develop skills to support responsible prescribing, improve infection control practices and improve patient outcomes within their own specific health care locality.

NICE has developed a free [e-learning](#) session on antimicrobial stewardship targeted at commissioning and provider organisations, service managers and local decision-making groups, to ensure that effective antimicrobial stewardship programmes are in place, and that prescribers are supported to make changes to their use of antimicrobials where necessary.

The North West Antibiotics Pharmacists Group has developed a free antimicrobial stewardship interactive [e-learning](#) package targeted at doctors and non-medical prescribers practising in the hospital setting.

AMSportal is a free [online](#) forum collaboratively developed by The Royal Pharmaceutical Society and the University College London and funded by Health Education England North Central and East London, that signposts viewer’s to resources and information to promote learning about microbiology and antimicrobial stewardship.

11. Resources for prescribers that could be linked from antibiotic policies and shared as part of prescriber teaching:

- [RCP effective antibiotic prescribing – Top Ten Tips](#)

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- [PHE antibiotics: secondary care prescriber's checklist](#)
- HEE guide on educational resources available on infection management, antimicrobial resistance and stewardship and infection prevention and control [*To be developed*]
- [NICE antimicrobial stewardship: prescribing antibiotics webpage](#)
- [NICE bites on antimicrobial stewardship](#)
- [PHE antimicrobial prescribing: resources for professional development and practice](#)
- [PHE AMR local indicators](#)
- [PHE AMR resources handbook](#)
- A [guide for GPs](#) and a short informative [animation](#) aimed at the public.

Discussion

From the information we collected we can deduce that:

- There are a number of educational / training resources for prescribers currently available in the system
- Compliance of providers to the [code of practice](#) requirements to ensure that all prescribers receive induction and training in prudent antimicrobial use in addition to update sessions (at least every three years) needs to improve
- Providers need to do more to ensure that all prescribers are familiar with the [PHE/ARHAI antimicrobial resistance and stewardship competencies](#)
- The role of education around AMR needs to be explored alongside other targeted interventions such as behaviour change approaches
- Clearer internal strategies and reporting structures within provider organisations on education delivery to prescribers on AMR may be needed
- The role of local peer support networks for prescribers in improving AMR prescribing data, audit outcomes and resistance data should be considered
- AMR training across all professional groups needs to improve too and the role of senior clinicians in this should not be overlooked
- Other methods for providing inter-professional education such as targeted blended teaching that includes e-learning should be explored. Technology innovations to support education on AMR should be explored further and embedded in the system.

These deductions and potential solutions have been discussed in-depth below.

Gaps in the training of prescribers on antimicrobial resistance

The data shows that a number of organisations (65%) have developed, supported, commissioned, delivered or recommended educational / training resources for prescribers or trainee prescribers on antimicrobial resistance targeted at both medical and non-medical prescribers. However despite the [Health and Social Care Act 2008 code of practice](#) expecting providers to ensure that all prescribers receive induction and training in prudent antimicrobial

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use, 33% replied that they did not do so. In addition 49% of organisations did not repeat sessions every three years as per national guidance (PHE & DH [2008](#); PHE [2011](#)). Considering that training is a [mandatory requirement](#), more needs to be done to explore why there are gaps in training delivery, although we acknowledge that the responses we received may not reflect practice throughout the system.

The [code](#) also expects that providers should ensure that prescribers are familiar with the antimicrobial resistance and stewardship competencies, however 60% of organisations stated that prescribers within their organisations were not familiar with and/or they do not provide training that covers the [PHE/ARHAI antimicrobial resistance and stewardship competencies](#). Equipping prescribers with skills for rational prescribing is essential (Kamarudin et al. [2013](#)), and the antimicrobial prescribing and stewardship (AMPS) competencies (DH & PHE [2013](#)) aim to help all independent prescribers improve the quality of prescribing practice. Reference to the antimicrobial resistance and stewardship competencies has been made in the competency framework for all prescribers (RPS, [2016](#)).

The responses on the training of staff especially the provision of mandatory core training in prudent antibiotic use for doctors, pharmacists and nurses in addition to an introductory session on each induction (PHE & DH [2008](#); PHE [2011](#)) shows much improvement is needed, particularly around update sessions. Organisations also need to ensure that educational resources take into account national recommendations i.e. [NICE guidance on antimicrobial stewardship](#); [C.Diff how to deal with the problem](#); [PHE/ARHAI antimicrobial prescribing and stewardship competencies](#); 'Start Smart then focus'; [PHE managing common infections: guidance for primary care](#) and/or [TARGET clinical toolkit](#).

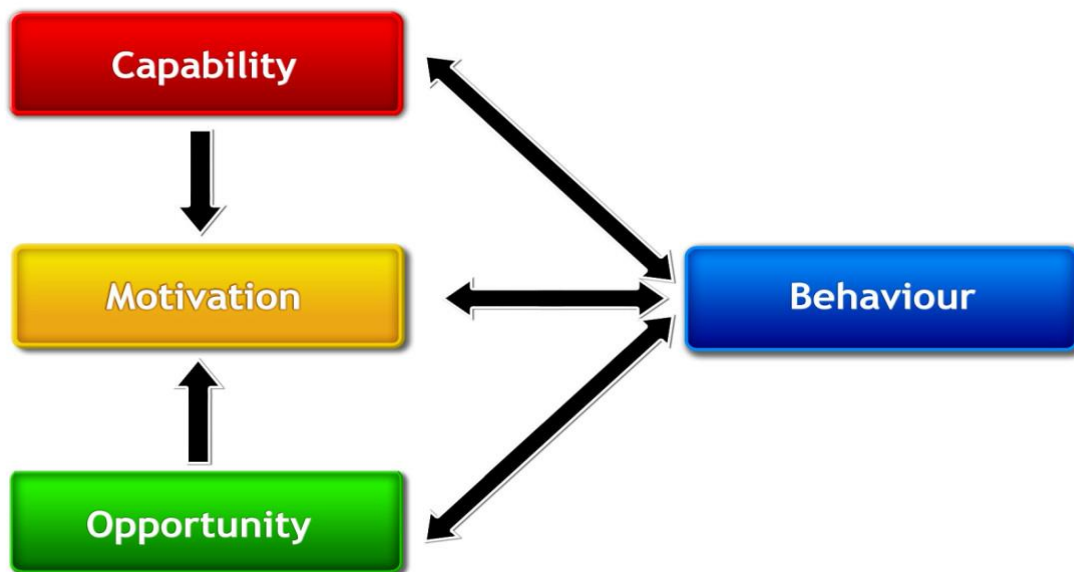
The importance of training prescribers on antimicrobial resistance

The education of health professionals to improve their knowledge and skills is vital for optimal patient care and health outcomes. Interventions to reduce excessive antibiotic prescribing to hospital inpatients can reduce antimicrobial resistance or hospital-acquired infections and that interventions to increase effective prescribing, including educational interventions, can improve clinical outcomes (Davey et al. [2013](#)). The role of education has to be explored alongside other targeted interventions, and cannot be viewed in isolation, as reflected in the comments received as part of this survey. The impact of education on behaviour change is complex, and various barriers can exist in terms of motivation and individual, team or organisational behaviour that can influence the adoption of evidence based practices.

The three key themes that underpin antimicrobial prescribing are decision-making autonomy, limitations of evidence-based policies and hierarchy (PHE [2015](#)). Overall, targeted multifaceted interventions can result in successful outcomes (NICE [2006](#), NICE [2015](#) & GP online [2015](#)), for example through the development of expert-led guidelines, pathways, educational sessions and reference materials (for both physicians and patients), that showed a 6% improvement of

guideline compliance in patients with pneumonia. Pharmacists challenging inappropriate prescribing of a particular antibiotic had the effect of reducing inappropriate prescribing and improving compliance by almost 10% (PHE [2015](#)).

Antimicrobial stewardship programmes could also benefit from the use of frameworks that characterise interventions and policies and show how these link together to enable or support behaviour change, for example using the COM-B behaviour change wheel (Michie et al. [2011](#)). Factors that promote or reduce AMR in different healthcare settings, through educational interventions in the working environment, should be explored further via practice educators.



The COM-B system - a framework for understanding behaviour (Michie et al. [2011](#))

The role of providers and networks in training prescribers on antimicrobial resistance

The [NHS Standard Contract 2017/18 and 2018/19 Service Conditions](#) expects that providers must comply with the [Code of Practice on the Prevention and Control of Infections](#). Providers have an important role in ensuring the healthcare workforce, including prescribers, are appropriately educated and trained on the risks posed by antimicrobial resistance and how they could help mitigate this risk. Organisations should consider the role of an antimicrobial resistance education strategy that sets out the training requirements for staff based on national recommendations, and also includes monitoring and reporting arrangements. Data on the number of staff trained on antimicrobial resistance and prescribing should be reported to the infection prevention and control committee and/or medicines management committee, and should be included in the organisation's annual statement on compliance with practice on infection prevention and cleanliness. The inclusion of antimicrobial resistance awareness as part of mandatory infection prevention and control training targeted for all staff on induction and at every update should also be considered. National bodies could consider collecting data on

the number of staff trained on AMR as part of [local AMR indicators](#) to allow national benchmarking on how organisations are performing. The existence of an antimicrobial prescribing and stewardship educational strategy could also be encouraged, by inclusion as part of CQUIN/quality premium (QP) monitoring by NHS Improvement, and assessment via a clear regulatory framework / checklist e.g. via CQC inspections if possible.

Organisations that show poor audit compliance to the local antibiotic policy and national recommendations, in addition to increasing resistance patterns and antimicrobial consumption should consider locally mandated and implemented training for staff on AMR. The appropriate use of antimicrobials should be included to job descriptions of all clinical staff in addition to compliance with practice on infection prevention and cleanliness. Protected learning time for educators and learners should also be considered locally. The role of senior clinicians and clinical directors on AMR leadership and training cannot be overlooked, and targeted awareness training sessions should also be focused on management and executive teams within healthcare providers. The role of peer support networks should be considered locally for prescribers that cover individual antimicrobial prescribing habits based on prescribing [data](#), audit outcomes and resistance data, and how they could help improve these.

More structural leadership may help too e.g. at local level via local community education provider networks (CEPNs) or sustainability and transformation plan ([STP](#)) footprints to coordinate, monitor and support local action around antimicrobial prescribing and stewardship educational interventions should be explored. Successful interventions between care settings, for example a new website to help GPs prescribe antibiotics more effectively in North West London (Imperial [2016](#)), should be supported and encouraged. Forums such as regional microbiology and antimicrobial pharmacist networks should be used to share examples of good practice on educational interventions that have resulted in successful outcomes. Staff should be encouraged to partake in national initiatives such as the [antibiotic guardian campaign](#) to raise awareness of the threats posed by antimicrobial resistance.

Suggestions for improving prescribing outcomes on antimicrobial resistance

The [Quality Premium \(QP\) for 2017-2019](#) that is intended to reward CCGs aims to reduce gram negative blood stream infections across the whole health economy; reduce inappropriate antibiotic prescribing for urinary tract infections in primary care; and show a sustained reduction of inappropriate prescribing in primary care. HEE may have a role in working with the [PHE Primary Care Unit](#) to explore the development of an e-learning package around prescribing for UTIs for primary care clinicians, to complement resources from [TARGET](#) that could be made available on [eLfH](#). The [Commissioning for Quality and Innovation \(CQUIN\) framework 2017-19](#) that supports improvements in the quality of services and the creation of new, improved patterns of care in secondary care aims to ensure the assessment of clinical antibiotic review between 24-72 hours of patients with sepsis who are still inpatients at 72 hours; and a reduction

in antibiotic consumption per 1,000 admissions (total antibiotic usage, total carbapenem usage and total piperacillin-tazobactam usage or both in-patients and out-patients per 1,000 admissions). To support these ambitions educational resources will need to be aligned with national guidance and staff updated accordingly.

Educational efforts should be targeted at specific groups within the hospital, rather than focussing just on hospital doctors overall (PHE [2015](#)). Non-prescribing professionals such as pharmacists and nurses are important members of the multidisciplinary team and are vital to antimicrobial stewardship activities. They therefore need to be equipped with the right knowledge and skills to help support this agenda and CCGs and NHS trusts/organisations need to do more to ensure training covers these professional groups. Clinical pharmacists have an important role at ward level in reviewing prescribing decisions, whilst nurses are central to almost all drug administration in managed care settings and could contribute more to antimicrobial stewardship (PHE [2015](#)).

Studies have shown that it is the senior clinicians who have a dominant influence over developing 'prescribing etiquette', showing the influence of culture on the formation of prescribing habits (PHE [2015](#)). Antimicrobial stewardship committees / antimicrobial management teams need to explore the role of inter-professional and interdisciplinary teaching as part of antimicrobial stewardship programmes. Learners respond well to interdisciplinary education as attitudes and perceptions of one another improve, and increases in collaborative knowledge and skills have been reported (WHO [2010](#), WHO [2013](#), RCN [2007](#), Reeves et al. [2016](#)). Senior clinicians, education and training pharmacists, clinical nurse educators, medical education leads, practice educators etc. could all be engaged by the antimicrobial stewardship committee and antimicrobial management team, to help support targeted education and training to specialties and directorates, especially where resource limitations exist. Training should be underpinned by information from local audits as per national recommendations (DH [2008](#)), and the antimicrobial management team (AMT) have an important role to play in ensuring this information is shared with staff. Information from the '[Start Smart then Focus](#)' toolkit and data from antibiotic audits and the '[fingertips](#)' portal should be shared with staff for their awareness.

The importance of dentists in antimicrobial stewardship has been highlighted too (Johnson & Hawkes [2014](#)) with [guidance](#) and [toolkits](#) available to support dentists on prescribing antimicrobials. Practice initiatives include audits on dental prescribing; learning via dental SCRIPT [\[Link\]](#); and use of national guidance e.g. those available from the Scottish Dental Clinical Effectiveness Programme ([2016](#)). PHE have also developed a dental antimicrobial stewardship toolkit ([2016](#)) in collaboration between the Dental Subgroup of Public Health England's English surveillance programme for antimicrobial utilisation and resistance (ESPAUR), Faculty of General Dental Practice (FGDP) and British Dental Association (BDA). It has been suggested that guidelines and education regarding prescribing for dental infections should be targeted to medical practitioners as well as dentists (Sweeney et al. [2007](#)). Dental professionals have a role too in working with medical and pharmacist colleagues on training for

non-dental health professionals in handling dental emergencies (BDA [2014](#)) and such initiatives should be supported and encouraged locally. Learning sessions around the management of oral infections are also available on the [eLfh](#) platform that all health professionals could utilise as part of their learning.

The role of leadership in improving prescribing outcomes on antimicrobial resistance

Trust boards have an important role in shaping the strategy, vision and purpose of an organisation and their role in shaping organisational culture is crucial in addition to prioritising quality and patient safety and open approaches to learning amongst others (NHS Leadership Academy [2013](#)). It is generally felt that encouraging trust board members to learn and take on the role of antimicrobial prescribing and stewardship could support awareness on the risks posed to the health of the nation by antimicrobial resistance. Such learning could be encouraged via induction frameworks for trust board members (NHSI [2016](#) and NHS Scotland [2015](#)), supplemented by an education package that focuses specifically on the roles and responsibilities associated with antimicrobial prescribing and stewardship and infection prevention and control. As part of HEE's work on sepsis education and training for healthcare staff across England ([2016](#)), a recommendation was made to draw on existing HEE educational and training resources to produce a sepsis educational package targeted at management and executive teams. As sepsis is a clinical syndrome caused by the body's immune and coagulation systems being switched on by an infection (NICE [2016](#)), it will be prudent to include elements on antimicrobial resistance and stewardship and infection prevention and control within this educational package. CCGs and NHS trusts or organisations could also choose to make learning mandatory using the '[Reducing Antimicrobial Resistance: An Introduction](#)' session that is freely available to all health and social care workers on the e-Learning for Health platform. Approaches to improving outcomes on antimicrobial stewardship and prescribing should be aligned with the Medical Leadership Competency Framework (Academy of Medical Royal Colleges and the NHS Institute for Innovation and Improvement [2010](#)) as part of the organisations engagement process.

Methods for training prescribers on antimicrobial resistance

Methods for providing education as per the responses received showed that majority of learning sessions were delivered as training workshop (37 resources - 33%). Other respondents chose 'other' and provided comments that showed targeted blended teaching methods that included a mix of training workshops / lectures with e-learning sessions. Respondents also used leaflets (18 resources - 16%); distance online learning (11 resources - 10%); e-learning (6 resources - 5%); and videos (6 resources - 5%). Blended teaching sessions could be considered by asking learners to complete quizzes and crosswords (PHE [2016](#)), providing interactive case discussions, and inclusion of films as part of the presentation e.g. a guide for GPs on

antimicrobial resistance (PHE & HEE [2015](#)) and / or a simple animation (PHE & HEE [2015a](#)) about the risks of antibiotic resistance and misuse.

E-learning may have a place in cases where resource limitations curtail the amount of time available to deliver education and training. However this form of learning may not help address local issues around antimicrobial prescribing, as results from audits and outcome data will still need to be shared. It has however been recognised that e-learning has become part of the mainstream in medical education (Ellaway & Masters, [2008](#)) and it has been suggested that technological intervention such as e-learning has good potential to fight antimicrobial resistance (Reyna et al. [2013](#)). An advantage of this training medium to learners is that it is easy to access and flexible as users can utilise this at a time and place of their own choosing (WHO [2015](#)). It also serves as a tool for inter-professional education, and studies have demonstrated an overall positive effect of e-learning or blended learning courses compared to the more traditional didactic teaching, in the acquisition and retention of knowledge (WHO [2013](#)). There may be limitations to this sort of learning (Cook [2007](#)), however supplementation with face to face teaching on ward rounds, targeted educational campaigns and interventions in clinical settings at organisational and directorate level and provision of guidance on prescribing will help overcome any barriers. A wide variety of e-learning sessions are freely available to all healthcare workers on the e-Learning for Health platform around antimicrobial resistance and stewardship, and the management of specific infections. A guide that signposts prescribers to learning materials on antimicrobial resistance and infection may help support their learning in different areas. Organisations could then include links to these learning sessions under the relevant sections within their antibiotic policies, to encourage learning around the management of specific infections that could enable improvement in outcomes. Learning sessions for secondary care prescribers should be updated to comply with NICE guidance on managing common infections ([2017](#)) once available.

A multifaceted educational programme is important to improve practices in antimicrobial prescribing (Butler et al. [2012](#) & Magin et al. [2015](#)). It is also recognised that internet resources have become important tools for getting information and advice on improving antimicrobial programs in everyday practice (Pagani et al. [2009](#)). Online interventions to support evidence-based use of antibiotics have also been found approval in primary care settings (Anthierens et al. [2012](#)), that could be replicated in variety of clinical settings supplemented by e-learning around specific areas and subjects. Apps are becoming popular too in supporting education around antimicrobial prescribing e.g. the MicroGuide app (Patel [2011](#)) and Antimicrobial Companion app (Walker [2016](#)). Readily available online training material should be signposted from these apps so that users can have quick access to resources when they need them. Another area is online formative assessments that provide a useful medium as a learning resource, capable of providing timely formative feedback and stimulating student-centered learning (Palmer & Devitt [2014](#)). Its role in supporting prescriber learning on antimicrobial resistance and stewardship should be explored further.

Conclusion

The provision of education on prudent antibiotic use for prescribers and other staff needs to improve for CCGs and NHS trusts or organisations. Healthcare providers have an important role in ensuring that staff have the right knowledge and skills in ensuring the appropriate use of antimicrobials in everyday practice, and any training needs are appropriately addressed. A wide variety of learning sessions are already available in the system for staff training that could be used to address any learning gaps. More can be done to promote these in the system and the role of a national guide to support this should be considered. Solutions to help enhance the education of prescribers on antimicrobial resistance should be further explored by HEE.

It is recognised that multifaceted interventions need to be used to support the education and training for staff on antimicrobial prescribing and stewardship. Efforts should not just be focused on particular settings and should be extended across the whole local health economy. National bodies, professional organisations and academic organisations should identify approaches to enhance interdisciplinary learning (WHO [2010](#)) around antimicrobial prescribing and stewardship. Inclusion of education monitoring on prudent antibiotic use as part of CQUIN/QP monitoring could be considered to enhance training delivery within CCGs and NHS trusts or organisations. National bodies may have a role in supporting improvement at local level by highlighting educational resources available to commissioners and providers.

To help achieve the aims above, we have set out a number of recommended actions targeted at ourselves, healthcare providers and other stakeholders.

Recommendations

Health Education England

1. HEE will create a sepsis educational package targeted at management and executive teams in 2107/18 (HEE [2016](#)). HEE should ensure that the relevant elements of infection prevention and control, antimicrobial resistance and antimicrobial stewardship will be included within this educational package.
2. Explore developing a guide to learning materials for antimicrobial resistance and infection, that signposts prescribers and other staff to available educational sessions that will help support learning in the system.
3. Explore the factors that promote or reduce antimicrobial in different healthcare environments, through educational interventions in the working environment, via a series of focus groups involving practice educators.
4. Investigate options for developing an individualised online formative assessment tool for health students and professionals on infection prevention and control and antimicrobial resistance and stewardship. This will support targeted individualised learning and education for all levels of practice (also mentioned in a previous report HEE [2016a](#)).
5. Improve information sharing around antimicrobial resistance training focussing on the educational resources that can be made available to support the target to reduce Gram-negative health care acquired infections and inappropriate antimicrobial prescribing (DH [2016a](#)).
6. Ensure that educational resources on the [e-learning for health](#) platform take into account national recommendations i.e. [NICE guidance on antimicrobial stewardship](#); [C.Diff how to deal with the problem](#); [PHE/ARHAI antimicrobial prescribing and stewardship competencies](#); 'Start Smart then focus'; [PHE managing common infections: guidance for primary care](#) and/or [TARGET clinical toolkit](#).
7. Ensure learning sessions for secondary care prescribers are updated to comply with NICE guidance on managing common infections ([2017](#)) once available.
8. Work with PHE to develop an e-learning package around prescribing for UTIs for primary care clinicians, to complement resources from [TARGET](#).

Healthcare providers

9. Ensure that all prescribers receive induction and training in prudent antimicrobial use in addition to update sessions (at least every three years).
10. Ensure that all prescribers are familiar with the [PHE/ARHAI antimicrobial resistance and stewardship competencies](#).
11. Consider the provision of mandatory core training in prudent antibiotic use for doctors, pharmacists and nurses as an introductory session on induction, in addition to update sessions.

12. Consider the role of an antimicrobial resistance education strategy that sets out the training requirements for staff based on national recommendations, and also includes monitoring and reporting arrangements.
13. Consider data reporting arrangements on the number of staff trained on antimicrobial resistance and prescribing to the infection prevention and control committee and/or medicines management committee. This information could be included in the organisation's annual statement on compliance with practice on infection prevention and cleanliness.
14. Ensure that educational resources take into account national recommendations i.e. [NICE guidance on antimicrobial stewardship](#); [C.Diff how to deal with the problem](#); [PHE/ARHAI antimicrobial prescribing and stewardship competencies](#); 'Start Smart then focus'; [PHE managing common infections: guidance for primary care](#) and/or [TARGET clinical toolkit](#).
15. Ensure learning sessions for secondary care prescribers are updated to comply with NICE guidance on managing common infections ([2017](#)) once available.
16. Ensure the inclusion of antimicrobial resistance awareness as part of mandatory infection prevention and control training targeted for all staff on induction and at every update should also be considered. Staff should be encouraged to sign up as [antibiotic guardians](#) during these sessions.
17. Consider locally mandated and implemented staff training on antimicrobial resistance for areas that show poor audit compliance to the local antibiotic policy and national recommendations, in addition to increasing resistance patterns and antimicrobial consumption.
18. The appropriate use of antimicrobials should be included to job descriptions of all clinical staff in addition to compliance with practice on infection prevention and cleanliness.
19. Ensure protected learning time for educators and learners locally.
20. Consider targeted awareness training sessions for management and executive teams, for example, senior clinicians and clinical directors on antimicrobial resistance leadership and training.
21. Consider the role of local peer support networks for prescribers focused on improving individual antimicrobial prescribing habits through the use of prescribing [data](#), audit outcomes and resistance data.
22. Explore the role of inter-professional and interdisciplinary teaching as part of antimicrobial stewardship programmes.

Other stakeholders

23. Explore the role of education alongside other targeted interventions, such as behaviour change especially individual, team or organisational behaviour on the adoption of evidence based antimicrobial resistance practices.

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24. Consider the use of frameworks that characterise interventions and policies and show how these link together to enable or support behaviour change.
25. Explore the role of collecting data on the number of staff trained on AMR as part of [local AMR indicators](#) to allow national benchmarking on how organisations are performing.
26. Encourage the adoption of an antimicrobial prescribing and stewardship educational strategy by inclusion as part of CQUIN/quality premium (QP), and assessment via a clear regulatory framework / checklist.
27. Ensure that educational resources take into account national recommendations i.e. [NICE guidance on antimicrobial stewardship](#); [C.Diff how to deal with the problem](#); [PHE/ARHAI antimicrobial prescribing and stewardship competencies](#); 'Start Smart then focus'; [PHE managing common infections: guidance for primary care](#) and/or [TARGET clinical toolkit](#).
28. Structural leadership at local level via local community education provider networks or sustainability and transformation plan ([STP](#)) footprints to coordinate, monitor and support local action around antimicrobial prescribing and stewardship educational interventions should be explored.
29. Regional microbiology and antimicrobial pharmacist networks should be used to share examples of good practice on educational interventions that have resulted in successful outcomes.

Authors:

Mohamed Sadak, Clinical Lead and Programme Manager Antimicrobial Resistance and Sepsis, Health Education England.

Janet Flint, Programme Lead, Population Health and Prevention – National Programmes, Health Education England.

Dr Sanjiv Ahluwalia, Postgraduate Dean at Health Education North Central and East London.

Antonio De Gregorio, Programme Coordinator – Antimicrobial Resistance and Sepsis, Health Education England.

Prof Ged Byrne, Director of Education & Quality, Health Education England North.

Prof Lisa Bayliss-Pratt, Director of Nursing, Health Education England.

Acknowledgements:

Dr Diane Ashiru-Oredope, Pharmacist Lead, AMR Programme, Public Health England.

Dr Cliodna McNulty, Head of Primary Care Unit, National Infection Service, Public Health England.

Elizabeth Beech, National Project Lead - Healthcare Acquired Infection and Antimicrobial Resistance, NHS Improvement.

Philip Howard, Consultant Pharmacist in Antimicrobials, Leeds Teaching Hospitals NHS Trust and National Project Lead - Healthcare Acquired Infection and Antimicrobial Resistance, NHS Improvement.

Stuart Brown, Antibiotic Pharmacist, County Durham and Darlington NHS Foundation Trust and National Project Lead - Healthcare Acquired Infection and Antimicrobial Resistance, NHS Improvement.

Joanne Bosanquet MBE, Deputy Chief Nurse, Public Health England.

Susie Singleton, Nurse Consultant, Public Health England.

Karen Shaw, Infection Prevention and Control Lead, Public Health England.

Prof Molly Courtenay, School of Healthcare Sciences, Cardiff University.

Emma Cramp, Antimicrobial Pharmacist, University Hospitals of Leicester NHS Trust.

Naomi Fleming, Pharmacist Advanced Microbiology and Infectious Disease, Kettering General Hospital Foundation Trust.

Appendixes

Appendix 1: Respondents

Barts Health NHS Trust
Blackpool Teaching Hospitals NHS Foundation Trust
Bolton NHS Foundation Trust
British Pharmacological Society
Cardiff University
Centre for Pharmacy Postgraduate Education (CPPE)
Cheshire & Wirral Partnership NHS Foundation Trust
City and Hackney CCG
City Hospitals Sunderland NHS Foundation Trust
Daleham Gardens Surgery
Dorset County Hospital NHS Foundation Trust
Eastern Cheshire, Vale Royal and South Cheshire CCGs
Epsom and St Helier University Hospitals NHS Trust
Glebelands Practice
Hampstead Group Practice
HEE Local Office: Health Education England East of England
HEE Local Office: Health Education England North East
HEE Local Office: Health Education England North West
HEE Local Office: Health Education England South West
HEE Local Office: Health Education England South London
HEE Local Office: Health Education England Thames Valley
HEE Local Office: Health Education England West Midlands
HEE Local Office: Health Education England Wessex
Homerton University Hospital NHS Foundation Trust
Kettering General Hospital NHS Foundation Trust
Kings College Hospital NHS Foundation Trust
Knowsley CCG
Lancashire County Council
London Fields Medical Centre
Lonsdale Medical Centre
Maidstone and Tunbridge Wells NHS Trust
Mid Cheshire Hospitals NHS Foundation Trust
Millennium Centre Pharmacy
Mill Street Medical Centre
Newcastle Hospitals NHSFT
NHS Bath and North East Somerset CCG
NHS Blackpool CCG
NHS Halton CCG
NHS St Helens CCG
NHS Tameside and Glossop CCG
North Cumbria University NHS Hospitals Trust

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Northern Devon HealthCare Trust
North Tees and Hartlepool Hospitals NHS Foundation Trust
Northumbria Healthcare NHS Foundation Trust
Northumberland, Tyne and Wear NHS Foundation Trust
Pennine Care NHS Foundation Trust
Public Health England
Royal Brompton and Harefield NHS Trust
Royal College of Emergency Medicine
Royal Free London NHS Foundation Trust
Royal Liverpool & Broadgreen University Hospitals NHS Trust
Royal Surrey County Hospital
Salisbury NHS Foundation Trust
Sheffield teaching Hospitals NHS Foundation Trust
South Tees Hospitals NHS Foundation Trust
Stockport CCG
Stockport NHS Foundation Trust
Sussex Community NHS Foundation Trust
Tameside and Glossop Integrated Care NHS Foundation Trust
Teesside University
The Hillingdon Hospitals NHS Foundation Trust
The Museum Practice
The Royal Wolverhampton NHS Trust
University of Chester
University Hospitals of Leicester
University Hospital South Manchester
University of Sunderland
University of West London
Western Road Medical Centre
Wirral University Teaching Hospital NHS Foundation Trust
Wye Valley NHS Trust
Yorkshire & Humber Academic Health Science Network

Appendix 2: Further information on gaps and how they could be addressed

Further information on what these gaps are and/or how they could be addressed (or provide any other thoughts if you feel there are no gaps to address):	Themes
<p>“Educational materials only partly address the reasons leading to antimicrobial prescribing. Socio-cultural aspects are mostly ignored. For example, how doctors-in-training behave within the medical hierarchy they are working in, sometimes leading to 'blindly' following what their seniors do, for fear of criticism.”</p>	<p>Organisational AMR Culture.</p>
<p>“Training for established consultants is ad hoc; we are hoping our local e-learning will help address this once it is mandated. Antimicrobial stewardship to be included in job descriptions / contracts similar to Infection Prevention.”</p>	<p>Organisational AMR Behaviour.</p> <p>Senior Clinician AMR Leadership.</p>
<p>“Not really an issue in the context of general practice perhaps it should be.”</p>	<p>Socio-cultural</p>
<p>“Need to provide more broad training for all prescribers, not just junior doctors.”</p>	<p>interactions aspects of prescribing.</p>
<p>“Lack of understanding of the importance.”</p>	
<p>“Prescribers not well prepared by university for antimicrobial stewardship. Senior clinicians sometimes fail to lead by example.”</p>	<p>Mandated training for staff on AMR.</p>
<p>“BMJ and RCGP.”</p>	
<p>“While research has explored antibiotic prescribing by general practitioners (GPs) for respiratory tract infections, despite the increasing volume of antibiotic prescriptions by NMPs, there is scant evidence available on their antibiotic prescribing. A number of factors have been identified that influence GPs’ prescribing decisions and available evidence suggests that NMPs encounter similar concerns over diagnostic uncertainty, are influenced by clinical guidelines and not unduly influenced by patient expectations for an antibiotic. However, research has not yet explored patient experiences of NMP management of RTIs and how this impacts patient satisfaction. Our research addresses this and findings will inform an intervention designed to reduce antibiotic prescribing for respiratory tract infections.”</p>	<p>AMR included in job descriptions.</p> <p>AMR training for all specialties and grades.</p> <p>AMR importance in General Practice.</p> <p>Focused AMR training for undergraduates especially for prescribing professions.</p>
<p>“Neither medical students nor qualified person, other than in Microbiology, seems to have received ANY microbiology or antibiotic education (from consultants to F1s). We spend more time holding everyone's hand and micro-managing antibiotic decision-making than actually doing our primary consultant work (we have no juniors). I know that almost ALL medical schools now FAIL to include Microbiology and Histology in their undergraduate training (Birmingham removed these in 1997!). So the gap(s) are clearly in the medical schools. If they know nothing after training, how can you expect them to understand antibiotic resistance? It is to the point of total negligence on the part of the medical schools.”</p>	<p>Research on AMR prescribing decisions.</p> <p>Role of non-medical prescribers in AMR.</p> <p>Nationally available</p>

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<p>“Undergraduate training on infection and antimicrobial use is woefully inadequate. Foundation doctors arrive underprepared. The level of knowledge at all grades is inadequate and puts an intolerable strain on those trying to direct appropriate prescribing.”</p>	<p>online resources e.g. e-learning.</p>
<p>“Complete lack of basic scientific knowledge and pharmacology.”</p>	<p>Locally mandated and implemented AMR training.</p>
<p>“Nationally supported online resources e.g. e-learning package which is developed nationally and implemented locally and mandated.”</p>	<p>Standardisation of teaching material.</p>
<p>“We have proposed to implement mandatory training for prescribers on antimicrobial stewardship.”</p>	<p>Learning resources need to be useful, relevant and practical.</p>
<p>“I am not aware of any e-learning and feel this would be useful as an update.”</p>	<p>Senior Clinician AMR Training.</p>
<p>“We do not have a structured approach to teaching on AMR. We do deliver ad hoc teaching on infection, but this could be standardised. It needs to be done in a way that does not lead to the usual feelings around mandatory training (not relevant / not practical / not a good use of time).”</p>	<p>Linking teaching to local resistance patterns.</p>
<p>“There is a huge problem in training medical staff as there is not enough time in their educational calendars to fit it in. NMPs are relatively easy to gather together at an annual conference we organise. There is a huge issue in not training senior prescribers in the organisation as junior Drs rely on them to sign off their training and if they question their antibiotic prescribing they risk irritating their mentor who will then make their training difficult so they choose to wait until the consultant makes the decision rather than risk the telling off. I have come across situations when the junior admits that what is on the prescription is inappropriate but will not change it as 'the boss wants it'.”</p>	<p>Protected learning time.</p>
<p>“Difficult to teach the whole of Microbiology and infection in a module on antibiotic use.”</p>	<p>Postgraduate AMR education gap.</p>
<p>“Local Resistance Patterns.”</p>	<p>Behaviour change techniques to support AMR learning.</p>
<p>“There are massive gaps from medical school and nursing teaching to ongoing teaching available. A lot of primary care doctors are paid on the fact of whether they meet their targets and as they are they do not know enough about prescribing antibiotics it often goes overlooked. The general feeling is ‘they can't harm’ - so let's just use. Also, there is a massive litigation scare with GPs.”</p>	<p>“Targets” should focus on learning and behaviour change.</p>
<p>“Our CCG has developed and supported training in antimicrobial resistance for all practices this year.”</p>	<p>Education on AMR risks.</p>
<p>“Prescription of antimicrobial without susceptibility testing. Besides those who did susceptibility testing they will not follow the guidelines for treatment the majority starts with second or third lines just to recover their patients rapidly; regardless toxicity, expenses and future resistance’.”</p>	<p>Stronger AMR emphasis in undergraduate and post-graduate for all</p>
<p>“We do not have mandatory sessions on antibiotic prescribing or resistance.”</p>	

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<p>“Junior doctors have only basic knowledge on antimicrobial prescribing. They are dependent on the Microbiology advice at times for simple queries. Undergraduate curriculum needs revamping on this subject. Online learning material will help – certification may be encouraged if not made mandatory. Post-graduate curriculum need to incorporate a strong emphasis on antimicrobial management just like generic skills are emphasised.”</p>	<p>professional curriculums.</p>
<p>“Prudent prescribing: we are looking to make training mandatory. Antimicrobials: we are looking to provide formal teaching sessions.”</p>	<p>Linking online AMR training to curriculums.</p>
<p>“Standardised focus needed rather than broad structure - local interventions harder to implement if not supported by clear evidence of practice gaps.”</p>	<p>Formal AMR teaching sessions.</p>
<p>“Must be more comprehensive to meet PHE recommendations. Severely under-resourced with no antimicrobial pharmacist at present.”</p>	<p>Linking training and education to outcomes and gaps e.g. audit results, resistance patterns, antimicrobial consumption etc.</p>
<p>“We currently provide training on appropriate antibiotic prescribing. The basis of this is preventing overuse and abuse of antibiotics so as to avoid the development of resistance. The doctors understand why there is so much concern about antibiotic resistance so I do not think that we need to dedicate a large part of the session to resistance alone. I therefore do not believe there is a gap in the training we provide because if we spend a significant portion of time talking about antibiotic resistance then we will not be able to spend more time on appropriate prescribing which is essential to preventing the development of resistance.”</p>	<p>Microbiologist led training.</p>
<p>“Although e-learning is available, we find that local microbiologist input is useful with data on local issues/case studies relating to resistance.”</p>	<p>Education on appropriate prescribing and not just AMR.</p>
<p>“All schools have confirmed that this training is integral to their programme delivery, and it is also included in the curriculum delivery for most of them. GP School stated that Specific antimicrobial resistance session or module on the day release course (DRC) isn't run, prescribing is included in all clinical topics and would include best practice and discussion around the appropriateness and risks of prescribing. Mid Wessex do run a session led by a Microbiologist as part of the DRC. GPR's have 1 to 1 tutorials every week and again it would cover good prescribing practice. Trainees would be expected to complete training in infection control as part of Trust induction and regular statutory and mandatory training which should include antibiotic stewards. One of our training programmes is infection which trains infection specialists and that includes antimicrobials and their resistances as a core component for training in microbiology, virology and infectious diseases. Infection trainees and trainers take part in teaching other trainees and healthcare professionals in antimicrobial resistance usually as part of training days and mandatory training of senior & junior medical staff and other</p>	<p>Integrating AMR training within all clinical specialties.</p> <p>AMR training for clinical staff.</p> <p>Online AMR training for prescribers.</p> <p>Link learning to available drug-bug resistance data.</p> <p>Standardised and commonly agreed AMR competences in curricula.</p>

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<p>healthcare professionals. Antimicrobial resistance is in speciality curricula of many of our other programmes (genitourinary medicine [GUM], Gastroenterology especially hepatology, respiratory, core medical training [CMT] and haematology) and is an integral part of training in these specialities.”</p>	<p>Access for AMR training at staff induction.</p> <p>NICE AMR guidance awareness.</p>
<p>“Training programme for medics, nurses and pharmacists.”</p>	
<p>“Lack of online resources targeted at healthcare professionals at the required level of detail. Only resource I am aware of is HEE level 1 for antimicrobial resistance which is too basic for prescribers.”</p>	<p>Microbiologist input.</p> <p>Encouraging uptake of resources.</p>
<p>“Curriculum currently under review sections of acute care common stem (ACCS) and higher specialist scientist training (HST) curriculum deals with adherence to local antibiotic policy but there is no specific section on antimicrobial resistance.”</p>	<p>Short induction resource.</p>
<p>“How to use drug bug resistance data to optimise prescribing - partly not accessible, but will be of fingertips.”</p>	
<p>“The indicative curriculum for pharmacists enrolled on IP courses, and the RPS single competency framework, incorporates stewardship and awareness of resistance, but does not mandate a common approach to education at this level. If a common level of understanding and competence is required then a commonly agreed curriculum is needed.”</p>	
<p>“We are not routinely given access to induction for all grades of staff, which is our main forum for imparting the information.”</p>	
<p>“NICE guidance. Local resistance patterns. Do not feel enough time for F1s to really instil stewardship practices at ward level.”</p>	
<p>“No formal training on this in CMT.”</p>	
<p>“The ready availability of consultant microbiologists and the constant updating of guidance regarding which antibiotics in light of constantly changing resistance patterns of course NICE guidance on sepsis is mutually incompatible with stewardship.”</p>	
<p>“Good information is available; however encouraging people to access this regularly can be more difficult.”</p>	
<p>“Quick induction package very short presentation.”</p>	

Appendix 3: Feedback received on other types of resources and details on any evidence of other interventions that have resulted in improvement

Comments received on the “other” type of resources. This also includes feedback received on the types of resources and those professionals these are targeted towards (where specified) and further details on any evidence of other interventions that have resulted in a change in behaviour for example any improvement in audit results, consumption data, resistance rates etc.	Themes
<p>“In-house learning materials include a classroom lecture as part of NMP course and continuous professional development (CPD) sessions on antimicrobial use. Three other resources are locally relevant presentations. Changes in guidelines have impacted on consumption of certain agents but overall consumption continues to rise in line with national picture. Audits have demonstrated improved practice in terms of documenting indication for antibiotics in medical notes/chart and following guidelines for choice of antibiotic. We have recently introduced an antibiotic specific section on the drug chart to facilitate a ‘Start Smart then Focus’ approach to antibiotic prescribing.”</p>	<ul style="list-style-type: none"> - Locally relevant presentations, quizzes and role-play simulation, workshops, leaflets and in-house learning materials classroom lecture as part of NMP course and CPD session on antimicrobial use e.g.
<p>“Locally developed e-learning for prescribers, administrators and dispensers of antimicrobials; antimicrobial prescribing teaching sessions as part of mandatory training for FY1 and FY2 doctors; signposted external e-learning and on line learning via the Trust antimicrobial guidelines site; bespoke presentations to medical meetings/grand rounds; promotion of antibiotic guardian and EAAD resources by way of screen savers and displays; and medical student teaching - tutorials during hospital based practice placements. Reference also made to the “Health and Education Cooperative” website public health section antimicrobial resistance and prescribing. Return to prescribing is specifically for pharmacists from all sectors and disciplines who are registered prescribers, but who have been out of prescribing practice for a year or more. Maintaining competence and confidence in prescribing is a guide that guides prescribers from all professions in how to use the prescribing competency framework as a learning needs assessment tool and then signposts resources that will help to address identified learning needs. Our CCG has delivered good levels of antimicrobial prescribing reduction.”</p>	<ul style="list-style-type: none"> to medical meetings/grand rounds. - Bulletins, short talks, smartphone and web app, feedback sessions, guidelines and pharmacy team alerts. - Changes in prescribing guidance available via the intranet and app, an antibiotic specific section on the drug chart, audits to measure practice and peer review of prescribing.
<p>“Peer reviews of prescribing plus audit and guidance. Antimicrobial prescribing power-point teaching for FY1 and FY2s; in-house Trust e-learning package; online learning (signposted from the “RxGuidelines Portal” under additional information, external links and resources); power-point presentations to prescribers; antibiotic guardian website and European Antibiotic Day (EAAD) resources on DH website; and medical student tutorials (verbal discussions and some hand-outs). The resources are for all doctors at the Trust. Teaching is underpinned by antibiotic</p>	<ul style="list-style-type: none"> - Locally developed e-learning for prescribers, administrators and dispensers of antimicrobials. - Antimicrobial

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<p>audits and C.Diff data analysis. Prescribers who have attended learning sessions are more likely to contact Microbiologist or the Infection Prevention Nurses for advice prior to prescribing.”</p>	<p>prescribing teaching sessions as part of mandatory training for FY1 and FY2 doctors.</p>
<p>“Guide currently available as PDF and version 2 will be printed. Training sessions on clinical areas including prescribing practice. This programme is the professional (NMC & HCPC) approved non-medical prescribing for appropriately qualified nurses, midwives and allied health professionals who meet the professional and legal requirements to prescribe on an independent/supplementary basis. Training is also provided from modules available from the CPPE website. Training has resulted in an improvement in the organisations ‘Safe Prescribing’ indicators and improved antibiotic audit results.”</p>	<p>- Signposted external e-learning and on line learning via the Trust antimicrobial guidelines site (e.g. “RxGuidelines Portal”).</p>
<p>“Guidelines available via intranet and app. The workshop and leaflet are in-house produced resources. The distance learning was through Future Learn and the E-learning through TARGET on the RCGP website. A leaflet was also developed for patients. The training sessions apply to everyone involved with medications.”</p>	<p>- Promotion of antibiotic guardian and EAAD resources by way of screen savers and displays.</p>
<p>“Local medicine management formulary plus discussion in tutorials re appropriate prescribing. FY1 Teaching, infection control, C.diff e-learning & antibiotic guideline cards. Teaching is targeted towards trainee medical prescribers i.e. university medical and healthcare students. Audit results have shown improved outcomes.”</p>	<p>- Medical and healthcare student teaching - tutorials during hospital based practice placements.</p>
<p>“Recommendations made from a research study designed to 1) explore patients’ expectations and experiences of nurse and pharmacist non-medical prescriber -led management of respiratory tract infections, 2) to examine whether patient expectations for antibiotics affect the likelihood of receiving them, and 3) to understand factors influencing patient satisfaction with respiratory tract infection. Recommendations from this work included those surrounding education for non-medical and medical prescribers. The work has been submitted to BMJ Open and we are currently waiting to hear if it has been accepted. We promote the HEE e-learning module on antimicrobial resistance and in-house material mainly directed at junior doctors (FY1s). Outcomes are monitored by reviewing our prescribing data on antibiotic usage.”</p>	<p>- Mandatory antimicrobial prescribing training.</p> <p>- A guide for prescribers from all professions in how to use the prescribing competency framework as a learning needs assessment tool which signposts resources that will help to address identified learning needs.</p> <p>- A guide book internal</p>

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<p>“Newsletters, communications and weekly surveillance. Return to prescribing course and maintaining competence and confidence in prescribing guide is shared with staff. SCRIPT variants cover foundation medical and dental, undergraduate, non-medical prescribers, nurses, pharmacists, GPs and local presentations by the antimicrobial pharmacist. Our research with nurse and pharmacist prescribers (who manage respiratory tract infections) across England, Scotland and Wales, identified that these non-medical prescribers use a range of management strategies without recourse to antibiotics, particularly in terms of taking a patient-centred approach. Overall, the expectations of patients’ in our study were met, and prescribers were not unduly influenced by patient expectations for an antibiotic. Patients were satisfied with the consultation, indicating that strategies used by non-medical prescribers were acceptable. The next stage of our research will explore in greater depth the patient centered management strategies used by nurse and pharmacist prescribers and this information will be used to inform the development of an intervention (for use by medical and non-medical prescribers) to reduce antibiotic prescribing for respiratory tract infections.”</p>	<p>resources.</p> <ul style="list-style-type: none"> - Maintaining competence and confidence in prescribing guide. - Return to prescribing training for those who have been out of prescribing practice for a year or more. - Teaching is underpinned by antibiotic audits and C.Diff data analysis. - Prescribers who have attended learning sessions are more likely to contact microbiologist or the infection prevention nurses for advice prior to prescribing. - Training is also provided from modules available from the CPPE website. - Training has resulted in an improvement in the organisations ‘Safe Prescribing’ indicators and improved antibiotic audit results. - Training presentation targeted at GPs and non-medical prescribers in GP practices that has resulted in improved audit results and reduced consumption. - Distance learning through Future Learn
<p>“Educational sessions are run throughout the year. Antimicrobial stewardship presentations to FY1s, FY2s and other groups ad hoc and an e-learning package developed for use internally. Training resources have been created after identifying problems via audits and root cause analysis (RCA). Surveillance involves comparison and benchmarking to previous years data.”</p>	
<p>“Training presentation targeted at GPs and non-medical prescribers in GP practices that has resulted in improved audit results and reduced consumption.”</p>	
<p>“Quizzes and role-play simulation that is a practical session. Educational resources are only for pharmacist non-medical prescribers and learning is linked to audit results, run charts, ePACT data etc.</p>	
<p>“Lecture/seminar delivered by an external specialist antimicrobial pharmacist and eternal expert university lecturer. Antimicrobial Stewardship training via power-point presentations adapted for each staff group and presented to NMPs, FY1, FY2 and pharmacists. TARGET Workshop - reduced prescribing in intervention practices, paper is in progress. The TARGET Workshop promotes the other resources mentioned in this survey.”</p>	
<p>“Regular lecture series training on antimicrobial resistance as part of a non-medical prescribers’ study day. Although we currently have no evidence on the effectiveness of the learning session, we hope to undertake an evaluation next year.”</p>	

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<p>“World Antibiotic Awareness Week (incorporating European Antibiotic Day). All our teaching sessions on antimicrobial stewardship are altered depending on the audience. Improvements in the annual prescribing audit and monthly prescribing audits have been observed.”</p>	<p>and the e-learning through TARGET on the RCGP website.</p>
<p>“A guide book to our resources, we call it the 'Guide to Resources' and mandatory antimicrobial prescribing training. Outcomes are monitored via PHE’s ‘fingertips’ data.”</p>	<ul style="list-style-type: none"> - Leaflet for patients. - Training sessions for everyone involved with medications.
<p>“Peer education resources for medical/healthcare university students to deliver in schools. RCGP Target Toolkit and PHE Antibiotic Guardian are also used for education purposes. Outcomes like reported pledges to change behaviour i.e. use nitrofurantoin first line, adopt use of patient information leaflets e.g. TARGET treating your infection patient leaflet, request for prescribing data following BGPert event and reduction in practice prescribing AMR indicator.”</p>	<ul style="list-style-type: none"> - Explore patients’ expectations and experiences in health professionals’ management of infections, examine whether patient expectations for antibiotics affect the likelihood of receiving them, and understand factors influencing patient satisfaction with specific infections.
<p>“Antimicrobial page on the Trust intranet and use of Facebook & Twitter especially for European Antibiotic Awareness Day. Trust online induction for new doctors/annual update for infection prevention & control that includes slides on antimicrobial stewardship.”</p>	<ul style="list-style-type: none"> - Newsletters, communications and weekly surveillance. - SCRIPT variants cover foundation medical and dental, undergraduate, non-medical prescribers, nurses, pharmacists, GPs.
<p>“Script e-learning for safe prescribing and power-point presentations.”</p>	
<p>“Antibiotic guardian campaign via social media. Guidance available via the Trust intranet to support prescribers e.g. on urine result interpretation, urine dipstick analysis etc. Learning materials available freely online for example on acute respiratory tract infections by TARGET and antibiotic resistance in primary care. Online guidance available for all Trust staff via RxGuidelines Portal. Improvement evidenced in policy compliance through audit measurement.”</p>	<ul style="list-style-type: none"> - Training resources have been created after identifying problems via audits and root cause analysis (RCA).
<p>“Audit a 10 point action plan largely based on TARGET toolkit resources and examples of best practice with an antimicrobial resistance update.”</p>	<p>Surveillance involves comparison and benchmarking to previous years data.</p>
<p>“Setting up and providing a peer support network for NMPs in GP practices and within this deliver educational content including antimicrobial stewardship, where NMPs had an AMR update and discussed their actual prescribing data. Promoted TARGET e learning resources to GPs. Delivered AMR update and training to GPs via existing educational forum on Bath GP Education & Research Trust. Other training sessions include a Safe Antimicrobial Prescribing for Foundation Doctors (two sessions over two years) and Antibiotic Awareness Forum (one hour lecture open to all staff members).”</p>	<ul style="list-style-type: none"> - Lecture/seminar
<p>“The fundamentals of antimicrobial resistance are incorporated in to undergraduate and postgraduate clinical programmes; for example, antimicrobial stewardship is a common theme that is expected to run through all of the MSc in Clinical Pharmacy (which incorporates the Certificate in Independent Prescribing for Pharmacists). Rather than there</p>	

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<p>being isolated stand-alone modules it is a common theme running through taught modules. World Antibiotic Awareness Week (incorporating European Antibiotic Day) is also promoted at the university.”</p>	<p>delivered by an external specialist antimicrobial pharmacist and external expert university lecturer.</p>
<p>“Interventions include bulletins, short talks, smartphone and web app, feedback sessions, guidelines and pharmacy team alerts. This is supported by a TARGET Workshop Resource, AMR in primary care module, ‘Treating Your Infection’ leaflet, and guide to TARGET resources.”</p>	<p>- TARGET workshop is used to promote resources and has reduced prescribing in intervention practices.</p>
<p>“Prescribing and AMR is mentioned in the general prescribing induction. There is no specific workshop and there is no training for other grades of staff. E-Bug Antibiotic Peer Education Lesson plan is also shared.”</p>	<p>- Teaching sessions on antimicrobial stewardship are altered depending on the audience.</p>
<p>“One to one teaching in clinical settings. Case studies on antibiotic prescribing, delivered as a workshop format with discussions. Part of mandatory training session on antibiotic prescribing for all FY1s.”</p>	<p>Improvements in the annual prescribing audit and monthly prescribing audits have been observed.</p>
<p>“ I've asked around our FPDs. Beyond being included as a topic in most of the generic teaching programmes delivered in the trust, all FY1s do a 4 month post in acute medicine with daily micro ward rounds Mon-Fri to discuss and review antibiotic use, with much discussion re good antibiotic guardianship. Their acute medicine team teaching includes teaching on antibiotic guardianship, with F1s encouraged to make a pledge as guardians- this ties in with curriculum objectives of public health, health promotion, external bodies etc. They have also produced a Hiblio video about antibiotic use. Promotion of Antibiotic Guardian.”</p>	<p>- Outcomes are monitored via PHE’s ‘fingertips’ data. - Peer education resources for medical/healthcare university students to deliver in schools.</p>
<p>“We have several resources that might be useful. Examples of useful resources include SCRIPT e-learning, Antibiotic Prescribing Guidelines leaflet; Patient Safety Alert Bulletins; short talks on AMR stewardships for all doctors joining the trust; didactic section on AMR stewardship within medical microbiology smartphone and web app; direct feedback provided to medical microbiology prescribers three times per week as part of AMR stewardship rounds; AMR guidelines for psychiatry produced following an audit; and pharmacy team informing the infection control team when antibiotics prescribed.”</p>	<p>- Outcomes like reported pledges to change behaviour i.e. use nitrofurantoin first line, adopt use of patient information leaflets e.g. TARGET treating your infection patient leaflet, request for prescribing data following BGPRT event and reduction in practice prescribing</p>
<p>“In house education is provided. All resources via RCGP Target plus funded a GP educationalist to run an education session.”</p>	
<p>“Power-point presentations; antimicrobial resistance and antimicrobial stewardship at ward level FY1 teaching workshop; case based discussions; NMP teaching workshop: Antimicrobial stewardship and FY2 teaching workshop: Antimicrobial resistance and stewardship.”</p>	
<p>“Our Dental FT's are undertaking a regional prescribing audit this year over 20 working days in December / January where they will be auditing</p>	

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<p>all prescriptions given to patients in the practices. All our DFT's undertake e-learning using Dental Script (West Midlands developed). We are using the SDCEP standards for prescribing in primary dental care.”</p>	<p>AMR indicator.</p>
<p>“RCGP TARGET training and PHE/BSAC target series.”</p>	<p>- Antimicrobial page on the Trust intranet and use of Facebook & Twitter especially.</p>
<p>“Prescribe e-learning program, Prescribing Simulator and Prescribing Safety Assessment.”</p>	<p>- Trust online induction for new doctors/annual update for infection prevention & control that includes slides on antimicrobial stewardship.</p>
<p>“The rise and rise of AMR.”</p>	<p>- Audit a 10 point action plan largely based on TARGET toolkit resources and examples of best practice with an antimicrobial resistance update.</p> <p>- Peer support network for NMPs in GP practices and within this deliver educational content including antimicrobial stewardship, where NMPs had an AMR update and discussed their actual prescribing data.</p> <p>- One to one teaching in clinical settings with case studies on antibiotic prescribing, delivered as a workshop format with discussions.</p> <p>- All FY1s do a 4 month post in acute medicine with daily micro ward rounds</p>

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	<p>Mon-Fri to discuss and review antibiotic use, with much discussion re good antibiotic guardianship. Their acute medicine team teaching includes teaching on antibiotic guardianship, with F1s encouraged to make a pledge as guardians.</p> <ul style="list-style-type: none">- Direct feedback provided to medical microbiology prescribers three times per week as part of AMR stewardship rounds.
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Appendix 4: Examples of good practice on training and educating staff on antimicrobial resistance

Do you have any examples of good practice on training and educating staff on antimicrobial resistance and principles of good antimicrobial stewardship that you could share?	Themes
“We have the Trust SPARED and ERA campaign .”	<ul style="list-style-type: none"> - Individual Trust led campaigns. - Communication and dissemination of information. - Monthly stewardship audits reported to directorates with actions to improve for poor performers. - Prescribing app. - Strategy to share prescribing data with practice that includes guidance on where and how this can be improved. - Audit pack with accompanying tools. - Training package for all practices. - Multi-professional sessions. - Medical Grand Round presentations. - ESPAUR data presentation - Link audits and ward rounds to teaching.
“Any information we receive on this topic is circulated amongst staff and pharmacists to make them fully aware of local policy.”	
“We undertake monthly audits on markers of stewardship which are shared with directorates and areas poorly performing are requested to undertake actions to improve.”	
“The prescribing app has help notes. We see intervention at the point of prescribing, with regular 'on the ward' intervention with prescribers as key.”	
“Peer review of antibiotic prescribing as part of Primary Care PLT.”	
“As part of our AMR 16/17 strategic plan we have shared with practices their current prescribing data with guidance on where and how this can be improved. We have also produced an audit pack which will be used as a tool in all practices. We are in the process of developing a training package which will be available for all practices to attend. In addition we continually promote the AMR messages via communications such as our newsletter; direct mailing and practice visits.”	
“Yes we make session especially in case of interests discussed in multi-professional manner.”	
“Medical Grand Round presentation at our hospital on ESPAUR data highlighted lack of awareness of the problems around increasing resistance and hence prompted more thought when initially prescribing antibiotics. Lack of understanding among both junior and senior staff is a major issue which is difficult to tackle.”	
“CCG do not provide any mandatory training for provider workforce.”	
“Currently quarterly audits of antibiotics prescribing in each practice subject to peer review.”	
“Trust wide monthly antimicrobial stewardship audits and antimicrobial stewardship ward rounds provide teaching.”	