

Interventions to improve antimicrobial prescribing of doctors in training (IMPACT): a realist review

Chrysanthi Papoutsi,^{1*} Karen Mattick,² Mark Pearson,³ Nicola Brennan,⁴ Simon Briscoe³ and Geoff Wong¹

¹Nuffield Department of Primary Care Health Sciences, University of Oxford, Oxford, UK

²Centre for Research in Professional Learning, University of Exeter, Exeter, UK

³National Institute for Health Research Collaboration for Leadership in Applied Health Research and Care for the South West Peninsula, Institute of Health Research, University of Exeter Medical School, Exeter, UK

⁴Collaboration for the Advancement of Medical Education Research and Assessment, Peninsula Schools of Medicine and Dentistry, Plymouth University, Plymouth, UK

*Corresponding author chrysanthi.papoutsi@phc.ox.ac.uk

Declared competing interests of authors: Geoff Wong is a member of the Health Technology Assessment Primary Care, Community and Preventive Interventions Panel. Mark Pearson's role was supported by the National Institute for Health Research (NIHR) Collaboration for Leadership in Applied Health Research and Care South West Peninsula.

Published February 2018

DOI: 10.3310/hsdr06100

Scientific summary

Improving antimicrobial prescribing of doctors in training

Health Services and Delivery Research 2018; Vol. 6: No. 10

DOI: 10.3310/hsdr06100

NIHR Journals Library www.journalslibrary.nihr.ac.uk

Scientific summary

Background

The burden of antimicrobial resistance (AMR) is becoming increasingly onerous, and efforts to curtail this are gaining priority at a global scale. These efforts are driven by recognition of the substantial human and financial costs associated with reduced efficiency of existing antimicrobial agents. It has been estimated that by 2050 there will be 10 million deaths a year globally as a result of drug resistance and the total cost of lost production will come to US\$100T. In England, following a broad range of interventions to improve antimicrobial stewardship, encouraging signs of reduction in total antimicrobial consumption have already been identified. However, significant work remains to be done as there is still uncertainty around how to implement different types of interventions in different contexts. There is also less understanding of how antimicrobial prescribing interventions should be tailored to address the specific needs of doctors in training (i.e. those who have graduated from medical school but are still undergoing postgraduate clinical training to become specialists or general practitioners).

Objectives

Our review on IMProving Antimicrobial presCribing for doctors in Training (IMPACT) was structured around the following questions.

1. What are the 'mechanisms' by which antimicrobial prescribing behaviour change interventions are believed to result in their intended outcomes?
2. What are the 'important contexts' that determine whether or not the different mechanisms produce intended outcomes?
3. In what circumstances are such interventions likely to be effective?

Methods

To account for the context in which antimicrobial prescribing decisions are made and the significant challenges encountered by doctors in training at different levels, we followed a realist approach for evidence synthesis. A realist review is an interpretive, theory-driven approach to synthesising evidence from qualitative, quantitative and mixed-methods research. Its main strength comes from providing findings that explain how and why context can influence outcomes. The review followed a detailed, published protocol based on Pawson's five iterative stages: (1) locating existing theories, (2) searching for evidence, (3) selecting articles, (4) extracting and organising data and (5) synthesising the evidence and drawing conclusions. To this we have added step 6: highlighting the importance of writing in realist sense-making.

Data sources

We carried out two different formal literature searches, using the following data sources: EMBASE, MEDLINE, MEDLINE In-Process & Other Non-Indexed Citations, PsycINFO, Web of Science, Cochrane Central Register of Controlled Trials (CENTRAL), Cochrane Database of Systematic Reviews, Health Technology Assessment (HTA) database and Applied Social Sciences Index and Abstracts (ASSIA). We also undertook forward citation chasing [using Google Scholar (Google Inc., Mountain View, CA, USA)] and manually searched citations contained in the reference lists of important articles and reports. Google alerts were set up and articles received from content experts were also included.

Inclusion and exclusion criteria

From the main literature search for this review, we included all studies on antimicrobial prescribing behaviour or interventions that referred to doctors in training (any specialty and level), regardless of study design or setting (hospital or primary care), and including all prescribing-related outcome measures. We excluded studies when they focused on drug administration (no prescribing decision). A second search was undertaken to allow the review to focus on issues that emerged as significant following analysis of the literature from the main search. Studies were included when they discussed the role of hierarchies, teamwork and decision-making, in relation to doctors in training (any specialty and level), regardless of study design or setting (hospital or primary care).

Screening and article selection

At the point of inclusion, based on relevance, the trustworthiness and rigour of each study were also assessed. Considerations of rigour and relevance were often inter-related, as papers were more likely to include data useful for programme theory refinement when they had followed their chosen methodology to the standard required.

Analysis and synthesis

Once the core data set was established, initial manual coding was carried out chronologically (from the most recent article) for familiarisation with the data. Analysis then continued on NVivo 10 (QSR International, Warrington, UK), focusing first on the richest sources, that is, articles with the most potential to inform the programme theory, and then applying the coding framework to the rest of the papers (inductively and deductively). In the first rounds of analysis, the content was classified in analytical categories. By looking at each of these categories more closely, we were able to apply a realist logic of analysis and identify sections of texts related to contexts, mechanisms and their relationships to outcomes. This means that we sought to interpret and explain how different groups of doctors in training responded to resources available in their environment (the mechanisms) with regard to antimicrobial prescribing, and to identify the specific contexts or circumstances when these mechanisms were likely to be 'triggered'. As the review progressed, we iteratively refined the programme theory, driven by interpretations of the data included in the literature, and rescrutinised studies for relevant data.

To develop a programme theory of the antimicrobial prescribing experiences of doctors in training, we moved iteratively between the analysis of particular examples, stakeholder interpretations, refinement of programme theory and further iterative searching for data to test particular subsections of the programme theory. A realist logic of analysis was used to analyse and synthesise the data in context–mechanism–outcome configurations. This included adding explanatory text through abductive and retroductive reasoning, to infer and elaborate on mechanisms (which often remained hidden or were not articulated adequately). Relationships between contexts, mechanisms and outcomes were sought not just within the same articles, but across sources (e.g. mechanisms inferred from one article could help explain the way contexts influenced outcomes in a different article).

The aim of the analysis was to reach theoretical saturation, in that sufficient information had been captured to explain the wide range of experiences of doctors in training with antimicrobial prescribing. Theoretical frameworks were also used to substantiate the inferences made about mechanisms, contexts and outcomes and the configurations between these elements, and to enhance the plausibility and coherence of the arguments.

Consistency checks

A second reviewer carried out consistency checks for a 10% sample of the literature retrieved, the screening results and the coding process for both the main and additional literature searches. Very limited inconsistencies were identified on two occasions, which were resolved through discussion.

Stakeholder group

A diverse stakeholder group was also recruited to provide content expertise for programme theory refinement throughout the review. The group included patient representatives/carers, consultants, doctors in training at different stages, pharmacists, microbiologists, academics and policy-makers.

Results

The process of screening and article selection resulted in 131 references. Of those, 81 references came from the main literature search and 35 references from the additional search. The remaining 15 articles resulted from citation tracking, targeted searches and expert suggestions, on the basis of relevance to the programme theory. Of the 131 references, 78 used quantitative methods, 37 used qualitative methods, 12 were mixed-methods papers, and there were also three position papers and one report.

This realist review moves beyond identifying barriers of and facilitators to appropriate antimicrobial prescribing for doctors in training to reach an explanation of how and why trainees engage with antimicrobial prescribing differently under different circumstances. We are interested in understanding what drives the behaviour of doctors in training in the presence of barriers and limitations such as diagnostic uncertainty, inexperience and lack of knowledge.

The review emphasised the significance of clinical hierarchies as a key influence in the complex decision-making processes associated with prescribing. The overarching programme theory explains how and why doctors in training decide, in hierarchical contexts, to passively comply or actively follow their senior prescribing habits. Senior supervisors play a critical role in setting the norms about not just the 'prescribing etiquette', but also how trainees should engage with antimicrobial specialists, how they should manage patient expectations and how they should consult prescribing aids.

These outcomes result from complex inter-relationships between the important contexts doctors in training are embedded in, where (1) there are primarily hierarchical relationships, (2) powerful prescribing norms are often implicitly in place, (3) there is little clarity around what roles and responsibilities doctors in training should undertake in relation to antimicrobial prescribing and (4) knowledge expectations are not explicitly communicated and applying knowledge in practice remains challenging.

Having analysed the documents included in the review, we drew conclusions on how these contexts trigger a number of different mechanisms – or responses – from doctors in training, such as fear of criticism, fear of having individual responsibility for patients deteriorating, the need to manage one's reputation and position in the team and the need to appear competent. These mechanisms seem to be prevalent in the way doctors in training enact antimicrobial prescribing decisions and negotiate these in their clinical contexts.

As discussed in the literature reviewed, doctors in training also encounter a lack of opportunities to meaningfully engage in dialogue with their seniors about the prescribing rationale. This means that they often observe different prescribing patterns in different settings, without gaining a clear understanding of why prescribing choices differ. The programme theory explains what drives reluctance or willingness to ask questions about antimicrobial prescribing or to challenge the decisions made by seniors. Collective norms often take precedence over individual willingness of senior supervisors to being challenged and trainees generally refrain from asking questions. However, this takes different forms depending on the level of training, on how role modelling is managed and on how trust relationships are built and reinforced within teams.

Conclusions

Significant research efforts and resources are currently being channelled towards tackling AMR and establishing appropriate stewardship. However, few interventions to change the antimicrobial prescribing practice of doctors in training are designed and implemented in a way that pays adequate attention to the influence of contexts and the ways these change during clinical training. The IMPACT review adds to a growing literature that acknowledges the importance of the wider context and attempts to explain how and why antimicrobial prescribing practices can be better embedded in the hierarchical and interprofessional dynamics of different health-care settings. By taking into account the way trainees negotiate antibiotic prescribing in practice, the review identified a number of implications for how interventions (e.g. training programmes, improvement initiatives) can be tailored effectively for doctors in training. Tailoring antimicrobial prescribing stewardship for doctors in training could focus on the following areas.

1. Antimicrobial resistance as 'everyone's business': the influence of hierarchical dynamics points to the importance of establishing antimicrobial prescribing as an immediate priority for all health professionals, not just specific groups of prescribers. This would require wider culture change, especially for those who set prescribing norms in clinical settings.
2. Specific roles and responsibilities for doctors in training: clarity around the roles trainees should undertake in relation to antimicrobial prescribing may help to overcome uncertainty and communicate an expectation for this group to gain active responsibility. These roles would need to be adjusted as appropriate for different levels of training (e.g. an explicit role for trainees could be to review the necessity of antibiotics) and to be accepted by the wider prescribing environment.
3. Clarity about knowledge required: increased support may be needed in gaining the levels of knowledge, skill and capability required by doctors in training to fulfil antimicrobial prescribing responsibilities. It should also be considered whether or not trainees have enough opportunities to apply this knowledge in practice, in the context of established workplace hierarchies and the 'prescribing etiquette'.
4. Clear processes for seeking advice and support: providing trainees with easy access to advice and support on antimicrobial prescribing, including from senior consultants, antimicrobial pharmacists or other antimicrobial specialists, as well as guidelines or other decision aids.
5. Senior endorsement and reinforcement: ensuring that antimicrobial prescribing interventions and related changes are meaningfully supported by influential seniors in the workplace.
6. Fostering trust relationships: actively building and sustaining trust relationships between senior and junior members of the clinical team would provide a safe environment for doctors in training to ask questions and challenge 'just-in-case' prescribing, rather than blindly following practice.

Together with our stakeholder group, we have developed dissemination materials (infographic for use by intervention designers and an animation video for use by trainees/trainers) to enable optimal tailoring, design and implementation of antimicrobial prescribing interventions targeted at doctors in training.

Future research

1. Further research could focus more substantially on the role of interprofessional support and learning to promote appropriate antimicrobial prescribing and stewardship.
2. Interdisciplinary engagement would be necessary, in order to gain an in-depth understanding of hierarchical working and to highlight the importance of role modelling for different training levels.
3. 'Good' practice examples of trainee decision-making, learning and role modelling are needed from clinical settings with improved performance in their antimicrobial prescribing rates. This should also include an in-depth understanding of how clinicians manage competing priorities (e.g. sepsis/ antimicrobial stewardship) in practice.
4. The high-level principles presented in this review could be further developed for implementation in practice.

Study registration

This study is registered as PROSPERO CRD42015017802.

Funding

Funding for this study was provided by the Health Services and Delivery Research programme of the National Institute for Health Research.

Health Services and Delivery Research

ISSN 2050-4349 (Print)

ISSN 2050-4357 (Online)

This journal is a member of and subscribes to the principles of the Committee on Publication Ethics (COPE) (www.publicationethics.org/).

Editorial contact: journals.library@nihr.ac.uk

The full HS&DR archive is freely available to view online at www.journalslibrary.nihr.ac.uk/hsdr. Print-on-demand copies can be purchased from the report pages of the NIHR Journals Library website: www.journalslibrary.nihr.ac.uk

Criteria for inclusion in the *Health Services and Delivery Research* journal

Reports are published in *Health Services and Delivery Research* (HS&DR) if (1) they have resulted from work for the HS&DR programme or programmes which preceded the HS&DR programme, and (2) they are of a sufficiently high scientific quality as assessed by the reviewers and editors.

HS&DR programme

The Health Services and Delivery Research (HS&DR) programme, part of the National Institute for Health Research (NIHR), was established to fund a broad range of research. It combines the strengths and contributions of two previous NIHR research programmes: the Health Services Research (HSR) programme and the Service Delivery and Organisation (SDO) programme, which were merged in January 2012.

The HS&DR programme aims to produce rigorous and relevant evidence on the quality, access and organisation of health services including costs and outcomes, as well as research on implementation. The programme will enhance the strategic focus on research that matters to the NHS and is keen to support ambitious evaluative research to improve health services.

For more information about the HS&DR programme please visit the website: <http://www.nets.nihr.ac.uk/programmes/hsdr>

This report

The research reported in this issue of the journal was funded by the HS&DR programme or one of its preceding programmes as project number 13/97/24. The contractual start date was in June 2015. The final report began editorial review in December 2016 and was accepted for publication in June 2017. The authors have been wholly responsible for all data collection, analysis and interpretation, and for writing up their work. The HS&DR editors and production house have tried to ensure the accuracy of the authors' report and would like to thank the reviewers for their constructive comments on the final report document. However, they do not accept liability for damages or losses arising from material published in this report.

This report presents independent research funded by the National Institute for Health Research (NIHR). The views and opinions expressed by authors in this publication are those of the authors and do not necessarily reflect those of the NHS, the NIHR, NETSCC, the HS&DR programme or the Department of Health and Social Care. If there are verbatim quotations included in this publication the views and opinions expressed by the interviewees are those of the interviewees and do not necessarily reflect those of the authors, those of the NHS, the NIHR, NETSCC, the HS&DR programme or the Department of Health and Social Care.

© Queen's Printer and Controller of HMSO 2018. This work was produced by Papoutsi *et al.* under the terms of a commissioning contract issued by the Secretary of State for Health. This issue may be freely reproduced for the purposes of private research and study and extracts (or indeed, the full report) may be included in professional journals provided that suitable acknowledgement is made and the reproduction is not associated with any form of advertising. Applications for commercial reproduction should be addressed to: NIHR Journals Library, National Institute for Health Research, Evaluation, Trials and Studies Coordinating Centre, Alpha House, University of Southampton Science Park, Southampton SO16 7NS, UK.

Published by the NIHR Journals Library (www.journalslibrary.nihr.ac.uk), produced by Prepress Projects Ltd, Perth, Scotland (www.prepress-projects.co.uk).

Health Services and Delivery Research Editor-in-Chief

Professor Jo Rycroft-Malone Professor of Health Services and Implementation Research, Bangor University, UK

NIHR Journals Library Editor-in-Chief

Professor Tom Walley Director, NIHR Evaluation, Trials and Studies and Director of the EME Programme, UK

NIHR Journals Library Editors

Professor Ken Stein Chair of HTA and EME Editorial Board and Professor of Public Health, University of Exeter Medical School, UK

Professor Andrée Le May Chair of NIHR Journals Library Editorial Group (HS&DR, PGfAR, PHR journals)

Dr Martin Ashton-Key Consultant in Public Health Medicine/Consultant Advisor, NETSCC, UK

Professor Matthias Beck Professor of Management, Cork University Business School, Department of Management and Marketing, University College Cork, Ireland

Dr Tessa Crilly Director, Crystal Blue Consulting Ltd, UK

Dr Eugenia Cronin Senior Scientific Advisor, Wessex Institute, UK

Dr Peter Davidson Director of the NIHR Dissemination Centre, University of Southampton, UK

Ms Tara Lamont Scientific Advisor, NETSCC, UK

Dr Catriona McDaid Senior Research Fellow, York Trials Unit, Department of Health Sciences, University of York, UK

Professor William McGuire Professor of Child Health, Hull York Medical School, University of York, UK

Professor Geoffrey Meads Professor of Wellbeing Research, University of Winchester, UK

Professor John Norrie Chair in Medical Statistics, University of Edinburgh, UK

Professor John Powell Consultant Clinical Adviser, National Institute for Health and Care Excellence (NICE), UK

Professor James Raftery Professor of Health Technology Assessment, Wessex Institute, Faculty of Medicine, University of Southampton, UK

Dr Rob Riemsma Reviews Manager, Kleijnen Systematic Reviews Ltd, UK

Professor Helen Roberts Professor of Child Health Research, UCL Institute of Child Health, UK

Professor Jonathan Ross Professor of Sexual Health and HIV, University Hospital Birmingham, UK

Professor Helen Snooks Professor of Health Services Research, Institute of Life Science, College of Medicine, Swansea University, UK

Professor Jim Thornton Professor of Obstetrics and Gynaecology, Faculty of Medicine and Health Sciences, University of Nottingham, UK

Professor Martin Underwood Director, Warwick Clinical Trials Unit, Warwick Medical School, University of Warwick, UK

Please visit the website for a list of members of the NIHR Journals Library Board:
www.journalslibrary.nihr.ac.uk/about/editors

Editorial contact: journals.library@nihr.ac.uk