

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

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Scientific Summary

Background

The burden of Anti-Microbial 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 to reduced efficiency of existing antimicrobial agents. It has been estimated that by 2050 there will be 10 million deaths a year globally due to drug resistance and the total cost of lost production will come to US\$100 trillion. 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' which determine whether 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

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realist approach for evidence synthesis. A realist review is an interpretive, theory-driven approach to synthesizing 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, (5) Synthesising the evidence and drawing conclusions. To this we have added Step (6), to highlight 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, PsycINFO, Web of Science, CENTRAL, Cochrane Database of Systematic Reviews, HTA database and ASSIA. We also undertook forward citation chasing (using Google Scholar) 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 was also assessed. Considerations of rigour and relevance were often interrelated, 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 dataset 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), focusing first on the richest sources, i.e. articles with 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 re-scrutinised 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 (CMOCs). This included adding explanatory text through abductive and retroductive analysis, 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 has 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, 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 main and additional literature search. Very limited inconsistencies were identified in 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 programme theory. Of the 131 references, 78 used quantitative methods, 37 used qualitative methods, 12 were mixed methods papers, and there were also 3 position papers and 1 report.

This realist review moves beyond identifying barriers 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

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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: (a) there are primarily hierarchical relationships, (b) powerful prescribing norms are often implicitly in place, (c) there is little clarity around what roles and responsibilities doctors-in-training should undertake in relation to antimicrobial prescribing, and (d) 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 – by doctors-in-training, such as fear of criticism, fear of having individual responsibility for patients deteriorating, need to manage one's reputation and position in the team, and need to appear as 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 lack of opportunities to meaningfully engage in dialogue with their seniors about the prescribing rationale. This means 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 effort and resources are currently being channelled towards tackling antimicrobial resistance 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 inter-professional dynamics of different healthcare settings. By taking in account the way trainees negotiate antibiotic prescribing in practice, the review identified a number of implications on 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. AMR as 'everyone's business': The influence of hierarchical dynamics points to the importance of establishing antimicrobial prescribing as an important and 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 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 enough opportunities exist for trainees 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 senior consultants, antimicrobial pharmacists or other antimicrobial specialists, as well as guidelines or other decisions aids.

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5. Senior endorsement and reinforcement: Ensuring 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 inter-professional 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

The study has been registered with PROSPERO (CRD42015017802).

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