# Exploring the implementation of interventions to reduce antibiotic use (ENACT study)

Appendices H, I and J

# Contents

# Appendix H: Behavioural content of effective research interventions

**Table H1. Behavioural content of effective research interventions**

Abbreviations used in this table

BCTs = behaviour change techniques

CRP POCT = c-reactive protein point-of-care testing

HCPs = healthcare professionals targeted in interventions

RTIs = respiratory tract infections

| First author, year, title | Setting: targeted health care professionals | Intervention | Behaviour change techniques | Theoretical domains framework domain | Intervention function |
|---|---|---|---|---|---|
| McNulty 2018<br><br>Effects of primary care antimicrobial stewardship outreach on antibiotic use by general practice staff: pragmatic randomized controlled trial of the TARGET antibiotics workshop | General practice: all staff | TARGET workshop<br><br>One hour workshop facilitated by existing NHS healthcare staff with promotion of TARGET website resources | • credible source<br>• information about health consequences<br>• information about social, environmental consequences<br>• instruction on how to perform behaviour<br>• feedback on behaviour<br>• social comparisons<br>• adding objects to the environment<br>• behavioural substitution<br>• action planning<br>• self-monitoring of behaviour<br>• monitoring of behaviour by others<br>• social support (practical)<br>• social support (unspecified)<br>• demonstrating behaviour<br>• incentive | • social influences<br>• beliefs about consequences<br>• environmental context and resources<br>• skills<br>• knowledge<br>• behavioural regulation | • environmental restructuring<br>• enablement<br>• incentivisation<br>• persuasion<br>• education<br>• training |
| Hallsworth 2016<br><br>Provision of social norm feedback to high prescribers of antibiotics in general practice: a pragmatic national randomised controlled trial | General practice: prescribers | Feedback intervention<br><br>Letter from England's Chief Medical Officer stating that the practice was at a higher rate of antibiotics prescribing than 80% of local practices) plus a patient leaflet | • feedback on behaviour<br>• social comparisons<br>• credible source<br>• instruction on how to perform the behaviour<br>• adding objects to the environment<br>• behavioural substitution<br>• information about health consequences | • knowledge<br>• social influences<br>• skills<br>• environmental context and resources<br>• behavioural regulation<br>• optimism<br>• beliefs about consequences | • education<br>• persuasion<br>• training<br>• environmental restructuring<br>• enablement |
| Gulliford 2014<br><br>Electronic health records for intervention research: a cluster randomized trial to reduce antibiotic prescribing in primary care (eCRT study) | General practice: prescribers | Decision support tools, electronically delivered and remotely installed, accessed during consultations<br><br>[Reported issues: low utilization in some practices, perhaps as some GPs enter | • adding objects to the environment<br>• prompts, cues<br>• behaviour substitution<br>• instruction on how to perform behaviour<br>• demonstrating the behaviour<br>• information about health consequences<br>• information about social, environmental consequences<br>• verbal persuasion about capability<br>• social support (unspecified) | • environmental context and resources<br>• memory, attention, decision making<br>• behavioural regulation<br>• skills<br>• knowledge<br>• beliefs about consequences<br>• social influences | • environmental restructuring<br>• enablement<br>• training<br>• education<br>• persuasion |

| First author, year, title | Setting: targeted health care professionals | Intervention | Behaviour change techniques | Theoretical domains framework domain | Intervention function |
|---|---|---|---|---|---|
| | | read codes after consultation; unable to ensure all prescribers saw the training materials and video] | | | |
| Little 2013a<br>Effects of internet-based training on antibiotic prescribing rates for acute respiratory-tract infections: a multinational, cluster, randomised, factorial, controlled trial (GRACE INTRO) | General practice: prescribers | 1) CRP POCT: provision of testing equipment and training including instructions on when and how to use the tests<br>2) Training in enhanced communication skills: how to negotiate management decisions with patients | • adding object to the environment<br>• behaviour substitution<br>• instruction on how to perform behaviour<br>• demonstrating the behaviour<br>• social support (unspecified)<br>• social support (practical)<br>• information about health consequences<br>• information about social, environmental consequences<br>• credible source | • environmental context and resources<br>• behavioural regulation<br>• skills<br>• social influences<br>• beliefs about consequences | • environmental restructuring<br>• enablement<br>• training<br>• persuasion<br>• education |
| Little 2013b<br>Clinical score and rapid antigen detection test to guide antibiotic use for sore throats: randomised controlled trial of PRISM (primary care streptococcal management) | General practice: prescribers | 1) Delayed prescription to be collected after 3 to 5 days if symptoms are not better or get worse<br>2) Clinical score (FeverPAIN),<br>3) Rapid antigen test used with clinical score (FeverPAIN) | • adding object to the environment<br>• instruction on how to perform behaviour<br>• information about health consequences | • environmental context and resources<br>• skills<br>• beliefs about consequences | • environmental restructuring<br>• training<br>• education |
| Butler 2012<br>Effectiveness of multifaceted educational programme to reduce antibiotic dispensing in primary care: practice based randomised controlled trial (STAR) | General practice: prescribers | Educational programme (STAR) including a practice seminar, online training and practice of consulting skills | • self-monitoring of behaviour<br>• information about health consequences<br>• information about social and environmental consequences<br>• instruction on how to perform behaviour<br>• demonstrating the behaviour<br>• credible source<br>• behavioural practice or rehearsal<br>• social support (unspecified)<br>• social support (practical)<br>• feedback on behaviour<br>• feedback on outcome<br>• social comparisons<br>• non-specific reward | • behavioural regulation<br>• beliefs about consequences<br>• skills<br>• social influences<br>• knowledge<br>• reinforcement | • enablement<br>• education<br>• training<br>• persuasion<br>• incentivisation |
| Francis 2009<br>Effect of using an interactive booklet about childhood respiratory tract infections in primary care | General practice: prescribers | Training in the use of interactive booklet on RTIs and use of the booklet in consultations | • adding object to the environment<br>• behavioural substitution<br>• instruction on how to perform the behaviour<br>• social support (unspecified)<br>• prompts, cues | • environmental context and resources<br>• behavioural regulation<br>• skills<br>• social influences | • environmental restructuring<br>• enablement<br>• training<br>• persuasion |

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| First author, year, title | Setting: targeted health care professionals | Intervention | Behaviour change techniques | Theoretical domains framework domain | Intervention function |
|---|---|---|---|---|---|
| consultations on reconsulting and antibiotic prescribing: a cluster randomised controlled trial | | | • demonstrating the behaviour | • memory, attention, decision making | |
| Cox 2001<br>Is it possible to decrease antibiotic prescribing in primary care? An analysis of outcomes in the management of patients with sore throats | General practice: prescribers | Revised evidence-based protocol for management of uncomplicated sore throats (focused on low antibiotics use) | • feedback on behaviour<br>• information about health consequences<br>• action planning<br>• instruction on how to perform the behaviour | • knowledge<br>• beliefs about consequences<br>• behavioural regulation<br>• skills | • education<br>• enablement |
| McNulty 2000<br>Primary care workshops can reduce and rationalize antibiotic prescribing | General practice: prescribers | Workshops on antibiotics prescribing: 1.5 to 2 hours, presentation of a poster, discussion of new antibiotics prescribing guidelines, key messages<br>[compared to no workshops or tutorials by a microbiologist] | • feedback on behaviour<br>• social comparisons<br>• instruction on how to perform the behaviour<br>• social support (unspecified) | • knowledge<br>• social influences<br>• skills | • education<br>• persuasion<br>• enablement |

# Appendix I: Theoretical congruence between BCTs, intervention functions and TDF domains

**Table I1. Theoretical congruence between BCTs and TDF domains**

Notes

In column one BCTs marked with an n in square brackets [n] were not in the matrix and were matched with theoretically congruent TDF domains based on a discussion with, and expertise of, the local authority.

In column 6, following the methods used in the previous CAUTI project and the pre-defined matrix (2), high theoretical congruence between BCTs and TDF domains was defined as a BCT being paired with 2 or more of the theoretically-matching key TDF domains (or with one key TDF domain if only one domain was theoretically linked to that BCT, according to the matrix). Medium congruence was defined as a BCT being paired with one key TDF domain (out of more than one domain theoretically linked in the matrix). Low congruence was defined as a BCT not being paired with any of the key TDF domains.

BCTs with a high congruence are coloured green, medium congruence coloured amber, low congruence coloured red.

| BCTs | National interventions (n=26) | Research interventions (n=5) | Linked TDF domains (according to matrix; key domains in bold) | TDF domain ranking (RQ1) | Theoretical congruence between BCT TDF domain |
|---|---|---|---|---|---|
| Instruction on how to perform a behaviour [n] | 24 | 5 | Skills | 3 | High |
| Information about health consequences | 14 | 3 | Beliefs about consequences<br>Knowledge | 1<br>8 | Medium |
| Adding objects to the environment | 9 | 3 | Environmental context and resources | 4 | High |

| BCTs | National interventions (n=26) | Research interventions (n=5) | Linked TDF domains (according to matrix; key domains in bold) | TDF domain ranking (RQ1) | Theoretical congruence between BCT TDF domain |
|---|---|---|---|---|---|
| Feedback on behaviour | 7 | 2 | Beliefs about consequences<br>Knowledge<br>Beliefs about capabilities<br>Goals | 1<br>8<br>9<br>0 | Medium |
| Credible source | 7 | 1 | Beliefs about consequences<br>Intentions<br>Goals | 1<br>5<br>0 | High |
| Action planning | 6 | 1 | Intentions<br>Goals<br>Memory, attention, decision making<br>Behavioural regulation | 5<br>0<br>10<br><br>0 | Medium |
| Demonstrating the behaviour | 4 | 3 | Social Influences<br>Skills | 2<br>3 | High |
| Information about social, environmental consequences | 5 | 2 | Beliefs about consequences<br>Knowledge | 1<br>8 | Medium |
| Social comparisons | 6 | 1 | Social influences | 2 | High |

| BCTs | National interventions (n=26) | Research interventions (n=5) | Linked TDF domains (according to matrix; key domains in bold) | TDF domain ranking (RQ1) | Theoretical congruence between BCT TDF domain |
|---|---|---|---|---|---|
| Social support (practical) | 6 | 1 | Social influences<br>Intentions<br>Beliefs about capabilities<br>Social or professional role and identity<br>Goals | 2<br>5<br>9<br><br>7<br>0 | High |
| Identification of self as a role model | 6 | 0 | Social influences | 2 | High |
| Self-monitoring of behaviour | 6 | 0 | Beliefs about consequences<br>Skills<br>Memory, attention, decision making<br>Behavioural regulation<br>Beliefs about capabilities | 1<br><br>3<br>10<br>9<br>0 | High |
| Social support (unspecified) | 2 | 4 | Social influences<br>Social or professional role and identity | 2<br>7 | Medium |
| Behavioural substitution | 2 | 3 | Behavioural regulation | 0 | Low |
| Feedback on outcome of behaviour | 5 | 0 | Beliefs about consequences<br>Knowledge<br>Beliefs about capabilities | 1<br>8<br>9 | Medium |

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| BCTs | National interventions (n=26) | Research interventions (n=5) | Linked TDF domains (according to matrix; key domains in bold) | TDF domain ranking (RQ1) | Theoretical congruence between BCT TDF domain |
|---|---|---|---|---|---|
| | | | Goals | 0 | |
| Behavioural practice or rehearsal | 3 | 0 | Skills<br>Beliefs about capabilities | 3<br>9 | Medium |
| Self-monitoring of outcomes | 3 | 0 | Beliefs about consequences<br>Beliefs about capabilities<br>Memory, attention, decision making | 1<br>9<br><br>10 | Medium |
| Prompts or cues | 1 | 2 | Environmental context and resources<br>Memory, attention, decision making<br>Behavioural regulation | 4<br><br>10<br><br>0 | Medium |
| Future punishment [n] | 2 | 0 | Intentions<br>Emotions<br>Goals<br>Reinforcement | 5<br>6<br>0<br>11 | High |
| Non-specific reward | 2 | 0 | Skills<br>Goals<br>Reinforcement | 3<br>0<br>11 | Medium |

| BCTs | National interventions (n=26) | Research interventions (n=5) | Linked TDF domains (according to matrix; key domains in bold) | TDF domain ranking (RQ1) | Theoretical congruence between BCT TDF domain |
|---|---|---|---|---|---|
| Salience of consequences | 2 | 0 | Beliefs about consequences<br>Knowledge | 1<br>8 | Medium |
| Social or non-material reward | 2 | 0 | Social Influences | 2 | High |
| Commitment | 1 | 0 | Intentions<br>Goals | 5<br>0 | Medium |
| Focus on past success | 1 | 0 | Beliefs about capabilities | 9 | Low |
| Framing or reframing [n] | 1 | 0 | Beliefs about consequences<br>Optimism | 1<br>0 | Medium |
| Goal setting | 1 | 0 | Skills<br>Intentions<br>Behavioural regulation<br>Beliefs about capabilities<br>Goals | 3<br>5<br>0<br>9<br>0 | High |
| Material reward | 1 | 0 | Skills<br>Reinforcement | 3<br>11 | Medium |
| Pharmacological support [n] | 1 | 0 | Skills | 3 | High |
| Problem solving | 1 | 0 | Goals<br>Beliefs about capabilities | 0<br>9 | Low |

| BCTs | National interventions (n=26) | Research interventions (n=5) | Linked TDF domains (according to matrix; key domains in bold) | TDF domain ranking (RQ1) | Theoretical congruence between BCT TDF domain |
|---|---|---|---|---|---|
| Pros and cons | 1 | 0 | Beliefs about consequences | 1 | High |
| Restructuring the physical environment | 1 | 0 | Environmental context and resources | 4 | High |
| Incentive | 1 | 0 | Skills | 3 | High |
| Monitoring of behaviour by others | 1 | 0 | Skills | 3 | High |
| Verbal persuasion about capabilities | 0 | 1 | Beliefs about capabilities<br>Optimism<br>Goals | 9<br>0<br>0 | Low |

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**Table I2. Theoretical congruence between intervention functions and Theoretical Domains Framework domains**

This table shows the theoretical congruence between the 9 intervention functions in the Behaviour Change Wheel, and the 6 key Theoretical Domains Framework domains. Cells in green with 'match' written inside indicate that this intervention function was appropriate for the relative domain and was identified in the interventions reviewed. Cells in red with 'miss' written inside indicate that this intervention function was appropriate for the relative domain but was not identified in the interventions reviewed. An accessible text version is provided below the table.

| Key 6 TDF domains | Intervention functions (Number of interventions serving each function; 26 national and 5 research interventions, max N=31) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Education (n=23) | Persuasion (n=12) | Incentivisation (n=9) | Coercion (n=2) | Training (n=27) | Restriction (n=0) | Environmental restructuring (n=6) | Modelling (n=3) | Enablement (n=24) |
| Beliefs about consequences | Match | Match | | | | | | Match | |
| Social influences | | | | | | Miss | Match | Match | Match |
| Skills | | | | | Match | | | | |
| Environmental context and resources | | | | | Match | Miss | Match | | Match |
| Intentions | Match | Match | Match | Match | | | | Match | |
| Emotion | | Match | Match | Match | | | | Match | Match |

Education was identified in 23 interventions, and was a match for beliefs about consequences and intentions. Persuasion was identified in 12 interventions, and was a match for beliefs about consequences, intentions and emotion. Incentivisation was

identified in 9 interventions and was a match for intentions and emotion. Coercion was identified in 2 interventions and was a match for intentions and emotion. Training was identified in 27 interventions and was a match for skills and environmental context and resources. Restriction was not identified in any interventions, despite being a match for social influences and environmental context and resources (and was therefore considered a missed opportunity). Environmental restructuring was identified in 6 interventions and was a match for social influences and environmental context and resources. Modelling was identified in 3 interventions and was a match for beliefs about consequences, social influences, intentions and emotion. Enablement was identified in 24 interventions and was a match for social influences, environmental context and resources and emotion.

# Appendix J: Suggestions for intervention modifications or new intervention components

**Table J1. Summary of the stakeholder consultation**

<span style="color:#8B2332">Notes</span>

Abbreviations used in the table: B = barrier, BCT = behaviour change technique, F = facilitator, GP = general practitioner, TDF = theoretical domains framework.

| Influences on antibiotic prescribing identified by the stakeholders | Intervention modifications or new intervention components suggested by the stakeholders |
|---|---|
| **All settings (not setting-specific)** | |
| • Providing specific data or feedback on individual prescribing reported as a helpful strategy.<br>• Differences in local guidelines and in interpretations may cause confusion on what is appropriate prescribing.<br>• Guidelines are available but dissemination and use is more problematic (guideline 'overload', no time to read them).<br>• Many good interventions are available but perhaps too many and in different places so it is unclear what is best to do.<br>• Impact of individual personalities and attitudes to, or ways of, managing risk in healthcare affects antibiotic prescribing.<br>• Being more junior to the high or inappropriate prescriber makes it difficult to influence that prescriber.<br>• Importance of consistency of messages and advice given across pharmacies, pharmacists, and GPs. | • Incentivise completing AMS training (for example, as part of CPD, CQP, appraisal, contracts). (Although there was no agreement on who should provide the incentives, for example, NHSE or CCGs).<br>• Incentivise adherence to guidelines (as above).<br>• Offer financial incentives for intended change.<br>• Make AMS training mandatary (for example, as part of CPD, appraisal).<br>• Tailor education or training to patient-facing and not patient-facing roles.<br>• Identify high prescribers and provide tailored interventions, support, and advice.<br>• Provide diagnostics, for example, CRP tests. (Although there were ambivalent views whether they would help or not). |

| Influences on antibiotic prescribing identified by the stakeholders | Intervention modifications or new intervention components suggested by the stakeholders |
|---|---|
| • Access to healthcare services (for example, perceived lack of access increases prescribing, for example on Friday afternoon).<br>• Decision-making fatigue linked to workload and timing when the prescribing decisions are made.<br>• Communication structures and working in silos, for example, CCG might communicate with GPs but OOH and pharmacies seem excluded from these networks.<br>• Whether prescribers have and use unique prescriber codes affects whether their prescribing can be tracked, monitored, accounted for (for example, unique codes not used by OOH prescribers, locums or dentists).<br>• Care-takers behaviours affect antibiotic taking in care homes.<br>• Importance of seeing a value in the intervention; otherwise it can end up being a tick box exercise.<br>• Need to prioritise AMS in everything, rather than seeing or presenting it as a separate issue.<br>• Basic knowledge, awareness and literature or guidelines supplied are currently sufficient; everyone knows what we *should* do and try to apply this.<br>• Lack of understanding of the importance of AMR and consequences of AMR; not seeing the impact of AMR.<br>• Data on resistance and local resistance patterns may be helpful in influencing change in antibiotic prescribing.<br>• Online training can be helpful but people have no time to do it if it is not mandatory and/or if they don't see value in it. | • Make the networks more inclusive and multi-professional (for example, include pharmacists and OOH staff in primary care networks, disseminate information to OOH and pharmacies, invite HPCs from different services to AMS training).<br>• Invite pharmacists working within general practices to come to CCG or locality meetings so that they are aware of the local AMS agenda and actions.<br>• Multi-professional small group-based learning sets.<br>• Make TARGET toolkit into an app.<br>• Provide (better) access to data on local antimicrobial resistance. Link antibiotic prescribing data with AMR data.<br>• Address concerns about sepsis (for example, one short summary or checklist of red-flag symptoms targeted at general practice, OOH or pharmacy (rather than hospitals as it is currently)).<br>• Incorporate tools or interventions into the clinical systems nationally to make them easy to use (for example, links to guidelines, guidelines updates, clinical scores, leaflets, Antibiotics Icon, and so on). |

| Influences on antibiotic prescribing identified by the stakeholders | Intervention modifications or new intervention components suggested by the stakeholders |
|---|---|
| • Patient expectations for antibiotics (can be fuelled by other HCPs, for example, community pharmacist or nurse, or past prescribing, but slowly improving with national campaigns).<br>• Concern about risks of not prescribing and sepsis.<br>• Easy access to patient leaflets (for example, incorporated into clinical systems) is helpful.<br>• Importance of the channels how the AMS training and resources are advertised and who underwrites it (for example, RCGP for TARGET).<br>• Having more case studies to see how CRP tests can work. | |
| **General practice** | |
| • Hospital consultants asking GPs to prescribe antibiotics, even if not necessary.<br>• Incentives and targets help.<br>• Timing of consultations (for example, Friday afternoon syndrome).<br>• Time pressure and workload (quicker to give a prescription).<br>• Decision fatigue.<br>• Perception of signs and symptoms (those who want to prescribe are more likely to interpret or record the signs and symptoms as indicating a need for antibiotics).<br>• Prescribers (for example, locums) may use other GPs' codes so it is not always clear who wrote the prescriptions.<br>• Diagnostics used to confirm diagnoses and educate patients. Uptake seems to be low and inconsistent. They are expensive. Doubts about accuracy and whether they would not have unintended consequences. | • Audit prescribing in all practices, provide feedback and identify and address the underlying reasons for high prescribing rates.<br>• Audit individual prescribing, provide feedback and work with individual high prescribers to address issues or reasons for high or inappropriate prescribing.<br>• Provide training to the 'front-of-the-house' practice staff (including receptionists and community pharmacy assistants) in giving self-care advice and signposting patients.<br>• Peer review prescribing between GPs (for example, as part of an appraisal process).<br>• Make audit of prescribing in practices mandatory. |

| Influences on antibiotic prescribing identified by the stakeholders | Intervention modifications or new intervention components suggested by the stakeholders |
|---|---|
| | • Incorporate guidelines into clinical system and decision support tools. |
| **Out-of-hours** | |
| • [Similar influences as in general practice (especially if they are 'extended access' surgeries), with some reported specifically for OOH.]<br>• The story that the patient presents, how many times the patient was already seen by a HCP, influences prescribing decision.<br>• Lack of awareness of local guidelines as in OOH there are often prescribers from various places (inductions are very quick).<br>• Time pressure and workload; how busy OOH is; time available for consultations; timing of the consultation.<br>• Lack of communication from the CCG, for example, about guidelines updates, training opportunities.<br>• Auditing prescribing in OOH is difficult as OOH don't have a specific geographical area or population linked.<br>• Manual audit of individual prescribing decisions and giving specific messages to the prescribers (for example, links to guidelines) can be helpful.<br>• In OOH prescribers do not use individual codes so automated audit of individual prescribing is not possible.<br>• Lack of accountability for prescribing as prescribing is not monitored by the CCG.<br>• No incentives or training offered to OOH (such as those offered to general practices) but these would be helpful in OOH too. | • Develop or improve tools, system or software to audit prescribing and give personalised messages (for example, pointing out to specific guidelines).<br>• Audit individual prescribing to identify inappropriate prescribing and provide personalised advice and/or information or training.<br>• Improve dissemination of guidelines (and guidelines updates) to OOH providers and prescribers.<br>• Make AMS training (for example, in CCGs, NHSE) available to OOH staff and invite them.<br>• Improve dissemination of information about training opportunities to OOH.<br>• Improve induction for new prescribers in OOH. |

| Influences on antibiotic prescribing identified by the stakeholders | Intervention modifications or new intervention components suggested by the stakeholders |
|---|---|
| • Lack of follow-up of patients to see if treatment plan worked – can stifle learning and confidence in decision making.<br>• Difficulty seeing patients' notes due to different computer systems.<br>• No access to lab results.<br>• Lack of understanding and accountability for using broad-spectrum antibiotics. | |
| **Community pharmacy** | |
| • Access (or lack of) to diagnostics (or lack of it) in pharmacies to check or reassure whether illness is minor:<br>    o differences in services commissioned by the NHS and offered in private pharmacies, for example, POCT in pharmacies is not commissioned by the NHS but is used in private pharmacies (for example, throat swabs paid for by patients)<br>• Concern over whether the use of diagnostics would actually drive prescribing up for financial benefit.<br>• Limited influence of the NHS or PHE over private services.<br>• Many different providers and computer systems.<br>• Who is in the pharmacy team (for example, a pharmacist prescriber, dispenser, counter assistant, pharmacy technician) – with varying degrees of training and experience.<br>• Patient presentations and expectations:<br>    o patients may know who in the pharmacy can prescribe and ask them specifically for antibiotics<br>    o how patients describe their symptoms influences the perception of illness and what to advise | • Provide skills training in giving self-care advice delivered to the whole pharmacy teams in order to:<br>    o ensure a good level and mix of *skills* in the pharmacy team (considering varying roles and level of experience or training)<br>    o develop *confidence* to be able to give self-care advice and not prescribe antibiotics and not automatically direct patients to a GP<br>    o ensure consistent messages about self-care and antibiotics<br>    o manage patient expectations for antibiotics<br>    o Training to include:<br>        o structured way(s) of asking patients the right questions and identifying red-flags<br>        o support or encouragement to pharmacy staff to provide self-care advice<br>        o unified or consistent ways of providing self-care advice |

| Influences on antibiotic prescribing identified by the stakeholders | Intervention modifications or new intervention components suggested by the stakeholders |
|---|---|
| <ul><li>○ patient expectation for free-of-charge medicines – pharmacists may not prescribe if there is no value in the medicine</li><li>Confidence and skills of pharmacy staff in asking the right questions and making a decision about what to advise the patient (self-care, going to a GP or to a hospital). Their confidence in clinical knowledge.</li><li>Confidence to give self-care advice is often low leading to over safety-netting and telling too many patients to see a GP.</li><li>Community pharmacists advising patients to see a GP creates a patient expectation for antibiotics (then harder for GPs to say no).</li><li>Lack of incentives to change, for example, to use patient leaflets.</li><li>Access to patient records - not used much in pharmacies (unclear why); easier to access patient records if the pharmacy is on the practice premises and they have a practice computer with access to records which helps with collaborative working.</li></ul> | <ul><li>○ promote using patient leaflets on symptom duration</li><li>○ promote signposting patients to self-help advice online</li><li>Promote using patient records to review whether antibiotics were prescribed appropriately.</li><li>Encourage pharmacists to challenge prescribing decisions (if they had access to and knew guidelines and diagnosis).</li><li>Provide access to diagnostics in community pharmacies (to address lack of confidence to decide whether illness is serious or self-care advice will be sufficient, but would need to be used with guidelines, and would need to offer training in how to use the tests).</li></ul> |

**Table J2. All identified suggestions for intervention modifications or new intervention components**

In column one barriers suggested by the stakeholders are indicated with "[stakeholder]" and were not coded into TDF domains. Barriers and facilitators for community pharmacy were only reported by stakeholders due to lack of research studies identified in this setting. The barriers and facilitators do not match exactly with the intervention suggestions because they are derived from, and defined on the basis of, the qualitative literature review (RQ1). Intervention suggestions were matched with the closest matching barriers or facilitators.
In column one key TDF indicators are given in square brackets.
In column 4 the BCTs listed are suggestions of BCTs that could be included in the intervention suggestions (for modifications or new intervention components); the exact BCTs would depend on how exactly the intervention suggestion was translated into intervention components and how these would be delivered. For example, providing training could, as an option, include 'demonstrating the behaviour' and 'behavioural practice or rehearsal'.

Abbreviations used in this table
B = barrier, BCT = behaviour change technique, F = facilitator, GP = general practitioner, TDF = theoretical domains framework.

| Barriers (B) or facilitators (F) addressed [key TDF domains or indication of stakeholder suggestion in square brackets] | Source of the suggestions | Suggested intervention components (intervention modifications or new components) | Behaviour change techniques | Included or excluded from the survey |
|---|---|---|---|---|
| For all settings (general practice, out-of-hours, community pharmacy) | | | | |
| F: Learning from peers on whether they can improve and how and about alternative prescribing techniques [Social influences] | Stakeholders | 1. Multi-disciplinary small group learning (for example, including GPs, nurses, pharmacists, CCG staff) to identify ways to improve implementation of AMS initiatives and share examples of good practice and | Social support (unspecified), Social support (practical) | Included (as #1) |

| Barriers (B) or facilitators (F) addressed [key TDF domains or indication of stakeholder suggestion in square brackets] | Source of the suggestions | Suggested intervention components (intervention modifications or new components) | Behaviour change techniques | Included or excluded from the survey |
|---|---|---|---|---|
| | | actions taken by others as part of AMS. | | |
| B: Clinical uncertainty; fear of missing a serious illness as a threat to professional expertise [Beliefs about consequences]; lack of access to POC diagnostic testing<br>F: access to POC diagnostics testing [Environmental context and resources] | Stakeholders; research evidence | 2. Provide diagnostic CRP testing, including training in using it and interpreting the results. | Adding object to the environment;<br>Information about health consequences;<br>Instruction how to perform behaviour;<br>Demonstrate behaviour | Included (as #7) |
| F: Knowledge of and access to case studies on how CRP testing works [stakeholder] | Stakeholders | 3. Provide case studies on implementation of CRP testing to better understand how CRP testing can work in different settings and to provide role models. | Information about social and environmental consequences;<br>Role modelling | Excluded |
| B: Disintegrated services and communication structures [stakeholder] | Stakeholders | 4. Co-organise AMS events together with different professional networks (for example, GPs, nurses, pharmacists, | Social support (practical) | Included (as #2) |

| Barriers (B) or facilitators (F) addressed [key TDF domains or indication of stakeholder suggestion in square brackets] | Source of the suggestions | Suggested intervention components (intervention modifications or new components) | Behaviour change techniques | Included or excluded from the survey |
|---|---|---|---|---|
| F: multi-disciplinary networks [stakeholder] | | OOH staff) to facilitate multi-disciplinary work and improve dissemination of information about AMS events and training to all professional networks. | | |
| F: Advice from or influence of relevant experts [Social influences], providing or underwriting the intervention by relevant people or organisations, for example, RCGP, BMA [stakeholder] | Stakeholders; research evidence | 5. Use relevant and credible sources to promote AMS and engagement with under-used AMS interventions. | Credible source | Included (as #3) |
| F: Ability to educate patients in consultations [Skills]; access to and use of patient leaflets helping to explain no-prescribing decisions and providing advice [Environmental context and resources] | Stakeholders, research evidence | 6. Promote higher uptake and interactive use of patient leaflets (for example, through training, role models, credible sources and peers promoting them) by all healthcare professionals in general practice, OOH and community pharmacy. | Adding object to the environment, Behaviour substitution, Social support (unspecified), Role modelling, Credible source | Excluded |

| Barriers (B) or facilitators (F) addressed [key TDF domains or indication of stakeholder suggestion in square brackets] | Source of the suggestions | Suggested intervention components (intervention modifications or new components) | Behaviour change techniques | Included or excluded from the survey |
|---|---|---|---|---|
| B: Inconsistent approaches to antibiotics prescribing [Environmental context and resources] <br> F: adopting guidelines or evidence as a standard practice (with intention to follow them) [Intentions] | Researchers, research evidence | 7. Agree on a consistent approach to antibiotic prescribing within an organisation (for example, make an action plan, agree a practice protocol on treating certain infections). | Action planning, Instructions on how to perform behaviour | Included (as #6) |
| F: Advice from and influence of relevant experts [Social influences] | Researchers | 8. Increase and standardise the role of CCG medicines optimisation teams and their responsibilities across all CCGs (for example, all CCGs to have adequate number of prescribing advisors and/or pharmacists to work more closely with practices, OOH and community pharmacies (for example, in auditing prescribing, disseminating information, providing training and advice). | Restructuring the social environment | Included (as #4) |

| Barriers (B) or facilitators (F) addressed [key TDF domains or indication of stakeholder suggestion in square brackets] | Source of the suggestions | Suggested intervention components (intervention modifications or new components) | Behaviour change techniques | Included or excluded from the survey |
|---|---|---|---|---|
| B: Variation in the skills and experience among staff (in particular reported for pharmacy teams) [stakeholder] | Stakeholders | 9. Provide AMS-related training to all patient-facing staff within an organisation to improve and minimise variation in skills and to ensure a consistent approach to providing advice to patients and antibiotic prescribing. | Restructuring the social environment; Instruction on how to perform the behaviour | Included (as #5) |
| F: Ability to elicit and address patient's concerns and expectations; ability to prepare a patient for, and justify, a decision whether to prescribe or not; ability to educate patients in consultations<br>B: lack of such abilities [Skills] | Stakeholders; research evidence | 10. Promote higher uptake of training (for example, STAR) including evidence to prescribers that patients expect reassurance and addressing their concerns, not necessarily a prescription, and development of skills, including:<br>• eliciting and addressing patients' concerns and expectations<br>• preparing patients for a decision whether to prescribe antibiotics or not | Instruction on how to perform the behaviours; Information about social and environmental consequences<br><br>(Could also include: Demonstrate behaviour, practice or rehearsal – depending on how the training is designed) | Excluded |

| Barriers (B) or facilitators (F) addressed [key TDF domains or indication of stakeholder suggestion in square brackets] | Source of the suggestions | Suggested intervention components (intervention modifications or new components) | Behaviour change techniques | Included or excluded from the survey |
|---|---|---|---|---|
| | | • educating patients about self-limiting illness and antibiotics<br>• providing self-care advice and sign-posting patients to sources of self-care information<br>• maintaining good relationship with patient and patient satisfaction (in ways other than by giving a prescription when inappropriate)<br>• ability to do that in a time-efficient way | | |
| B: Poor dissemination of guidelines (in particular to OOH) [stakeholder] | Stakeholders; research evidence | 11. Improve dissemination and implementation of (new) guidelines (for example, CCGs or NHS England improve dissemination of information, including to OOH providers, offer update training and meetings). | Social support (practical) | Excluded |
| B: Lack of communication from CCGs to OOH about AMS [stakeholder]; Lack of | Stakeholders | 12. Improve dissemination and uptake of AMS-related training opportunities, in particular to OOH providers | Social support (practical) | Excluded |

| Barriers (B) or facilitators (F) addressed [key TDF domains or indication of stakeholder suggestion in square brackets] | Source of the suggestions | Suggested intervention components (intervention modifications or new components) | Behaviour change techniques | Included or excluded from the survey |
|---|---|---|---|---|
| training (or invitations to training) on AMS offered to OOH by CCGs [stakeholder] | | (together with opening existing AMS training to OOH providers). | | |
| **For general practice** | | | | |
| F: Advice from colleagues when uncertain or to reinforce appropriate prescribing decisions, perceptions of own prescribing compared to others [Social influences] | Stakeholders | 1. Prescribing advisors or practice prescribing leads to encourage GPs to peer review each other's antibiotic prescribing, review uncertain cases regularly and get advice from peers on what could or should have been done (for example, as part of an appraisal process or a task within a practice meeting). | Social support (unspecified), Feedback on behaviour | Included (as #6) |
| F: Having prescribing monitored and audited, receiving feedback on prescribing B: lack of accountability for prescribing [Social influences] | Stakeholders; research evidence | 2. Audit prescribing in <u>all</u> practices, to be done by CCG prescribing advisors or practice prescribing leads, and identify underlying reasons for high or inappropriate prescribing, provide tailored advice to practice prescribers and agree practice action plans. | Feedback on behaviour, Problem solving, Action planning | Included (as #2) |

| Barriers (B) or facilitators (F) addressed [key TDF domains or indication of stakeholder suggestion in square brackets] | Source of the suggestions | Suggested intervention components (intervention modifications or new components) | Behaviour change techniques | Included or excluded from the survey |
|---|---|---|---|---|
| F: Having prescribing monitored and audited, receiving feedback on prescribing<br>B: lack of accountability for prescribing [Social influences]; individual personalities and attitudes to managing risk in healthcare [stakeholder] | Stakeholders | 3. Audit prescribing of individual prescribers in practices, to be done by CCG prescribing advisors or practice prescribing leads, provide individual feedback on prescribing, identify individual high prescribers (or those not following guidelines), identify underlying reasons for high or inappropriate prescribing, provide tailored advice and agree individual action plans. | Feedback on behaviour, Problem solving, Action planning | Included (as #3) |
| B: Lack of consistency in auditing prescribing [stakeholder] | Stakeholders | 4. Make prescribing audit mandatory in all practices nationally (for example, as part of CQC or other CCG or national targets for practices). | Restructuring the social environment | Excluded |
| B: (Belief about) limited access to GP or medical services lowering threshold for prescribing [Environmental context and resources] | Stakeholders | 5. Provide information on the exact (amount of) time that there is no access to healthcare available locally to patients and encourage all prescribers to know the exact times and locations of available healthcare | Information about social and environmental consequences | Included (as #9) |

| Barriers (B) or facilitators (F) addressed [key TDF domains or indication of stakeholder suggestion in square brackets] | Source of the suggestions | Suggested intervention components (intervention modifications or new components) | Behaviour change techniques | Included or excluded from the survey |
|---|---|---|---|---|
| | | services to provide to patients (for example, as a leaflet). | | |
| F: Awareness or knowledge of evidence and guidelines [Knowledge]; easy access to patient leaflets [stakeholder] B: lack of time to engage with interventions [stakeholder]; clinical uncertainty [Beliefs about consequences] | Stakeholders | 6. Clinical system providers to incorporate interventions (for example, guidelines, leaflets, clinical decision support tools) into all clinical systems nationally. | Prompts or cues, Adding objects to the environment | Included (as #7) |
| F: Use of financial incentives to change antibiotics prescribing [Reinforcement] B: lack of incentives to change or engage with interventions [stakeholder] | Stakeholders | 7. All CCGs to provide financial incentives to general practices for intended behaviours (for example, to engage with interventions, adhere to guidelines, do prescribing audits) or outcomes (for example, reduce antibiotics prescribing). | Material incentive (behaviour or outcome) | Excluded |
| B: Lack of incentives to engage with interventions [stakeholder] | Stakeholders | 8. Make AMS training mandatory (for example, evidence-based STAR training as part of CQC, contracts, | Restructuring the social environment | Included (as #10) |

| Barriers (B) or facilitators (F) addressed [key TDF domains or indication of stakeholder suggestion in square brackets] | Source of the suggestions | Suggested intervention components (intervention modifications or new components) | Behaviour change techniques | Included or excluded from the survey |
|---|---|---|---|---|
| | | targets) if practice prescribing rates reach a certain threshold (for example, top 25% nationally or locally). | | |
| B: Lack of understanding of and awareness of AMR [stakeholder]; doubt about impact of GPs' prescribing on AMR<br>F: belief that GPs' prescribing meaningfully contributes to AMR [Beliefs about consequences] | Stakeholders; research evidence | 9. Improve dissemination and awareness of data on local antimicrobial resistance patterns and evidence that links it with prescribing rates, describing the relation between antibiotic prescribing and antimicrobial resistance (for example, by CCG prescribing advisors communicating this information to practices, together with feedback on antibiotic prescribing rates as part of regular reviews, audits or training). | Information about health consequences,<br>Feedback on outcome of behaviours | Included (as #5) |
| B: Prescribers not using unique codes making it difficult to automate prescribing audit [stakeholder] | Stakeholders | 10. Promote or regulate the use of unique prescriber codes in order to be able to provide individual prescribing feedback. | Restructuring the social environment | Included (as #4) |

| Barriers (B) or facilitators (F) addressed [key TDF domains or indication of stakeholder suggestion in square brackets] | Source of the suggestions | Suggested intervention components (intervention modifications or new components) | Behaviour change techniques | Included or excluded from the survey |
|---|---|---|---|---|
| F: Ability to preserve a good relationship and patient satisfaction in other ways than prescribing [Skills] | Researchers | 11. Improve dissemination of evidence to general practice prescribers (by peers or other credible sources) that patients most often want reassurance, and addressing their concerns in consultations is sufficient, without necessarily giving an antibiotic prescription (for example, as part of existing training delivered to prescribers). | Information about social and environmental consequences, Credible source | Excluded |
| B: Responding to immediate pressures (for example, patient in front) over long-term consequences of AMR [Memory, attending and decision processes]; wanting to prevent re-consultations by giving a prescription F: Wanting to save time and prevent future consultations by investing time in educating | Research evidence | 12. Emphasise the benefits to prescribers of not prescribing when inappropriate and of taking time to educate patients and provide self-care advice (for example, lower re-consultations, future consultations and patient expectation of antibiotics. | Information about social and environmental consequences | Excluded |

| Barriers (B) or facilitators (F) addressed [key TDF domains or indication of stakeholder suggestion in square brackets] | Source of the suggestions | Suggested intervention components (intervention modifications or new components) | Behaviour change techniques | Included or excluded from the survey |
|---|---|---|---|---|
| patients about self-care of self-limiting illnesses [Beliefs about consequences] | | | | |
| (no specific barriers or facilitators identified in literature or by stakeholders) | Research evidence | 13. Implement computer prompts into clinical systems nationally and provide training in how to use the prompts to optimise antibiotic prescribing (for example, reminders to reduce broad-spectrum antibiotics, to use delayed prescriptions, patient leaflets). | Prompts, cues, Instruction on how to perform the behaviour, Demonstrate the behaviour | Excluded (but partly included in #7) |
| (no specific barriers or facilitators identified in literature or by stakeholders) | Research evidence | 14. Appoint AMS lead GPs in all practices to lead on AMS-related issues, for example, by organising practice meetings about AMS, disseminating information about new guidelines, encouraging peers to implement interventions. | Social support (practical), Social support (unspecified), Credible source | Included (as #1) |
| (no specific barriers or facilitators identified in literature or by stakeholders) | Research evidence | 15. CCG prescribing advisors to provide encouragement and verbal persuasion to promote AMS-related behaviour change (for example, | Social support (unspecified), Verbal persuasion | Excluded |

| Barriers (B) or facilitators (F) addressed [key TDF domains or indication of stakeholder suggestion in square brackets] | Source of the suggestions | Suggested intervention components (intervention modifications or new components) | Behaviour change techniques | Included or excluded from the survey |
|---|---|---|---|---|
| | | encouraging or persuading GP directly in what they could do to reduce antibiotic prescribing). | | |
| **For out-of-hours** | | | | |
| F: Having prescribing monitored and audited, receiving feedback on prescribing<br>B: lack of accountability for prescribing [Social influences]; auditing and benchmarking prescribing in OOH impossible or difficult due to not being linked to population or area [stakeholder]<br>B: Lack of understanding of and accountability for prescribing broad-spectrum | Stakeholders | 1. Manual audit of (sample of) individual prescriptions (prescribing decisions) in OOH (especially the use of broad-spectrum antibiotics), identify underlying reasons for high or inappropriate prescribing, followed by provision of personalised feedback and advice or training to prescribers, and agreed action plans. | Feedback on behaviour, Problem solving, Action planning | Excluded |

| Barriers (B) or facilitators (F) addressed [key TDF domains or indication of stakeholder suggestion in square brackets] | Source of the suggestions | Suggested intervention components (intervention modifications or new components) | Behaviour change techniques | Included or excluded from the survey |
|---|---|---|---|---|
| antibiotics in OOH [stakeholder] | | | | |
| B: Auditing and benchmarking prescribing in OOH impossible or difficult due to not being linked to population or area [stakeholder] | Stakeholders | 2. Develop tools or system to enable audit of prescribing in OOH and provision of personalised feedback and advice. | Restructuring the social environment, Adding objects to the environment | Included (as #2) |
| B: Lack of consistency in auditing prescribing [stakeholder] | Stakeholders | 3. Make prescribing audit in OOH mandatory. | Restructuring the social environment | Included (as #5) |
| B: Lack of awareness or knowledge of local guidelines by new or locum GPs in OOH [stakeholder] | Stakeholders | 4. Improve induction for new prescribers in OOH to ensure knowledge of local AMS-relevant guidelines, specifically indications for antibiotic prescribing, information on first-line antibiotics, practice agreed action plans or approaches to prescribing antibiotics. | Social support (practical) | Included (as #6) |

| Barriers (B) or facilitators (F) addressed [key TDF domains or indication of stakeholder suggestion in square brackets] | Source of the suggestions | Suggested intervention components (intervention modifications or new components) | Behaviour change techniques | Included or excluded from the survey |
|---|---|---|---|---|
| B: (Belief about) limited access to GP or medical services lowering threshold for prescribing [Environmental context and resources] | Stakeholders | 5. Provide information on the exact (amount of) time that there is no access to healthcare available locally to patients and encourage all prescribers to know the exact times and locations of available healthcare services to provide to patients (for example, as a leaflet). | Information about social and environmental consequences | Excluded |
| F: Awareness or knowledge of evidence and guidelines [Knowledge]; easy access to patient leaflets [stakeholder] B: lack of time to engage with interventions [stakeholder]; clinical uncertainty [Beliefs about consequences] | Stakeholders | 6. Clinical system providers to incorporate interventions (for example, guidelines, leaflets, clinical decision support tools) into all clinical systems nationally. | Prompts or cues, Adding objects to the environment | Included (as #8) |
| B: Lack of understanding of and awareness of AMR [stakeholder]; doubt about | Stakeholders, research evidence | 7. Improve dissemination and awareness of data on local antimicrobial resistance patterns and evidence that links it with prescribing rates describing the relation between | Information about health consequences, Feedback on outcome of behaviours | Included (as #4) |

| Barriers (B) or facilitators (F) addressed [key TDF domains or indication of stakeholder suggestion in square brackets] | Source of the suggestions | Suggested intervention components (intervention modifications or new components) | Behaviour change techniques | Included or excluded from the survey |
|---|---|---|---|---|
| impact of GPs' prescribing on AMR <br> F: belief that GPs' prescribing meaningfully contributes to AMR [Beliefs about consequences] | | antibiotic prescribing and antimicrobial resistance (for example, by CCG prescribing advisors communicating this information to OOH, together with feedback on antibiotic prescribing rates as part of regular reviews, audits or training). | | |
| B: Prescribers not using unique codes making it difficult to automate prescribing audit [stakeholder] | Stakeholders | 8. Promote or regulate the use of unique prescriber codes in order to be able to provide individual prescribing feedback. | Restructuring the social environment | Included (as #3) |
| F: Belief that delayed prescriptions can be helpful [Intentions] <br> B: Belief that delayed prescribing is not an effective strategy for appropriate or prudent antibiotics prescribing; perception that patients use delayed prescriptions inappropriately | Research evidence | 9. Promote increased use of delayed prescriptions (instead of immediate prescriptions) by providing evidence to prescribers on why delayed prescribing is beneficial to them and their patients and on how patients typically use delayed prescriptions. | Verbal persuasion, Social support (unspecified), Information about social and environmental consequences, Feedback on behaviour | Included (as #7) |

| Barriers (B) or facilitators (F) addressed [key TDF domains or indication of stakeholder suggestion in square brackets] | Source of the suggestions | Suggested intervention components (intervention modifications or new components) | Behaviour change techniques | Included or excluded from the survey |
|---|---|---|---|---|
| (lack of feedback on how patients use delayed prescriptions) [Beliefs about consequences] | | | | |
| F: Ability to preserve a good relationship and patient satisfaction in other ways than prescribing [Skills] | Researchers | 10. Improve dissemination of evidence to prescribers in OOH (by peers or other credible sources) that patients most often want reassurance, and addressing their concerns in consultations is sufficient, not necessarily a prescription (for example, as part of existing training delivered to prescribers). | Information about social and environmental consequences, Credible source | Excluded |
| B: Responding to immediate pressures (for example, patient in front) over long-term consequences of AMR [Memory, attending and decision processes]; wanting to prevent re-consultations by giving a prescription | Research evidence | 11. Emphasise the benefits to prescribers of not prescribing when inappropriate and of taking time to educate patients and provide self-care advice (for example, lower re-consultations, future consultations and patient expectation of antibiotics). | Information about social and environmental consequences | Excluded |

| Barriers (B) or facilitators (F) addressed [key TDF domains or indication of stakeholder suggestion in square brackets] | Source of the suggestions | Suggested intervention components (intervention modifications or new components) | Behaviour change techniques | Included or excluded from the survey |
|---|---|---|---|---|
| F: Wanting to save time and prevent future consultations by investing time in educating patients about self-care of self-limiting illnesses [Beliefs about consequences] | | | | |
| (No specific barriers or facilitators identified in literature or by stakeholders) | Research evidence | 12. Appoint AMS lead GPs in all OOH to lead on AMS-related issues, for example, by organising practice meetings about AMS, disseminating information about new guidelines, encouraging peers to implement interventions. | Social support (practical), Social support (unspecified), Credible source | Included (as #1) |
| (No specific barriers or facilitators identified in literature or by stakeholders) | Research evidence | 13. CCG prescribing advisors to provide encouragement and verbal persuasion to promote AMS-related behaviour change (for example, encouraging or persuading GP directly in what they could do to reduce antibiotic prescribing). | Social support (unspecified), Verbal persuasion | Excluded |

| Barriers (B) or facilitators (F) addressed [key TDF domains or indication of stakeholder suggestion in square brackets] | Source of the suggestions | Suggested intervention components (intervention modifications or new components) | Behaviour change techniques | Included or excluded from the survey |
|---|---|---|---|---|
| B: Lack of follow-up of patients between general practice and OOH | Researchers | 14. Make patient information and history available on OOH IT system, and the OOH information available on GP IT system for a GP to be able to follow-up afterwards. | Restructuring the physical environment | Included (as #9) |
| **For community pharmacy** | | | | |
| B: Low use of patient records in community pharmacy to review prescribing [stakeholder] | Stakeholders | 1. Promote the use of patient records by pharmacists to review whether antibiotics were prescribed appropriately and encourage pharmacists to flag GP prescribing decisions if antibiotics were prescribed inappropriately (not according to guidelines). | Social support (unspecified), Verbal persuasion about capability | Included (spilt into suggestions #1 and #2) |
| B: Lack of skills of community pharmacy staff to ask questions and make decisions what to advise patients [stakeholder]; lack of confidence of community | Stakeholders | 2. Provide training in structured way(s) of asking patients the right questions and identifying red-flags to help decide what to advise patients (for example, whether to give them self-help advice or suggest seeing a GP). | Instruction on how to perform the behaviour (Could also include: Demonstration of the behaviour, Behavioural practice or rehearsal - | Included (as #4) |

| Barriers (B) or facilitators (F) addressed [key TDF domains or indication of stakeholder suggestion in square brackets] | Source of the suggestions | Suggested intervention components (intervention modifications or new components) | Behaviour change techniques | Included or excluded from the survey |
|---|---|---|---|---|
| pharmacy staff on what to advise and over-advising to see a GP [stakeholder]; patient's concern about illness [stakeholder] | | | depending on how the training is designed) | |
| B: Low use of patient records in community pharmacy to review prescribing [stakeholder]; lack of review of COPD back up antibiotics (suggested by research team) | Stakeholders, researchers | 3. Pharmacy staff to prompt GPs to review long-term and repeat antibiotic prescriptions (for example, for COPD patients). | Social support (unspecified) | Included (as #3) |
| F: Access to and use of patient leaflets (helping to explain no-antibiotic prescribing decisions and providing advice) [Environmental context and resources] | Stakeholders (suggestion wasn't specific to setting), researchers (narrowed down to this setting as leaflets | 4. Promote routine interactive use of patient leaflets with patients with self-limiting infections (for example, through training, role models, respected and trusted experts promoting use of leaflets). | Adding object to the environment, Social support (unspecified), Role modelling, Credible source | Included (as #5) |

| Barriers (B) or facilitators (F) addressed [key TDF domains or indication of stakeholder suggestion in square brackets] | Source of the suggestions | Suggested intervention components (intervention modifications or new components) | Behaviour change techniques | Included or excluded from the survey |
|---|---|---|---|---|
| | already available in GP, OOH settings), research evidence | | | |

**Table J3. Suggestions excluded from the final list of suggestions for the survey**

| Suggested intervention components | Reasons for exclusion |
|---|---|
| **For all settings** | |
| Provide case studies on implementation of point-of-care CRP testing to better understand how CRP testing can work in different settings and to provide role models. | Suggestion was not specific enough: the steering group suggested that healthcare organisations operate differently and it would be difficult to transfer learning; also implementation studies are currently underway to provide some examples of implementation. |
| Promote higher uptake and interactive use of patient leaflets (for example, through training, role models, credible sources and peers promoting them) by all healthcare professionals in general practice, OOH and community pharmacy. | Suggestion was moved to community pharmacy setting only; patient leaflets are already being used in general practice and OOH settings. |
| Promote higher uptake of training which provides evidence to prescribers that patients want reassurance and their concerns addressed, (not necessarily a prescription), and equips prescribers with the following skills:<br>• eliciting and addressing patients' concerns and expectations<br>• educating patients about self-limiting illness and antibiotics<br>• providing self-care advice and sign-posting patients to sources of self-care information<br>• maintaining good relationship with patient when not prescribing<br>• ability to do all of the above in a time-efficient way | Suggestion was removed due to too much overlap with existing online trainings and because it was not specific enough in terms of delivery. |
| Improve dissemination and implementation of (new) guidelines to all settings, in particular to OOH providers (for example, by offering update training and meetings). | Suggestion was not specific enough, especially in terms of how dissemination can be improved (CCG already disseminate guidelines so it remains unclear how else it can be improved.) |
| Improve dissemination and uptake of AMS-related training opportunities, in particular to OOH providers (together with opening existing AMS training to OOH providers). | Similar to other suggestions; it was not specific enough, especially in terms of how dissemination and uptake can be improved. |

| Suggested intervention components | Reasons for exclusion |
|---|---|
| **For general practice** | |
| Make prescribing audit mandatory in all practices nationally (for example, as part of CQC or other CCG or national targets for practices). | Suggestion removed as the steering group advised it is not realistic; audit is already part of the CQC. |
| Improve dissemination of evidence to general practice prescribers (by peers or other credible sources) that patients most often want reassurance, and that addressing their concerns in consultations is sufficient (for example, as part of existing training delivered to prescribers). | Suggestion removed as it is already part of existing, nationally implemented online STAR training. |
| All CCGs to provide financial incentives to general practices for intended behaviours (for example, to engage with interventions, adhere to guidelines, do prescribing audits) or outcomes (for example, reduce antibiotic prescribing). | Suggestion removed as the steering group questioned the evidence on whether financial incentives facilitate sustainable change and advised that long-term financial incentives were unrealistic, whereas some have already been implemented. |
| Emphasise the benefits to prescribers of not prescribing when inappropriate and of taking time to educate patients and provide self-care advice (for example, lower re-consultations, future consultations and patient expectation of antibiotics). | Suggestion was removed as the steering group advised this is already available as part of the TARGET resources. |
| Implement computer prompts into clinical systems nationally and provide training in how to use the prompts to optimise antibiotic prescribing (for example, reminders to reduce broad-spectrum antibiotics, to use delayed prescriptions, patient leaflets). | The steering group advised this is already being developed as part of the TARGET resources; also lacking specificity on what prompts would need to be implemented. The suggestions for computer prompts was incorporated as a part of suggestion 7 for GPs (that is, incorporating interventions into clinical systems). |
| CCG prescribing advisors to provide encouragement and verbal persuasion to promote AMS-related behaviour change (for example, encouraging or persuading GPs directly in what they could do to reduce antibiotic prescribing). | Suggestion was removed as the steering group advised it is training for CCG prescribing advisors in this is already part of an existing TARGET intervention or resources. |
| **Out-of-hours** | |
| Manual audit of (sample of) individual prescriptions (prescribing decisions) in OOH (especially the use of broad-spectrum antibiotics), identify underlying | Suggestion was removed as the steering group advised that software exist that does it; developing tools or |

| Suggested intervention components | Reasons for exclusion |
|---|---|
| reasons for high or inappropriate prescribing, followed by provision of personalised feedback and advice or training to prescribers, and agreed action plans. | system to enable audit is already included in another suggestion. |
| Improve dissemination of evidence to prescribers in OOH (by peers or other credible sources) that patients most often want reassurance, and addressing their concerns in consultations is sufficient (for example, as part of existing training delivered to prescribers). | Suggestion was removed as the steering group advised that this is important for all settings and, to some extent, is already happening; the suggestion is unspecific in terms of how to improve dissemination. |
| CCG prescribing advisors to provide encouragement and verbal persuasion to promote AMS-related behaviour change (for example, encouraging or persuading prescribers directly in what they could do to reduce antibiotic prescribing). | Suggestion was removed as it is already covered by a suggestion for all settings (that is, use respected and trusted, national and local experts… to promote AMS…). |
| Provide information on the exact (amount of) time that there is no access to healthcare available locally to patients and encourage all prescribers to know the exact times and locations of available healthcare services to provide to patients (for example, as a leaflet). | Considered to be not relevant to OOH. (The suggestion was included in for general practice setting). |
| Emphasise the benefits to prescribers of not prescribing when inappropriate and of taking time to educate patients and provide self-care advice (for example, lower re-consultations, future consultations and patient expectation of antibiotics). | Suggestion was removed as the steering group advised this is already available as part of the TARGET resources. |

**Table J4. Final list of suggested intervention components included in the stakeholder survey**

Notes

In column one barriers suggested by the stakeholders are indicated by "[stakeholder]" and were not coded into TDF domains. Barriers and facilitators for community pharmacy were only reported by stakeholders due to lack of research studies identified in this setting. The barriers and facilitators do not match exactly with the intervention suggestions because they are derived from, and defined on the basis of, the qualitative literature review (RQ1). Intervention suggestions were matched with the closest matching barriers or facilitators.
In column one key theoretical domains frameworks are indicated in square brackets.
In column 4 BCTs listed are suggestions of BCTs that could be included in the intervention suggestions (for modifications or new intervention components). The exact BCTs would depend on how exactly the intervention suggestion was translated into intervention components and how these would be delivered. For example, providing training could, as an option, include 'demonstrating the behaviour' and 'behavioural practice or rehearsal'.

Abbreviations used in the table

B = barrier, BCT = behaviour change technique, F = facilitator, GP = general practitioner, TDF = theoretical domains framework.

| Barriers (B) or facilitators (F) addressed Key TDF domains, or indication or stakeholder suggestion, in square brackets | Source for the suggestions | Suggested intervention components (intervention modifications or new components) | BCTs |
|---|---|---|---|
| **For all settings** | | | |
| F: Learning from peers on whether they can improve and how and about alternative prescribing techniques [Social influences] | Stakeholders, researchers | 1. Multi-disciplinary small group learning (for example, including local GPs, nurses, pharmacists, CCG staff) to identify ways to improve implementation of antimicrobial stewardship (AMS) initiatives and share local examples of good practice and actions taken by others as part of AMS. | Social support (practical), Social support (unspecified) |

| Barriers (B) or facilitators (F) addressed Key TDF domains, or indication or stakeholder suggestion, in square brackets | Source for the suggestions | Suggested intervention components (intervention modifications or new components) | BCTs |
|---|---|---|---|
| B: Disintegrated services and communication structures [stakeholder] F: multi-disciplinary networks [stakeholder] | Stakeholders | 2. Co-organise national AMS events together with different professional networks (for example, GPs, nurses, pharmacists, OOH staff) to facilitate multi-disciplinary work and improve dissemination of information about AMS and training to all relevant professional networks. | Social support (practical), Social support (unspecified) |
| F: Advice from or influence of relevant experts [Social influences], providing or underwriting the intervention by relevant people or organisations, for example, RCGP, BMA [stakeholder] | Stakeholders; research evidence | 3. Use respected and trusted, national and local experts with relevant professional backgrounds to promote AMS and engagement with under-used AMS interventions by giving talks and endorsing AMS approaches. | Credible source, Social support (unspecified) |
| F: Advice from and influence of relevant experts [Social influences] | Researchers | 4. Increase staff time available to work on AMS within commissioning teams and standardise the AMS-related roles; for example, all commissioners to have adequate number of prescribing advisors and/or pharmacists to work more closely with practices, OOH and community pharmacies, for example, by auditing prescribing, disseminating information, providing training and advice. | Restructuring the social environment |

| Barriers (B) or facilitators (F) addressed Key TDF domains, or indication or stakeholder suggestion, in square brackets | Source for the suggestions | Suggested intervention components (intervention modifications or new components) | BCTs |
|---|---|---|---|
| B: Variation in the skills and experience among staff (in particular reported for pharmacy teams) [stakeholder] | Stakeholders | 5. Provide online AMS training to all patient-facing staff within an organisation to improve (and minimise variation in) skills to ensure a consistent approach to providing advice to patients and antibiotic prescribing for respiratory tract infections. | Social support (practical), Social support unspecified) |
| B: Inconsistent approaches to antibiotic prescribing [Environmental context and resources] F: adopting guidelines or evidence as a standard practice (with intention to follow them) [Intentions] | Research evidence, researchers | 6. Agree on a consistent local approach to antibiotic prescribing within an organisation, such as a general practice, OOH or community pharmacy; for example, by agreeing an AMS-related action plan, a practice protocol on treating certain infections and/or following national or local guidelines. | Action planning, Instruction on how to perform the behaviour |
| B: Clinical uncertainty; fear of missing a serious illness as a threat to professional expertise [Beliefs about consequences]; lack of access to POC diagnostic testing | Stakeholders; research evidence | 7. Provide diagnostic point-of-care CRP testing, including training in using it, interpreting the results and maintaining the equipment. | Adding objects to the environment, Information about health consequences, Instruction how to perform the behaviour |

| Barriers (B) or facilitators (F) addressed<br>Key TDF domains, or indication or stakeholder suggestion, in square brackets | Source for the suggestions | Suggested intervention components<br>(intervention modifications or new components) | BCTs |
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| F: access to POC diagnostics testing [Environmental context and resources] | | | |
| **For general practice** | | | |
| (Lack of a leader to lead on, and encourage engagement with, AMS-related issues) | Research evidence | 1. Appoint AMS lead GPs in all practices to lead on AMS-related issues, for example, by organising practice meetings about AMS, disseminating information about new guidelines, encouraging peers to implement interventions. | Social support (practical), Social support (unspecified), Credible source |
| F: Advice from colleagues when uncertain or to reinforce appropriate prescribing decisions, perceptions of own prescribing compared to others [Social influences] | Stakeholders | 2. Prescribing advisors or practice prescribing/AMS leads to carry out standardised quality improvement (for example, supported by IT system functionality) and use prescribing data to identify underlying reasons for high or inappropriate antibiotic prescribing, provide tailored advice to prescribers and agree practice action plans (for example, practice plan to reduce immediate antibiotic prescribing for acute cough). | Social support (unspecified), Feedback on behaviour, Problem solving, Action planning |
| F: Having prescribing monitored and audited, receiving feedback on prescribing | Stakeholders | 3. Audit prescribing of individual prescribers in general practices, to be done by local (CCG) prescribing advisors, practice prescribing or AMS leads or practice pharmacists, and provide individual feedback on prescribing, identify underlying | Social support (unspecified), Feedback on behaviour, Problem solving, |

| Barriers (B) or facilitators (F) addressed Key TDF domains, or indication or stakeholder suggestion, in square brackets | Source for the suggestions | Suggested intervention components (intervention modifications or new components) | BCTs |
|---|---|---|---|
| B: lack of accountability for prescribing [Social influences]; individual personalities and attitudes to managing risk in healthcare [stakeholder] | | reasons for high-inappropriate antibiotic prescribing, provide tailored advice and agree individual action plans (for example, individual prescriber's plan to reduce immediate antibiotic prescribing for acute cough). | Action planning |
| B: Prescribers not using unique codes making it difficult to automate prescribing audit [stakeholder] | Stakeholders | 4. Promote or regulate the use of unique prescriber codes to be able to provide individual prescribing feedback. | Restructuring the social environment |
| B: Lack of understanding of and awareness of AMR [stakeholder]; doubt about impact of GPs' prescribing on AMR F: belief that GPs' prescribing meaningfully contributes to AMR [Beliefs about consequences] | Stakeholders, research evidence | 5. Improve dissemination and awareness of data on local antimicrobial resistance patterns and evidence that links it with prescribing rates, describing the relation between antibiotic prescribing and antimicrobial resistance (for example, by prescribing advisors communicating this information to practices, together with feedback on AMR and antibiotic prescribing rates as part of regular reviews, audits or training). | Information about health consequences, Feedback on outcome of behaviour |

| Barriers (B) or facilitators (F) addressed Key TDF domains, or indication or stakeholder suggestion, in square brackets | Source for the suggestions | Suggested intervention components (intervention modifications or new components) | BCTs |
|---|---|---|---|
| F: Advice from colleagues when uncertain or to reinforce appropriate prescribing decisions, perceptions of own prescribing compared to others [Social influences] | Stakeholders | 6. Local prescribing advisors or practice prescribing/AMS leads to encourage GPs to peer review each other's antibiotic prescribing, review uncertain cases regularly and promote discussion on alternative approaches to immediate prescribing (for example, as a task within a practice meeting). | Social support (unspecified), Feedback on behaviour, Social comparison |
| F: Awareness or knowledge of evidence and guidelines [Knowledge]; easy access to patient leaflets [stakeholder] B: lack of time to engage with interventions [stakeholder]; clinical uncertainty [Beliefs about consequences] | Stakeholders, research evidence (on prompts) | 7. Clinical system providers to incorporate interventions (for example, guidelines, leaflets, clinical decision support tools, computer prompts to use delayed or back-up prescriptions, computer prompts to reduce broad-spectrum antibiotics) into all clinical systems nationally and commissioners to ensure that practices activate and are aware of these functions on their clinical system. | Adding objects to the environment, Prompts or cues |
| F: Belief that delayed prescriptions can be helpful B: Belief that delayed prescribing is not an | Research evidence | 8. Promote increased use of delayed or back-up prescriptions (instead of immediate prescriptions) by providing online skills training to prescribers. Training to include information on why delayed or back-up prescribing is beneficial, how patients use | Social support (unspecified), Social support (practical), |

| Barriers (B) or facilitators (F) addressed Key TDF domains, or indication or stakeholder suggestion, in square brackets | Source for the suggestions | Suggested intervention components (intervention modifications or new components) | BCTs |
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| effective strategy for appropriate or prudent antibiotics prescribing; perception that patients use delayed prescriptions inappropriately (lack of feedback on how patients use delayed prescriptions) [Beliefs about consequences] | | delayed or back-up prescriptions, and by a practice agreeing on a process to provide delayed or back-up prescriptions. | Information about health consequences, Information about social and environmental consequences, Action planning |
| B: Limited access to GP or medical services (lowering threshold for prescribing) [Environmental context and resources] | Stakeholders | 9. Provide information on opening hours of all local healthcare services for prescribers and patients to know what care is available to patients outside GP hours (for example, as a leaflet, on a practice website) to prevent higher prescribing on Fridays. | Information about social and environmental consequences |
| B: Lack of incentives to engage with interventions [stakeholder] | Stakeholders | 10. Make AMS training mandatory (for example, evidence-based training as part of CQC, contracts, targets) if practice prescribing rates reach a certain threshold (for example, top 25% nationally or locally). | Restructuring the social environment, Non-specific incentive |
| **For out-of-hours** | | | |

| Barriers (B) or facilitators (F) addressed Key TDF domains, or indication or stakeholder suggestion, in square brackets | Source for the suggestions | Suggested intervention components (intervention modifications or new components) | BCTs |
|---|---|---|---|
| (Lack of a leader to lead on, and encourage engagement with, AMS-related issues) | Research evidence | 1. Appoint AMS lead prescriber in all OOH sites to lead on AMS-related issues, for example, by organising meetings about AMS, disseminating information about new guidelines, encouraging peers to implement interventions. | Social support (practical), Social support (unspecified), Credible source |
| B: Auditing and benchmarking prescribing in OOH impossible or difficult due to not being linked to population or area [stakeholder] | Stakeholders, researchers | 2. Develop tools or system to enable audit of prescribing in OOH and provision of personalised feedback and advice. | Restructuring the social environment, Adding objects to the environment |
| B: Prescribers not using unique codes making it difficult to automate prescribing audit [stakeholder] | Stakeholders | 3. Promote or regulate the use of unique prescriber codes in order to provide individual prescribing feedback. | Restructuring the social environment |
| B: Lack of understanding of and awareness of AMR [stakeholder]; doubt about impact of GPs' prescribing on AMR | Stakeholders, research evidence | 4. Improve dissemination and awareness of data on local antimicrobial resistance patterns and evidence that links it with prescribing rates describing the relation between antibiotic prescribing and antimicrobial resistance (for example, by prescribing advisors communicating this information to OOH, | Information about health consequences; Feedback on outcome of behaviour |

| Barriers (B) or facilitators (F) addressed Key TDF domains, or indication or stakeholder suggestion, in square brackets | Source for the suggestions | Suggested intervention components (intervention modifications or new components) | BCTs |
|---|---|---|---|
| F: belief that GPs' prescribing meaningfully contributes to AMR [Beliefs about consequences] | | together with feedback on AMR and antibiotic prescribing rates as part of regular reviews, audits or training). | |
| B: Lack of consistency in auditing prescribing [stakeholder] | Stakeholders | 5. Make antibiotic prescribing or infection audit in OOH mandatory. | Restructuring the social environment, Non-specific incentive |
| B: Lack of awareness or knowledge of local guidelines by new or locum GPs in OOH [stakeholder] | Stakeholders | 6. Improve induction for new prescribers in OOH to ensure knowledge of local AMS-relevant guidelines (for example, indications for antibiotic prescribing, first-line antibiotics) and organisation-agreed approaches to prescribing antibiotics. | Social support (practical) |
| F: Belief that delayed prescriptions can be helpful B: Belief that delayed prescribing is not an effective strategy for appropriate or prudent antibiotic prescribing; perception that patients use delayed prescriptions | Researchers, research evidence | 7. Promote increased use of delayed or back up prescriptions (instead of immediate prescriptions) by providing online skills training to prescribers. Training to include information on why delayed or back-up prescribing is beneficial, how patients use delayed or back up prescriptions, how to discuss delayed or back up prescriptions with patients, and how it can be used in OOH. | Social support (unspecified), Social support (practical), Information about health consequences, Information about social and environmental consequences, Action planning |

| Barriers (B) or facilitators (F) addressed Key TDF domains, or indication or stakeholder suggestion, in square brackets | Source for the suggestions | Suggested intervention components (intervention modifications or new components) | BCTs |
|---|---|---|---|
| inappropriately (lack of feedback on how patients use delayed prescriptions) [Beliefs about consequences] | | | |
| F: Awareness or knowledge of evidence and guidelines [Knowledge]; easy access to patient leaflets [stakeholder] B: lack of time to engage with interventions [stakeholder]; clinical uncertainty about illness [Beliefs about consequences] | Stakeholders, research evidence (on prompts) | 8. Clinical system providers to incorporate interventions (for example, guidelines, leaflets, clinical decision support tools, computer prompts to use delayed or back-up prescriptions, computer prompts to reduce broad-spectrum antibiotics) into all clinical systems nationally and commissioners or providers to ensure these are activated and OOH staff are aware of these functions on their clinical system. | Adding objects to the environment, Prompts or cues |
| B: Lack of follow-up of patients between general practice and OOH (suggested by research team) | Researchers | 9. Make patient information and history available on OOH IT system, and the OOH information available on GP IT system for a GP to be able to follow-up afterwards. | Restructuring the physical environment |

| Barriers (B) or facilitators (F) addressed<br>Key TDF domains, or indication or stakeholder suggestion, in square brackets | Source for the suggestions | Suggested intervention components<br>(intervention modifications or new components) | BCTs |
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| **For community pharmacy** | | | |
| B: Low use of patient records in community pharmacy to review prescribing [stakeholder] | Stakeholders | 1. Promote the use of patient records by pharmacists (for example, by digital prompts) to review whether antibiotics were prescribed appropriately. | Social support (unspecified) |
| B: Low use of patient records in community pharmacy to review prescribing [stakeholder] | Stakeholders | 2. Encourage pharmacists to feedback to GPs where antibiotics were not prescribed according to guidelines (for example, through a checklist for clinical screening, dispensing and handing out antibiotics). | Social support (unspecified)<br>(Could also include: Verbal persuasion about capability) |
| B: Low use of patient records in community pharmacy to review prescribing [stakeholder]; lack of review of COPD back up antibiotics (suggested by research team) | Stakeholders, researchers | 3. Pharmacy staff to prompt GPs to review long-term and repeat antibiotic prescriptions (for example, for COPD patients). | Social support (unspecified) |
| B: Lack of skills of community pharmacy staff to ask questions and make | Stakeholders | 4. Provide training and resources to structure the way(s) of asking patients the right questions about self-limiting infections and identifying red flags to help decide what to advise patients | Social support (unspecified), |

| Barriers (B) or facilitators (F) addressed Key TDF domains, or indication or stakeholder suggestion, in square brackets | Source for the suggestions | Suggested intervention components (intervention modifications or new components) | BCTs |
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| decisions what to advise patients [stakeholder]; lack of confidence of community pharmacy staff on what to advise and over-advising to see a GP [stakeholder]; patient's concern about illness [stakeholder] | | (for example, whether to give self-help advice or suggest seeing a GP). | (Could also include: Verbal persuasion about capability) |
| F: Access to and use of patient leaflets (helping to explain no-antibiotic prescribing decisions and providing advice) [Environmental context and resources] | Stakeholders (suggestion wasn't specific to setting), researchers (narrowed down to this setting as leaflets already available in GP, OOH settings), research evidence | 5. Promote routine interactive use of patient leaflets with patients with self-limiting infections (for example, through training, role models, respected and trusted experts promoting use of leaflets). | Adding object to the environment, Social support (unspecified), Role modelling, Credible source |