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Using theory to examine influences on antibiotic prescribing by nurse and pharmacist prescribers: A qualitative study using the Theoretical Domains framework and COM-B

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Title: Using theory to examine influences on antibiotic prescribing by nurse and pharmacist prescribers: A qualitative study using the Theoretical Domains framework and COM-B

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Antibiotic prescribing by nurse and pharmacist prescribers

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ABSTRACT

Objectives: Around 31,000 nurses and 4000 pharmacists in the United Kingdom have the same prescribing capability as doctors, and their numbers are increasing to fulfil the workforce needs of the National Health Service. Respiratory tract infections are frequently managed by these prescribers who are responsible for around 8% of all primary care antibiotic prescriptions. Only limited evidence has explored antibiotic prescribing amongst nurse and pharmacist prescribers, and there are no interventions designed specifically to target the antibiotic prescribing behaviour of these groups. The objectives of this research was (1) To use a theoretical framework to identify the factors that influence their management of respiratory tract infections. (2) To identify the Behaviour Change Techniques that can be used as the basis for the development of a theoretically informed intervention to support appropriate prescribing behaviour.

Design: A qualitative design comprising semi-structured interviews, using the Theoretical Domains framework and COM-B.

Setting: Primary care

Participants: Twenty one prescribers (4 pharmacists and 17 nurses)

Results: Twelve Theoretical Domains were found to influence the management of respiratory tract infections by nurse and pharmacist prescribers, and forty naturally occurring Behaviour Change Techniques were identified that facilitate appropriate prescribing behaviour.

Conclusion: A wide range of factors influence the antibiotic prescribing behaviour of nurse and pharmacists prescribers for respiratory tract infections, and a number of techniques are used by these prescribers to facilitate appropriate prescribing. Given that increasing numbers of these prescribers are working in primary care and managing infections, it is important that these findings are used to develop interventions to support appropriate prescribing behaviour by these groups.

ARTICLE SUMMARY

Strengths and weaknesses

- Using an established framework to explore the theoretical mechanisms of action and mechanisms of change to understand the antibiotic prescribing behaviour of nurse and pharmacist prescriber's is a key strength

- Although participants were a national sample, few were pharmacists and so our findings may not present an accurate picture of this population, however, this picture reflects UK primary care where most prescribers are nurses

- Although data saturation was achieved, participants were determined through our approach to sampling and may have been more motivated towards appropriate antibiotic prescribing, with less motivated prescribers possibly having additional deterrents.

INTRODUCTION

Multi-drug resistant infections are one of the greatest threats to human health (World Health Organisation.[1] Antimicrobial resistance (AMR) is responsible for an estimated 25,000 deaths and €1.5 billion in extra healthcare costs every year in the European Union (EU) alone.[2] Direct consequences of these infections include loss of protection for patients undergoing operations and medical procedures, increased hospital stay, and longer illnesses.[1]

Between 2000 and 2010 the global human consumption of antibiotics increased by 36%.[3] The inappropriate use of antimicrobials, particularly antibiotics in humans, is a leading driver for the increase in AMR,[4] however, resistance is reversible [5] and strategies that support appropriate antibiotic use are important.[6]

Most antibiotcs are prescribed in primary care for respiratory tract infections (RTIs),[7-9] however, most of these infections spontaneously resolve without an antibiotic. Conserving antibiotic sensitivity through the management of RTIs without recourse to antibiotics is a global priority [5,7,10,11] and the antibiotic prescribing behaviour of healthcare professionals is a key target for intervention.

Existing research has focused upon trying to understand how General Practitioners (GPs) make prescribing decisions for patients with acute RTIs. Key influences include GPs' perception of patient expectations [12], patient pressure [13], diagnostic uncertainty and fear of complications [14], factors imposed by healthcare systems and specific characteristics of clinician [15]. Systematic reviews [16-17] of interventions designed to reduce inappropriate antibiotic prescribing by general practitioners (GPs), have identified that effective interventions, are those that target the broader patient population, are complex and multifaceted in addressing barriers to change in specific healthcare settings. Further, multifaceted interventions aimed at promoting shared decision-making [18] have had promising results.

In the United Kingdom (UK), around 31,000 nurses and 4000 pharmacists have the same prescribing capability as doctors. The numbers of these 'non-medical prescribers (NMPs)' is steadily increasing,[19] to fulfil the workforce needs of the National Health Service (NHS).[20-22] These prescribers frequently manage patients with RTIs and are responsible for around 8% of all primary care antibiotic prescriptions [15 19] however, only limited evidence has explored their antibiotic prescribing practice. Like GPs, diagnostic ambiguity, and patient expectations can influence their decision to prescribe an antibiotic.[23] Furthermore, nurse/pharmacist prescribers perceive themselves to be open to scrutiny by medical prescribers, and so are conscious of keeping to clinical guidelines.[23] Although these prescribers have developed strategies for managing RTI consultations, there is scope for improvement.[24]

It is essential that interventions are tailored to the population and context in which the target behaviours are delivered.[25,26] Although interventions exist to support the various antimicrobial stewardship (AMS) activities in which NMPs are involved,[27] there are no interventions designed specifically to target their antibiotic prescribing behaviour.

Growing evidence supports the use of theory to identify barriers and facilitators to changing practitioner behaviour.[17, 28] One such approach is the Behaviour Change Wheel (BCW).[26] The original BCW, encompasses three layers that should be considered when supporting behaviour change; 1) the determinants of behaviour (COM-B); 2) intervention functions with which to intervene with these determinants; 3) policy categories to support change on a more structural level. At the hub of the BCW, the COM-B model aims to facilitate a behavioural diagnosis by understanding the determinants of behaviour, highlighting an individual's Capability, both physical (such as skills) and psychological (such as knowledge); their Opportunity, both social (norms of practice) and physical (time/space); and Motivation, both reflective (influenced by beliefs such as confidence and intention) and automatic (influenced by emotion

or habit). This model is helpful when developing an intervention, as it can be easily mapped to an Intervention Function (i.e. Education, Training, Enablement) using the table in Michie et al.[29] The Theoretical Domains Framework (TDF) [30] unpacks the COM-B further, as it seperates psycho-social drivers of behaviour into 14 domains covering a spectrum of theoretical determinants (knowledge, memory, skills and identity). This helps separate potential ambiguity when attempting to contextualise the determinants of COM-B; i.e. a Psychological Capability barrier could be both a lack of Knowledge or poor Memory; each of which would require a different Intervention Function; e.g. Education to increase Knowledge or Enablement to enhance Memory, and in turn different Behaviour Change Techniques (BCTs) e.g. giving information to increase knowledge; using prompts and cues to enhance memory. As this science has developed, the TDF has been conceptualised as an additional layer to the BCW after the COM-B [28, 31] and COM-B has been mapped to the TDF [26] and a selection of BCTs from the BCT Taxonomy Version 1 [32] that can be selected as intervention components to change behaviour.[28]

However, there is another way to identify and code BCTs related to the facilitators of behaviour that lacks empirical evidence. Qualitative exploration, allows for both an in-depth COM-B/TDF behavioural diagnosis and the identification of naturally occurring BCTs used by the target population when the target baviour is facilitated.

Objectives

- To use a theoretical framework to identify the factors that influence management of RTIs
- To identify BCTs that can be used as the basis for the development of a theoretically informed intervention to support appropriate prescribing behaviour

METHODS

Design

A qualitative approach, utilising semi-structured interviews.

Recruitment of participants

A sample of primary care nurse and pharmacist prescribers responsible for managing patients with RTIs, were recruited nationally. Recruitment occurred through the Royal College of Nursing (RCN) General Practice (GP) Nurse Forum, and the Royal Pharmaceutical Society (RPS) Discussion Group. A message was placed on the Facebook page of the RCN GP Nurse Forum and the RPS Pharmacist Prescribing Discussion Group, describing the study and inviting interested eligible participants to contact the researchers. Members of the Queens Nurse Institute were also invited to take part by the Chief Executive.

Materials

An interview schedule was developed based on the TDF (see Table 1). The TDF, as opposed to the simpler COM-B, allowed a more detailed investigation of behavioural determinanats. Interviews were audio-recorded on a dictaphone and a recording application on a Tablet to reduce the risk of data corruption/loss.

Table 1 – Interview guide and prompts used under each Theoretical Domain

Theoretical domain	**Examples of interview prompts**
Knowledge	.....What do you know about the use of antibiotics for self-limiting ……RTIs? What knowledge do you draw upon when managing patients with RTIs?
Skills	What skills do you think are needed/helpful in managing these consultations? If you have decided not to prescribe an antibiotic, what skills are needed to help manage that consultation?
Social/professional role	What do you think is your role in reducing antibiotic use and antimicrobial resistance? To what extent do you see this as part of your job? What is the role of other practitioners in reducing antibiotic use and antimicrobial resistance?

Beliefs about capabilities	How confident do you feel that you are able to manage RTI consultations? How confident do you feel in making decisions about whether to prescribe antibiotics? What if you are unsure about a diagnosis?
Optimism	How confident are you that your consultations with patients with RTIs will have a positive outcome? How is this affected by whether an antibiotic is prescribed?
Beliefs about consequences	What factors influence your decision to prescribe antibiotics? What are the benefits and risks of not prescribing antibiotics for RTIs?
Goals	What are your goals when managing patients within RTI consultations?
Reinforcement	What factors may reinforce your decision to prescribe not to prescribe antibiotics? What factors hinder this decision process?
Intentions	What motivates you to prescribe or not?
Memory/attention/decision process	How do you decide whether or not to prescribe an antibiotic to someone presenting with RTI? What processes do you usually follow when managing patients with RTIs?
Environmental context and resources	What factors support or hinder you to manage these consultations? (e.g. practice setting, community factors, available resources) How do systems in place support you to prescribe appropriately?
Social influences	How do patients influence the way you manage RTI consultations and whether you prescribe antibiotics? How do the people you work with influence your management of RTIs and your decisions around whether to prescribe antibiotics? How do you think you compare with other prescribers in terms of antibiotic prescribing for RTIs?
Emotion	How do consultations with patients with RTIs make you feel? Are there consultations that feel more difficult or uncomfortable? How do your feelings at the time (mood, feelings towards the patient, fatigue) affect whether or not you prescribe antibiotics?

Behavioural regulation	What things could support you to manage RTI consultations more satisfactorily for you and the patient? How do you ensure that your antibiotic prescribing is appropriate to the situation? What things support you to make decisions about antibiotic prescribing?

Procedure

Potential participants who had expressed interest in the study were emailed a participant information sheet and a consent form. They were able to ask any questions prior to providing consent before their interview. Semi-structured telephone interviews were conducted and audio-recorded by an experienced qualitative researcher (TC) and transcribed verbatim. Data collection was between June-July 2017. Mean interview time was 45 minutes (range 25-65 min).

Data analysis

Taking an initial inductive approach and drawing from thematic analysis,[33] assisted by the aid of computer software (NVivo), two researchers (TC/MC) independently coded the transcript data. Initial codes and emerging themes were then discussed/reviewed with a third qualitative researcher (SR). Saturation was achieved i.e. later interview data were categorised within the existing coding frame with no additional new codes. Following agreement, the third researcher then deductively mapped codes to the appropriate 'domains' within the TDF and agreed with MC. All codes were mapped onto at least one domain. A further qualitative researcher with expertise in the BCW (AC), then checked and agreed initial codes and their relevance to each TDF domain. Using the BCTTv1,[32] quotes were then coded by AC for the BCTs that the population had described when discussing what influences their behaviour, and subsequently checked by SR and MC.

Ethics approval and consent to participate

Ethical approval for the study was provided by the School of Healthcare Sciences Research Governance and Ethics Committee, Cardiff University (4475REC).

Patient and Public Involvement

Patients were not involved in the development of the research question, outcome measures, design of the study, or, recruitment to, and conduct of, the study.

RESULTS

Participants

Twenty one prescribers (4 pharmacists and 17 nurses), with between 1-17 years prescribing experience (mean 8.5 years, standard deviation (SD) 3.7) and between 2.5-32 years experience in their current role (mean 11 years, SD 8.5) took part in interviews. Most worked in general practice, had 15 minute consultations, and reported seeing around 25 patients a week with a RTIs (see Table 2) .

Table 2 – Demographic details

Interviewee	Role	Time qualified in current role	Time qualified as a prescriber	Clinical setting	No. of RTIs consultations a week	Length of appointment (minutes)
1	Nurse Practitioner	11	7	Out of hours walk in service	25 in summer months but many more in winter	15
2	Advanced Nurse Practitioner	5	5	General practice	20 summer months and 40 winter months	15
3	Advanced Nurse Practitioner	14	8	General practice	75 in the winter 30 in summer	15
4	Advanced Nurse Practitioner	2.5	17	General practice	25	10
5	Advanced Nurse Practitioner	24	14	Intermediate care (keep	25 in the summer	30-45

				patients out of hospital)	more in winter	
6	Lead nurse in a general practice walk-in centre	7	7	Walk in centre	30	15
7	Pharmacist	2		General practice	20	15
8	Advanced Nurse Practitioner	16	10	General practice	16-20	15
9	Advanced Nurse Practitioner	3	1	General practice	30	15
10	Nurse	32	3	Intermediate care (keep patients out of hospital)	(missing data)	30-120
11	Advanced Nurse Practitioner	6	7	General practice and out of hours service	50	15
12	Advanced Nurse Practitioner	4	6	General practice	40	15
13	Advanced Nurse Practitioner	11	11	(missing data)	Several a day	2 hours
14	Clinical pharmacist	3	10	General practice	16-20	15
15	Advanced Nurse Practitioner	7	13	General practice	20-50	10-15
16	General Practice Nurse	10	8	General practice	25	15
17	Nurse	25	10	Out of hours unscheduled care	1-6	20
18	Lead Practice Nurse	4	11	General practice	10	15
19	Lead nurse	18	10	General practice	30	15-20
20	Pharmacist	11	6	General practice	25	15
21	Pharmacist	24	6	General practice	varied	20

Factors influencing the management of RTIs

Twenty six codes were inductively assigned to the data from the interview transcripts. Codes were then mapped to the TDF domains, whereby twelve domains were identified as factors that influence appropriate antibiotic prescribing. TDF domains were then mapped onto the COM-B model to enable future intervention design (see Supplementary Table 1).

The section below describes how data aligns within the TDF domains. Interview quotes are followed by letters and numbers in brackets that indicate the interviewee number (I=interviewee, N =nurse, P=pharmacist).

Knowledge [Psychological capability]

Influences on antibiotic prescribing included knowledge of current prescribing guidelines and AMS practices (with training mechanisms in place to facilitate this) and knowledge of AMR and its consequences at an individual and a population level. Awareness of own prescribing rate in comparison to other prescribers and national prescribing levels was another important influence.

> *"..we have a local meeting, a training session, like an audit with the local CCG [clinical commissioning group] team, in relation to our practices antibiotic prescribing and comparing it to the area in the north west and things like that, so that kind of helped influence and perhaps reduced my antibiotic prescribing".* (I7P)

Memory, attention and decision processes [Psychological Capability]

Treatment decisions were made by weighing up information from guidelines, patient pre-existing conditions, and illnesses present within the local community, and a full examination and point of care testing if appropriate.

> *"If we have decided that they do have an acute bacterial (infection) that would benefit from antimicrobial treatments, I would use the HPA guidelines, un-amended. So we follow the guidelines that are the national ones, and depending on the patient's situation because of the allergies, co-existing conditions, previous treatment perhaps, knowledge of locally circulating bugs, and I would choose according to that."* (I21P)

Behavioural Regulation [Psychological Capability]

Awareness of antibiotic prescribing rate in relation to colleagues and ability to self-regulate behaviour, influenced prescribing practice as described above. However, formal auditing of prescribing from outside of the practice was not necessarily welcomed.

> *"Making sure that there are audits that you can do so that you can benchmark your work against colleagues. If you are consistently prescribing too much, I think medicines management should*

identify you, and you should be asked to do a top-up course. You know when you get 3 points on your license, I think you need to do a half day training course So over in Bath and Somerset, that is what they have been doing with her medicines management team, so if you are over prescribing, against your peers, you are identified and you are invited to come down for a training day. It is a little bit heavy handed, but we are heading towards a very scary place….". (I2N)

Skills [Physical Capability]

A range of skills were described as those required to manage the consultation, including physical examination skills and interpersonal communication skills, alongside clinical instinct.

"…you have to be competent, not only with your history taking… But, examination skills; you have to be able to examine… The patient; you have to be able to relate those findings… to the patient in a language that they can understand." (I15N)

Social/Professional role and identity [Reflective Motivation]

Elements of the NMP role (i.e.time to talk to patients, being up to date with guidelines, and the stringency of prescribing rules) was reported to support appropriate antibiotic prescribing. Participants saw themselves as personally and professionally responsible for appropriate prescribing with several highlighting their role as antibiotic guardians (i.e taken a pledge to prescribe responsibly) to manage patient expectation.

"..so I've got that responsibility to the health service and to society, and that partly comes with the privilege of being a prescriber. …I think this is definitely part of my role." (I17N)

Beliefs about capabilities [Reflective Motivation]

Newly qualified prescribers reported how a lack of confidence meant advice from more senior colleagues could negatively influence their prescribing decisions, whilst others indicated they were confident, recognising the limits of their role.

> *".. there is one drug that you used to prescribe for chest infections and it was always for 7 days and the guidelines now are actually for 5 days, and now I always check my guide because I am just like that and now I am more confident to say no actually it should only be five but when I very first started prescribing I found that really difficult …because I felt maybe I should be prescribing longer than it says on the guide, because more experienced people are telling me that, so I think when you are a newly qualified prescriber, the more experienced people can have a strong influence over you and it is not always right."*(I10N)

Beliefs about Consequences [Reflective Motivation]

Prescribers described 'managing risk' by being cautious about withholding antibiotics when managing patients at risk of developing complications, e.g. young children, elderly patients, or those with pre-existing conditions, alongside those where there was diagnostic uncertainty due to a language barrier. In these cases they were more likely to prescribe antibiotics.

> *"I may treat someone who is very frail, but I wouldn't treat someone who is well… simply because the consequences of not treating would be more serious, with the risk of hospitalisation. So what I am talking about is almost a threshold prescribing, and I think I do adjust that threshold according to the individual… based on their risk."* (I19N)

The consequences of antibiotic use, at an individual and population level, influenced prescribing decisions. Prescribers believed that prescribing antibiotics unnecessarily reinforced patients' beliefs they were the appropriate treatment and influenced future expectations.

> *"Some GP's will just write a prescription for 7 days with 250mg of amoxicillin, three times a day. And it's a homeopathic dose it's a pat on the head and a piece of green paper, and the patient comes away from that consultation happy, they have got their antibiotics, they won't get better because of the antibiotics, they will get better because it is self-limiting, viral RTI. But what that health care professional is doing, is perpetuating the expectation of I am unwell, I will get antibiotics I will get better. The hard thing you have to do as a prescriber is to turn around and say you don't need antibiotics at this time".* (I11N)

Fear of a complaint as a consequence of not prescribing, sometimes influenced prescribing decisions, and some participants reported prescribing antibiotics in some cases because patients would just re-consult if they weren't given them.

> *"If you leave a patient dissatisfied or with any unmet needs they are more likely to re-consult, they will either go to out of hours, A&E, or they will go and see another clinician in the practice."* (I2N)

Goals [Automatic Motivation]

Prescribing at an appropriate rate was a key goal for some prescribers. Audit and benchmarking practices were motivators to reduce prescribing, introducing competition to be the prescriber with the lowest rate.

> *"I am someone with lower antibiotic prescribing rates however, I only work part time. I wouldn't want my data to be high as this would look really bad amongst colleagues."* (I16N)

Reinforcement [Automatic Motivation]

Audit and feedback processes, and use of rewards, reinforced appropriate prescribing behavior.

> *"This year we have looked at the use of quinolones, ketasporines and Co-amoxiclav .. influenced of course by the national agenda but also our local medicines management team at the CCG, they push that agenda as one of their priorities for the year and resource it through the prescribing incentive scheme. So inevitably there were rewards available to practices and practitioners, so that will influence my prescribing for sure."* (I21P)

Emotion [Automatic Motivation]

Antibiotics were sometimes prescribed if patients did not listen to prescribers. Empathy for unwell patients could also make a no prescribing decision difficult. The time of day, day of the week, feeling stressed and tired, also influenced prescribing, prescribers, in these instances, being less conservative in their use of antibiotics.

> *"..towards the end of the day, I am a little bit more lenient, because you are tired and a bit stressed and you want to go home, and sometimes it can be an easy fix. I try not to, but sometimes, whether at the beginning of the day you weren't quite sure, you would rationalise it a bit more and explain it a bit more, whereas you might at the end of the day, you might sort of lean to like well I am not quite sure, ok just take them."(*I12N)

Environmental context and resources [Physical Opportunity]

Participants described how they used an array of accessible resources, including tailored and locally relevant information, local and national guidelines, point-of-care testing, decision support tools and information about patients (including co-morbidities, previous antibiotic use, and frequency of return

visits), to inform treatment decisions and to communicate these decisions to their patients. Working under time pressures in a busy environment was reported by some prescribers to impact negatively on prescribing. Many acknowledged that having longer appointment times (15 minutes) than GPs, facilitated patient education and discussions about treatment decisions.

> *"Time is an element … so the GPs get 10 minutes… myself and some of theNurse Practitioners that I work with … in our practice have 15..... after a few years of experience, we kind of can do a respiratorytract infection consultation in 10 minutes… you can do it, so you still have that extra sort of like two to three, four minutes… Which we can spend on educating the patient* (I7P)

Time and resources to follow-up patients, encouraging patients to return if symptoms did not improve, and the ability to allow patients to contact them quickly, were highlighted as important by some prescribers. Patient features, such as age, influenced the ease with which it was possible to manage RTIs without antibiotics, with technological literacy cited as being helpful here. Language barriers were also reported to be a problem,while maintaining appropriate prescribing.

Social influences [Social Opportunity]

A range of strategies, including reassurance, education (including information on symptoms, length of time to get better, self-management and red flags) and active patient engagement in decision making, were used to manage patients' expectations for an antibiotic. Patients pressure for an antibiotic was described as a key challenge and strategies to manage this included delayed prescribing, patient education, and consistency in antibiotic use. Public awareness campaigns and environmental prompts were also helpful. Good patient rapport and a trusting relationship was described as important when communicating a 'no prescribing' decision. Most prescribers discussed the role of other prescribers in influencing their prescribing decisions, including the role of social and collaborative networks. Collaborative working helped avoid situations whereby patients try to obtain an antibiotic from a different prescriber, and reassured prescribers that they were consistent in their decision making. However, such working occasionally led to problems, especially when disputes about the appropriateness of antibiotics arose and the other prescriber was a clinician.

> *"People (another prescriber) will say, just give them another one (different type of antibiotic) , and I will think that's not really what I am asking you, I just wanted to discuss it and see if we can do something else, because I am not really sure if it is going to do anything if I do take you know (different type of antibiotic)… But then you are arguing with another clinician and maybe that is a doctor versus another nurse practitioner, so there is a slightly different playing field there. So yes those are some of the things (that influence prescribing)".* (I3N)

Identification of behaviour change techniques

Forty naturally occurring BCTs (see Supplementary Table 1) were identified as used by nurse and pharmacist prescribers when the target behaviour (i.e. appropriate antibiotic prescribing) is facilitated. Two or more of these BCTs were coded within each TDF domain (see Table 3).

Table 3 – TDF domains and associated BCTs

Domain	**BCTs' suggested by nurse and pharmacist prescribers to support behaviour**
Knowledge	Instruction on how to perform the behaviour *Information about health consequences Social comparison *Feedback on behaviour Credible source
Skills	Instruction on how to perform a behaviour Demonstration of the behaviour
Social/professional role and identity	Identification of self as role model Social comparison Instruction on how to perform the behaviour
Beliefs about capabilities	*Focus on past success Verbal persuasion about capability Mental rehearsal of successful performance
Beliefs about consequences	Instruction on how to perform the behaviour Information about health consequences *Information about social and environmental consequences Demonstration of the behaviour
Reinforcement	Material reward (behaviour) Monitoring behaviour by others without feedback Feedback on behaviour
Goals	Self-monitoring of behaviour *Goal setting (behaviour) Review behaviour goal(s)
Memory, attention and decision processes	Problem solving Instruction on how to perform the behaviour
Environmental context and resources	Instruction on how to perform the behaviour *Prompts and cues

	Problem solving
Social influences	*Social support (unspecified) Problem solving Social comparison Restructuring the social environment Goal setting (behaviour) Information about health consequences
Emotion	*Reduce negative emotions Information about emotional consequences Monitoring of emotional consequences
Behavioral regulation	*Self-monitoring of behaviour Feedback on behaviour Social comparison

* BCT and associated TDF domains also identified by Cane et al (2015)

BCTs that occurred frequently across domains included 'Instruction on how to perform the behaviour,' (information on current guidelines, knowledge of patient self-management), 'Self monitoring of behaviour' (highlighting own prescribing behaviour), 'Feedback on behaviour' (the use of audit to scrutinise prescribing practice), Social comparison (comparison of behaviour to peers), 'Information about health consequences' (consequences of antimicrobial resistance), 'Demonstration of behaviour' (physical examination skills, no antibiotic prescribing behaviour), 'Problem solving' (patient engagement in decision making), and 'Goal setting' (reduce prescribing rate). These are therefore prime BCTs to use for future intervention.

DISCUSSION

Statement of principal findings

To our knowledge this is the first study to use a theoretical framework to identify the factors that influence the antibiotic prescribing behaviour for RTIs, by nurse and pharmacist prescribers, and examine how this might inform the development of an intervention to support appropriate prescribing behaviour. Twelve TDF domains were found to influence the management of RTIs by these prescribers based on initial inductive analysis, and forty naturally occurring BCTs were identified to facilitate the behaviour.

Strengths and weaknesses

Using an established framework to explore the theoretical mechanisms of action and mechanisms of change to understand the antibiotic prescribing behaviour of nurse and pharmacist prescriber's is a key strength. By using the TDF and the BCTTv1 we have identified core ingredients that can be used in interventions to support appropriate antibiotic prescribing by these groups.

A further key strength is that participants were a national sample, purposefully aimed at primary care nurse and pharmacist prescribers who prescribe for RTIs. However, few were pharmacists, and most worked in general practice. Therefore, the findings may not present an accurate picture of this population, rather, they may represent the views of nurses working in general practice. However, this picture reflects UK primary care where most prescribers are nurses [24] with high numbers working in general practice. [34]

Interviews were undertaken iteratively, with no new data relevant to the topic of interest generated in the latter interviews, suggesting data saturation. However, participants were determined through our approach to sampling and may have been more motivated towards appropriate antibiotic prescribing. Less motivated prescribers may have additional deterrents. Hence the identification of BCTs within the domain of 'motivation' may *overestimate* the occurenace of these features in the wider prescribing population.

Comparison with other studies

Our findings have identified that a broad range of factors influence the prescribing behaviour of nurse and pharmacist prescribers. Although there is limited evidence available that has examined the prescribing behaviour of these groups, several studies have identified some of these influences on the antibiotic prescribing behaviour of nurses. Similar to findings reported by Williams [35] and Rowbotham, [23] we found that relationships with other prescribers and knowledge of current guidelines, influenced behaviour.

Diagnostic uncertainty and the clinical condition of the patient, influences we identified, have also been reported by Abbo,[36] Rowbotham [23] and Adorka.[37]. As in our research, patient expectations for an antibiotic, has also been cited previously.[23, 37] Interestingly, prescribers in our study reported that they saw patient expectations for an antibiotic as an an opportunity to educate patients, and that having additional time enabled them to capitablise upon this teachable moment. [38]

Our findings are in-line with expert consensus work [39] which has mapped BCTs to TDF domains for which they are most likely to be effective. Associations between 9 of the BCTs we identified with 7 TDF domains support the associations described by Cane et al [39] (See Table 3). Although not focusing on nurse and pharmacist prescribers, McParlin et al [40] used the TDF domains and BCT taxonomy to understand the way in which AMR public health interventions operate. These researchers analysed 20 interventions, designed to increase public antimicrobial awareness and/or to improve AMS. All but three interventions demonstrated effectiveness. As identified in our research, commonly used individual BCTs associated with the TDF domain Knowledge were 'Information about health consequences'and 'Instruction on how to perform a behaviour'. 'Prompts and cues' were similarly associated with the domain 'Environmental Context and Resources'. 'Monitoring of behaviour without feedback', and 'Feedback on behaviour', also BCTs identified as important in our research, were reported by these researchers to be unique to the most successful interventions.

Meaning of the study: Possible explanations and implications for clinicians and policy makers

Our findings can be used as the basis for development of a theoretically informed intervention to support appropriate prescribing by these prescribers. They can also be used by practitioners to identify their individual facilitators and barriers to appropriate prescribing. Policy makers, researchers in collaboration with practitioners, will need to consider these barriers and facilitators before designing an acceptable intervention.

Unanswered questions and future research

The next step is to develop an intervention based on our findings and test its feasibility and acceptability among nurse and pharmacist prescribers and whether it results in lasting changes to antibiotic prescribing behaviours.

CONCLUSION

Given that increasing numbers of NMPs working in primary care and managing infections, it is important that these findings are used to develop interventions to support appropriate prescribing behaviour by these groups.

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COMPETING INTERESTS

All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf and declare: no support from any organisation for the submitted work, no financial relationships with any organisations that might have an interest in the submitted work in the previous three years, no other relationships or activities that could appear to have influenced the submitted work..”

CONTRIBUTORSHHIP STATEMENT

MC made a substantial contribution to the conception and design of the work; the acquisition and interpretation of data, and drafting of the work. SR and AC made a substantial contribution to the design of the work, the acquisition, analysis and interpretation of data, and drafting of the work. RL, SP, KY, made a substantial contribution to the acquisition and interpretation of data, and critically revised drafts of the work. All authors approved the final version to be published and agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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INTEGRITY OF THE DATA AND ACCURACY OF THE DATA ANALYSIS

All authors had full access to all the data in the study and can take responsibility for the integrity of the data and the accuracy of the data analysis.

TRANSPARENCY DECLARATION

The lead author affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

DATA SHARING STATEMENT

No additional data available i.e. the dataset supporting the conclusions of this article are included within the article.

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Supplementary Table 1: Codes mapped to TDF, COM-B and BCTs

COM-B	Theoretical Domain	Codes and examples of interview quotes	BCTs
CAPABILITY (Psychological)	**Knowledge:** An awareness of the existence of something	**Training and knowledge around appropriate prescribing** *"We all need to make sure that we are aware of current guidelines, when to prescribe, and when you shouldn't … to ensure that you are giing safe care". (Interviewee 2 - nurse)* *"I think if they (practices) held 3 monthly or a yearly a sort of group session which they could invite local people to come to and people could give them a short presentation on you know winter is coming up, this is what you need to do to look after yourself, so you kind of educate the population beforehand". (Interviewee 7 – pharmacist)*	4.1 Instruction on how to perform the behaviour
		Knowledge of own prescribing rate *"..having your medicines management team come round and benchmark you against national standards, benchmark you against your peers, make you challenge and reflect on your clinical practice, I think those are all invaluable and should be encouraged." (Interviewee 2 – nurse).* *"Yes we have a local meeting, a training session, it was more like a meeting actually but like an audit with the local CCG team, in relation to our practices antibiotic prescribing and comparing it to the area in the north west and things like that, so that kind of helped influence and perhaps reduced my antibiotic prescribing, by having a bit more scrutiny in prescribing so*	6.2 Social comparison 2.2 Feedback on behaviour
		Knowledge of AB resistance *"I have sort of come from an area (practice) where they really are quite tough on it (resistance) and I can understand the consequences. And also, when you see people through and you see that those antibiotics are a quick fix of a consultation at a time, haven't made any difference, then you are dealing with something that is probably either not infective, or like you say, where the antibiotics are just not working, maybe because of resistance." (Interviewee 5 – nurse)* *"I can remember going to a few talks (by microbiologists) on those like god twenty odd years ago, and I have not been to anything recently and I don't know where the forum would be, to have those sort of discussions, so that would be really useful, but I haven't come across any of those". (Interviewee 5 – nurse)* *"I think they are important (training updates) there's e-learning which is useful as you can undertake this in your own time..you can sort of touch on the edges of this subject (antimicrobial resistance) when its e-learning..it helps to raise awareness."(Interviewee 6 – nurse)*	5.2. Information about health consequences 9.1. Credible source 4.1 Instructions on how to

			perform a behaviour
CAPABILITY (Physical)	**Skills:** An ability or proficiency acquired through practice	**Consultation skills** *"You have to be confident, and you have to be… be competent, not only with your history taking… But, um, also with, um, knowledge of guidelines, um, knowledge of, er… er… or examination skills; you have to be able to examine… The patient; you have to be able to relate those findings… to the patient in a language that they can understand." (Interviewee 15 – nurse)* *"Typically, the clinical examination would start with sats, move on to lymph's, then we would go to throat, we go to ear examination if it was indicated, then we would do potentially shirt off, and we would do respiratory signs front and back oscultation, percussion… shirt back on, summary of assessments, patient's point of view, consider treatments or safety netting, whether it be immediate treatment or whether it be standby treatments or it would be no you have got a viral infection here, so we go through the signs and what to look out for. And then they would be on their way (inaudible) to make sure that they knew what to do if things were to go badly, and when to seek review". (Interviewee 17 – nurse)*	4.1 Instruction on how to perform behaviour 6.1 Demonstration of the behaviour
CAPABILITY (Psychologicall)	**Memory, attention and decision processes:** The ability to retain information, focus selectively on aspects of the environment and choose between two or more alternatives	**Considering a range of factors in decision making** *"Looking at things like are they feverish, do they have other symptoms of being unwell, do you know what I mean, or is this just localised to the chest. We obviously do a full examination of the chest and look for signs, and see if we have got uneven signs, is it worse on the left or the right, which would indicate infection. We also much more than in general practice, which I find quite odd really, that I am still getting used to, do bloods. So if they have got a raised white cell count or they are CRP indicative as infection rather than as a disease process…." (Interviewee 21- pharmacist)* *"If we have decided that they do have an acute bacterial that would benefit from antimicrobial treatments, I would use the HPA guidelines, un-amended. So we follow the guidelines that are the national ones, and depending on the patient's situation because of the allergies, co-existing conditions, previous treatment perhaps, knowledge of locally circulating bugs, and I would choose according to that". (Interviewee 13 – nurse)*	1.2.Problem solving 4.1 Instructions on how to perform a behaviour
CAPABILITY (Psychological)	**Behavioural regulation:** (Anything aimed at managing or changing objectively	**Benchmarking and audit processes** *"Making sure that there are audits that you can do so that you can benchmark your work against your colleagues. If you are consistently prescribing too much, I think medicines management should identify you, and you should be asked to do a top-up course. You know when you get 3 points on your license, I think you need to do a half day training course. So over in Bath and Somerset, that is what they have been doing with her medicines management team, so if you are over prescribing, against your peers, you are identified and you are invited to come down for a training day. It is a little bit heavy handed, but we are heading towards a very scary place and I think we need to be quite bold with our interventions". Interviewee 2 – nurse)*	6.2 Social comparison *2.2* Feedback on behaviour

	observed or measured actions	*"I am happy about that, because that is all about auditing your own practice and doing things like that yes. I mean I do go through periods where I audit people that I see, what's happened, did they come back, did they get better, did they get worse, and that also kind of reassures you as well that you are either doing the right or the wrong thing, you know it is just... and you can do that at anytime, not just because you have been doing it for 14 years, but because you need to sort of turn the soil so to speak*". (Interviewee 3 – nurse)	2.3 Self-monitoring of behaviour
MOTIVATION (Reflective)	**Social/professional role and identity:** A coherent set of behaviours and displayed personal qualities of an individual in a social or work setting	**Responsibility for appropriate prescribing** *"I believe I have a responsibility to follow guidelines and not prescribe an antibiotic if it is not needed. I see this as part of my job. I believe that it is part of my role to prescribe antibiotics appropriately and so help to reduce antimicrobial resistance". (Interviewee 16 – nurse)"..so I've got that responsibility to the health service and to society, and that partly comes with the privilege of being a prescriber. …I think this is definitely part of my role, is…is managing antimicrobial prescribing". (Interviewee 17 – nurse)* *"….and also on the wall (poster) I have this pledge to care from Public Health England, I am an antibiotic guardian, so I point that to them (patients)as well, it has got my picture on it and I have signed it…*"(Interviewee 8 – nurse)	13.1 Identification of self as role model
		Value-add of non-medical prescriber role *"I do think as nurse prescribers, there is that added value from a nurse….I am probably more contentious and I am thinking more about what if this isn't right and, whereas GP's are very busy, they are doing lots of things… they have seen it before they have done this for a long long time, but we area much more updated on new guidance and much more aware of being up to date on new guidance …"(Interviewee 5 – nurse)* *"The non-medical prescribing course is so stringent and so strict that I don't think you will see non-medical prescribers doing this sort of thing [prescribing on the basis of patient expectation]".(Interviewee 2 – nurse)* *"there is that added value from a nurse prescriber….I am probably more contentious and I am thinking more about what if this isn't right and, whereas GP's are very busy, they are doing lots of things… they have seen it before they have done this for a long long time, but we are much more updated on new guidance…*"(Interviewee 5- nurse)	6.2 Social comparison 4.1 Instructions on how to perform a behaviour
	Beliefs about capabilities (Acceptance of the truth, reality or validity about an ability, talent or	**Confidence in own abilities and awareness of own limits/limits of NMP role** *"…so there is one drug that you used to prescribe for chest infections and it was always for 7 days and the guidelines now are actually for 5 days, and now I always check my guide because I am just like that and now I am more confident to say no actually it should only be five but when I very first started prescribing I found that really really difficult …because I felt maybe I should be prescribing longer than it says on the guide, because more experienced people are telling me that so I think when*	15.3 Focus on past success 15.1 Verbal persuasion

	facility that a person can put to constructive use	*you are a newly qualified prescriber, the more experienced people can have a strong influence over you and it is not always right..'(Interviewee 10 – nurse)* *"I think I am fairly confident, there is always that element of doubt, you know there are no certainties in this world but if you give a thorough examination, you safety net appropriately, you are aware of the guidelines, you should be fairly confident at what you are doing, but I think new patient diagnostics are incredibly important in general practice". (Interviewee 2 – nurse)*	about capability 15.2 Mental rehearsal of successful performance
	Beliefs about Consequences: Acceptance of the truth, reality, or validity about outcomes of a behaviour in a given situation	**Managing risk** *"It can be for instance if they have got COPD or any on going respiratory problems because we have to be guided by that as well, well obviously the physical examination if they come in with a temperature, low blood pressure or a high pulse, or their chest is really rattily, so it is guided by my clinical examination".* (Interviewee 7 – pharmacist) *"…and for me your level of frailty and how poorly you are are deciding factors, and I may choose to treat someone who is very frail, but I wouldn't treat someone who is well… simply because the consequences of not treating would be much more serious, with the risk of hospitalisation. So what I am talking about is almost a threshold prescribing, and I think I do adjust that threshold according to the individual… based on their risk". (Interviewee 10 – nurse))*	4.1 Instruction on how to perform the behaviour 5.1 Information about health consequences
		Consequences/risks of using antibiotics *"We know that it is on the increase, we know that it has been fuelled by the over prescription of antibiotics, we know that if we don't do anything about it, we are potentially heading to an antibiotic apocalypse. And we know by 2050, that more people will die of antimicrobial resistance disease than they do of cancers and car crashes today". (Interviewee 2 – nurse)* *"You know that prescribing certain antibiotics are going to make people actually feel more unwell "(Interviewee 15 – nurse)*	5.1 Information about health consequences
		Fear of complaint *"Some patients can be really quite demanding, um, and, er, well, make complaints as well. recently I'd had, in fact, two complaints that I had not prescribed antibiotics, which had then been prescribed by other clinicians". (Interviewee 4 – nurse)* *"The expectations are easier to manage these days, of course there are arguments, well heated discussions, occasionally with patients who insist they want antibiotics… but occasionally in that situation we may be adopt a delayed prescription strategy, which can be really valuable in terms of defusing that situation"'(Interviewee 10 – nurse)*	5.3 Information about social and environmental consequences
		Meeting expectations and satisfaction	

		"As long as you have met their expectations or challenged their concerns, and have given them an answer that they understand in a way that they understand it, then they will leave satisfied whether they have got antibiotics or not!. (Interviewee 2 – nurse) *"But it is if you leave a patient dissatisfied or with any unmet needs they are more likely to re-consult, to come back in to clinic, so they will either go to out of hours, A & E, or they will go and see another clinician in the GP practice, or you can end up with them having a long discussion about what antibiotics can and can't do". (Interviewee 2 – nurse)* *Patients will be satisfied if expectations are met but some patients will come back for antibiotics if you don't prescribe." (Interviewee 2 – nurse)*	5.3 Information about social and environmental consequences
		Prescribing antibiotics reinforces patient beliefs about their effectiveness *"…the GP saw them last week, saw that they had a chesty cough, they had a bit of a temperature and they were coughing up something green and they prescribed some amoxicillin, and they have safety netted and said if you are no better in a week come back. Guess what, the patient is going to come back. So they come back and see me, and they say right I was here last week I saw GP Y, they said I have got a chest infection, they gave me some antibiotics, they said come back if I am no better. I am no better. I need some stronger antibiotics". (Interviewee 2 – nurse)* *"Some GP's will just write a prescription for 7 days with 250mg of amoxicillin, three times a day. And it's a homeopathic dose it's a pat on the head and a piece of green paper, and the patient comes away from that consultation happy, they have got their antibiotics, they won't get better because of the antibiotics, they will get better because it is self-limiting, viral RTI. But what that health care professional is doing, is perpetuating the expectation of I am unwell, I will get antibiotics I will get better. The hard thing you have to do as a prescriber is to turn around and say you don't need antibiotics at this time" (Interviewee 11 – nurse)*	6.1 Demonstration of behaviour
MOTIVATION (Automatic)	**Goals:** Mental representations of outcomes or end states that an individual wants to achieve	**Maintain appropriate levels of prescribing** *"….whether you are doing it yourself (auditing) or someone else is and when you look in prescribing, when they send you the prescribing breakdown for the different practices within your area, you always want to try and be on the low side."' (Interviewee 3 – nurse)* *"I recently looked at some of our prescribing data and I am not doing badly. I am someone with lower antibiotic prescribing rates however, I only work part time. I wouldn't want my data to be high as this would look really bad amongst colleagues" (Interviewee 16 – nurse)* *"…in nurse meetings I am always banging on about it, they are probably sick of it now.. Just so that everyone doesn't over prescribe, and for all of my prescribing, for every antibiotic it is actually audited, so I can actually see if someone is overprescribing are there trends that are slightly out or who might be prescribing just for the sake of it because it is an easier life, and trying to eradicate it that way as well.."* (Interviewee 6 – nurse)	2.3 Self-monitoring of behaviour 1.1 Goal setting (behaviour) 1.5 Review behaviour goal

	Reinforcement: (Increasing the probability of a response by arranging a dependent relationship, or contingency, between the response and a given stimulus	**Audit and feedback as a mechanism for reinforcing appropriate prescribing** *"Specifically, this year we have looked at the use of quinolones, ketasporines and comoxiclad and that was influenced of course by the national agenda but also our local medicines management team at the CCG, they push that agenda as one of their priorities for the year and resource it through the prescribing incentive scheme. So inevitably there were rewards available to practices and practitioners, so that will influence my prescribing for sure" (Interviewee 21 – pharmacist)* *"So over in Bath and Somerset, that is what they (medicines management team) has been doing, so if you are over prescribing, against your peers, you are identified and you are invited to come down for a training day. It's a little bit heavy handed, but we are heading towards a very scary place and I think we need to be quite bold with our interventions".* (Interviewee 2 – nurse)	2.1 Monitoring of behaviour by others without feedback 10.2 Material reward (behaviour) 2.2 Feedback on behaviour
	Emotion: A complex reaction pattern, involving experiential, behavioural, and physiological elements, by which the individual attempts to deal with a personally significant matter or event	**Empathy for patient suffering** *"If they have got an infection and they have waited quite a long time in the delays coming in to see someone or, if it's a really busy day and they are sat there in the waiting room for hours and you can just see them getting worse and worse, and you are thinking someone needs to see this patient and get them in. You feel terrible for them, if you can give them… they are kind of looking at you wanting to be able to feel better and looking for that magic cure and you know it's going to take time, you do feel for them.."(Interviewee 6 – nurse)* *"They can be very angry, frustrated, annoyed, frightened as well. It is petrifying, if you live on your own and you think you have got a serious chest infection, what if there is not going to be anyone there in the middle of the night, that is frightening, you really feel for them. Relief as well, you've listened to my chest, there is nothing there, hopefully I can get on with my day" Interviewee 2 – nurse)* *"They might be waiting… And obviously sometimes they are not very happy about that so that can influence my decision, because actually if they have been waiting an hour and they feel poorly and they want antibiotics what am I going to do… Am I going to sit there and explain that they don't want it, or am I going to give it to them. That is a difficult scenario…". (Interviewee 9 – nurse)* **Influence of stress and fatigue on ability to make prescribing decisions** *"…you know it shouldn't but if you are tired and exhausted we know that quality and safety slips, we know that if you are in any profession, you miss your breaks, you are overtired, you've worked too long your head is somewhere else. Whether you are laying block, waiting on tables, nursing, you know a surgeon (a politician), you know if you are not there in present, you are going to let standards slip so you need to look after yourself". (Interviewee 2 – nurse)*	11.2 Reduce negative emotions (within the practitioner) 5.6 Information about emotional consequences 5.4 Monitoring of emotional consequences 11.2 Reduce negative emotions

		"Probably towards the end of the day, I am probably a little bit more lenient, because you are tired and a bit stressed and you want to go home, and sometimes it can be an easy fix. I try not to, but sometimes, whether at the beginning of the day you weren't quite sure, you would rationalise it a bit more and explain it a bit more, whereas you might at the end of the day, you might sort of lean to like well I am not quite sure, ok just take them.." (Interviewee 12 – nurse) **Influence of emotions on prescribing decisions** *"Of course, you are never perfect all the time, but yes there are certainly times when I can recall when I have just gone (sigh) look here you go, you are never going to believe me anyway, or I have not got got through to you, I have not done it, or it is too much of a fight to argue the other way. And that is really disappointing, you don't get any sort of pride in your work from that, it's very very disheartening". (Interviewee 6 – nurse)* *"So I use local guidelines but I also like I say because I know a lot of local guidelines, and obviously from reading up on things and looking at NICE guidelines, I use univadis and stuff like that, and I have been on the GP updates so I sort of use what I get from those as well, very much so I tend to, the local guidelines are there and I can see what neighbouring practices there and as I say the hospital seems to just give comoxiclad first thing, but I do what I think is the right thing through the different bits of evidence that there is around you know". (Interviewee 5 – nurse)* *"Diagnostics, patient diagnostics, I am going to go back to that one, I think our consultations can be very subjective, they can be influenced by so many different factors from the clinicians to the patients themselves, and having some objective measures in there can really tighten things up". (Interviewee 2 – nurse)* *"where you are seeing a patient every 15 minutes and half of them are all going to come in with the same thing, and you are going to have the same consultation, at repeated times throughout the day where this all looks really viral. I know you feel awful, but I don't think antibiotics are going to do anything for you, and then you have the conversation about the antibiotics, that was exhausting. That is why I got involved with the diagnostics because I couldn't emotionally go through another winter of listening to someone's chest, giving them my opinion and for them to throw it back at me". (Interviewee 4 – nurse)* *"It is very hard to divorce yourself from your feelings, and if you have had a long day and it is your last patient, it's a Friday evening and as I say it is usually Mrs Smith with twins aged 8 with snotty noses at quarter to six on a Friday evening. Your feelings are I want to go home and it shouldn't influence your decision making but I would be lying to you if it old you it didn't because it does influence your decision making". (Interviewee 11 – nurse)*	
OPPORTUNITY (Physical)	**Environmental context and resources:** Any	**Availability and accessibility of resources to make and communicate prescribing decisions** *"So I use local guidelines but I also like I say because I know a lot of local guidelines, and obviously from reading up on things and looking at NICE guidelines, I use univadis and stuff like that, and I have been on the GP updates so I sort of use what I*	4.1 Instruction on how to

	circumstance of a person's situation or environment that discourages or encourages the development of skills and abilities, independence, social competence and adaptive behaviour	*get from those as well, very much so I tend to, the local guidelines are there and I can see what neighbouring practices there and as I say the hospital seems to just give comoxiclad first thing, but I do what I think is the right thing through the different bits of evidence that there is around you know". (Interviewee 5 -nurse)* *"Diagnostics, patient diagnostics, I am going to go back to that one, I think our consultations can be very subjective, they can be influenced by so many different factors from the clinicians to the patients themselves, and having some objective measures in there can really tighten things up". (Interviewee 2 – nurse)* *"Obviously the PC will tell you you have notes on the PMR, about whether they have got these comorbidities and the system will also tell you when they last had an antibiotic, which one is being prescribed to and what they are doing with it, how often are they returning with these symptoms so the computer kind of helps you in that sense" (Interviewee 7 – pharmacist)* *"Then in your GP practices, making sure that you have got the posters up, I like the posters that tell patients it's normal to go on for X amount of time, ear infections, it's normal to go on for this amount of time…."(Interviewee 2 – nurse)* *"Massively helpful are the GP leaflets, you hand them to the patients, the reason why you are not prescribing and the safety net so that they feel reassured that they know precisely when they need to seek help". (Interviewee 21 – pharmacist)*	perform behaviour 7.1 Prompts and cues 7.1 Prompt and cue
		Time and workload pressures *"Yes but they might not have challenged the patient, they might not have really asked them are you really expecting antibiotics or do you just want me to check and makes sure you are ok, and that takes time … I have got the luxury of a 15 minute appointment. … I think you would struggle to give really good quality care under the pressures that current GPs have". (Intervviewee 12 – nurse)* *"So you still have that extra 2,3, 4 minutes we can spend on educating the patient. So I normally print off the antibiotic toolkit from I think the royal college of… the RCGP website, there is an antibiotics leaflet on there, so I will print the leaflet off and I will give it to them and explain to them, these are your symptoms, this is what you need to in case this happens you need to come back to us, so I think the time element is the restriction*". (Interviewee 7 pharmacist) *"I am really fortunate now and I would try to, and when I was I was in general practice, to offer a follow up appointment, say I will see you tomorrow or the next day, or when I was on triage, just give me a ring tomorrow morning if you have really had a bad night and we will take it from ther.."*e (Interviewee 5 – nurse) *"I think time is an element there… so the GPs get 10 minutes… myself and some of the… the Nurse Practitioners that I work with in… in our practice, they get 15 minutes as well… And I get 15 minutes, so, I mean, after… after a few years of experience, we… we… we kind of can do a respiratory tract… tract infection consultation in 10 minutes… you can do it, so you still have that extra sort of like two to three, four minutes… Which we can spend on educating the patient (Interviewee 7 – pharmaicst)*	

OPPORTUNITY (Social)		**Patient factors** *"Generally, I think some of the younger patients, some of them are a little bit more understanding when you give them the explanation you know, why you are not giving them the antibiotics, and we give them that sheet (patient information leaflet) and obviously they can go and google stuff their selves if they want .."(Interviewee 18 – nurse)* *"If there are any communication difficulties, so you know if they can't hear very well. If they can't understand me very well, if there are language problems, it is very difficult to manage patients who have learning difficulties, you might not be able to get a thorough story, they may be frightened by their examination as well, you have got patients who have got phobias as well, they don't want to come in, they will be forced to come in, and then they will tell you anything so they can get out as fast as they can, so all those things can hinder it and cloud your examination". (Interviewee 15 – nurse)* *"We have got quite a lot of eastern Europeans in the area and I assume from when they come in they always get antibiotics for whatever they go for, so they do come in expecting them and the because there is the language barrier, that creates quite a problem, explaining why you can't give them, and then they are not really understanding why you are not because they are just expecting them."* (Interviewee 12 – nurse) *"I have decision making support tools as well which allow me to text my management plan, so my consultation and my management plan I can text it straight to their phone. That is really handy if someone doesn't… for example a child has been bought in by a grandparent but the grandparents don't speak English, and the mum or dad is at work and I can text mum and dad and say look, I have seen your child, this is what I did, this is what I found out and this is what I've planned…"*(Interviewee 2 – nurse)	1.2 Problem solving
	Social influences (Those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviours	**Manage patient expectation and satisfaction while providing appropriate care** *"I get them to engage with making the decision, and sometimes they'll say oh well just leave it, you know, and if things get worse we'll come back, and sometimes they say, um, you know, I'm happy to take that risk of actually not having the antibiotics. And very often, they don't, you know, when you put it like that and you ask them to make the decision, the patient will choose not to have the antibiotics but come back if they get worse". (Interviewee 17 – nurse)* "My goals are that the patient gets the correct diagnosis at the correct time by the correct clinician, that's my goal. I don't want to see anyone going to hospital, I want people to be managed in the community, I want them to be seen at the right time, that's my goal, to get the correct diagnosis, and the correct management plan, that is absolutely my goal". (Interviewee 2 – nurse)	1.2 Problem solving 1.1 Goal setting (behaviour)

		Patient expectations and pressure for antibiotics *"I wouldn't prescribe if somebody asked me to, what I would do is sort of use that opportunity to give my rationale and sort of like maybe educate in terms of… so that next time they didn't ask somebody else…" . (Interviewee 10 nurse)* *"I think maybe just trying to increase the public's awareness of the appropriate use of antibiotics… that a viral cough can leave you with a cough for 6 weeks. Most people don't know that, …. So I think for me managing it nationally, if we could have better education". '(Interviewee 10 – nurse)* *"If you asked all the doctors nurses and pharmacists that I work with, they would all say I think for patients, that we all are singing from the same hymn sheet here and they are quickly getting used to the fact that antibiotics aren't just automatically given every time you have a bit of a cough or a splutter."* (Interviewee 21 - pharmacist) *"I refused, I said you really don't need any amoxicillin, you don't need anything, and he stood there, and he stood up above me, intimidating me saying you will give me what I want, and I said, I am really sorry but I will not. So what did he do, what did he do, he went out, he went outside, he phoned out of hours again and got another appointment and this time wouldn't come in and see me. So he spent 8 hours of boxing day in the out of hours service, in Weston-supermare to get the antibiotics..". (Interviewee 11 – nurse)*	5.1 Information about health consequences
		Patient-prescriber relationship *"I know in my head this is not a bacterial infection, and then it is that good communication, being open, friendly. So that the patients will then kind of listen and accept and trust what you are saying. I think gaining trust is really important". (Interviewee 9 – nurse)* *"I am lucky in my job I have got time to talk to people, but in general practice I think, often as a nurse practitioner you have often built up a trusting relationship, and I think on the whole people do find you easier to talk to than doctors. That is just so valuable, if you can use that to make an intervention if you like, to try and make a difference to expectations". (Interviewee 5 – nurse)* *"Yes you need a good rapport with that patient, you need to have them trust you in the first place so that they actually believe your judgement, and also to be able to feedback why you don't feel antibiotics are right at that time." (Interviewee 6 – nurse)*	3.1 Social support (unspecified)

		Relationships with other prescribers *"Sometimes there might be a clinical issue where there might be something going on here that I am missing, or it might be can you (colleague) come in and have a chat and really we can both decided that definitely we don't need to hand out an antibiotic, it can be something like, that's standard across the board for seeing patients anyway. It can be another tool you can use to avoid prescribing". (Interviewee 3 – nurse)* *"I will follow up or one of my colleagues, the three ANP's in the team, so we will follow people up and we would know if they are getting worse, I mean often in my current role, we have carers who will go in 4 times a day, we would definitely review people, so it's really useful actually you can see exactly how people are doing and whether it has made a difference or not". (Interviewee 5 – nurse)* *"People (another prescriber) will say, just give them another one (different type of antibiotic) and I will think that's not really what I am asking you, I just wanted to discuss it and see if we can do something else, because I am not really sure if it is going to do anything if I do take you know (different type of antibiotic)… But then you are arguing with another clinician and maybe that is a doctor versus another nurse practitioner, so there is a slightly different playing field there. So yes those are some of the things (that influence prescribing)". (Interviewee 3 – nurse)* *"I think you never work entirely alone in healthcare you have always got somebody to talk to and somebody to bounce it off, there are even things now you know like there is an ANP Facebook page, which is great because you will sit and you will mull over this in the evening and you will see all of these conversations going on, did I do the right thing here, what are the factors. You know it is easy to be critical of people for prescribing possibly inappropriately, but everybody understands the pressures that are there… " (Interviewee 5 – nurse)*	3.1 Social support (unspecified) 12.2 Restructuring the social environment 6.2 Social comparison

Standards for Reporting Qualitative Research (SRQR)*

http://www.equator-network.org/reporting-guidelines/srqr/

	Page/line no(s).
Title and abstract	
Title - Concise description of the nature and topic of the study Identifying the study as qualitative or indicating the approach (e.g., ethnography, grounded theory) or data collection methods (e.g., interview, focus group) is recommended	Page 1
Abstract - Summary of key elements of the study using the abstract format of the intended publication; typically includes background, purpose, methods, results, and conclusions	Page 2
Introduction	
Problem formulation - Description and significance of the problem/phenomenon studied; review of relevant theory and empirical work; problem statement	Page 3-5
Purpose or research question - Purpose of the study and specific objectives or questions	Page 5
Methods	
Qualitative approach and research paradigm - Qualitative approach (e.g., ethnography, grounded theory, case study, phenomenology, narrative research) and guiding theory if appropriate; identifying the research paradigm (e.g., postpositivist, constructivist/ interpretivist) is also recommended; rationale**	Page 5
Researcher characteristics and reflexivity - Researchers' characteristics that may influence the research, including personal attributes, qualifications/experience, relationship with participants, assumptions, and/or presuppositions; potential or actual interaction between researchers' characteristics and the research questions, approach, methods, results, and/or transferability	Page 5-9
Context - Setting/site and salient contextual factors; rationale**	Page 6
Sampling strategy - How and why research participants, documents, or events were selected; criteria for deciding when no further sampling was necessary (e.g., sampling saturation); rationale**	Page 6
Ethical issues pertaining to human subjects - Documentation of approval by an appropriate ethics review board and participant consent, or explanation for lack thereof; other confidentiality and data security issues	Page 8
Data collection methods - Types of data collected; details of data collection procedures including (as appropriate) start and stop dates of data collection and analysis, iterative process, triangulation of sources/methods, and modification of procedures in response to evolving study findings; rationale**	Page 6-8

Data collection instruments and technologies - Description of instruments (e.g., interview guides, questionnaires) and devices (e.g., audio recorders) used for data collection; if/how the instrument(s) changed over the course of the study	Page 6-8
Units of study - Number and relevant characteristics of participants, documents, or events included in the study; level of participation (could be reported in results)	Pages 9-10
Data processing - Methods for processing data prior to and during analysis, including transcription, data entry, data management and security, verification of data integrity, data coding, and anonymization/de-identification of excerpts	Page 8
Data analysis - Process by which inferences, themes, etc., were identified and developed, including the researchers involved in data analysis; usually references a specific paradigm or approach; rationale**	Page 8
Techniques to enhance trustworthiness - Techniques to enhance trustworthiness and credibility of data analysis (e.g., member checking, audit trail, triangulation); rationale**	Page 8

Results/findings

Synthesis and interpretation - Main findings (e.g., interpretations, inferences, and themes); might include development of a theory or model, or integration with prior research or theory	Page 9-18
Links to empirical data - Evidence (e.g., quotes, field notes, text excerpts, photographs) to substantiate analytic findings	Page 9-18

Discussion

Integration with prior work, implications, transferability, and contribution(s) to the field - Short summary of main findings; explanation of how findings and conclusions connect to, support, elaborate on, or challenge conclusions of earlier scholarship; discussion of scope of application/generalizability; identification of unique contribution(s) to scholarship in a discipline or field	Pages 18-21s
Limitations - Trustworthiness and limitations of findings	Page 19

Other

Conflicts of interest - Potential sources of influence or perceived influence on study conduct and conclusions; how these were managed	N/A
Funding - Sources of funding and other support; role of funders in data collection, interpretation, and reporting	Page 22

*The authors created the SRQR by searching the literature to identify guidelines, reporting standards, and critical appraisal criteria for qualitative research; reviewing the reference lists of retrieved sources; and contacting experts to gain feedback. The SRQR aims to improve the transparency of all aspects of qualitative research by providing clear standards for reporting qualitative research.

**The rationale should briefly discuss the justification for choosing that theory, approach, method, or technique rather than other options available, the assumptions and limitations implicit in those choices, and how those choices influence study conclusions and transferability. As appropriate, the rationale for several items might be discussed together.

Reference:

O'Brien BC, Harris IB, Beckman TJ, Reed DA, Cook DA. **Standards for reporting qualitative research: a synthesis of recommendations.** *Academic Medicine*, Vol. 89, No. 9 / Sept 2014
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Examining influences on antibiotic prescribing by nurse and pharmacist prescribers: A qualitative study using the Theoretical Domains Framework and COM-B

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Title: Examining influences on antibiotic prescribing by nurse and pharmacist prescribers: A qualitative study using the Theoretical Domains Framework and COM-B

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Antibiotic prescribing by nurse and pharmacist prescribers

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ABSTRACT

Objectives: Respiratory tract infections are frequently managed by nurse and pharmacist prescribers and these prescribers are responsible for 8% of all primary care antibiotic prescriptions. Few studies have explored antibiotic prescribing amongst these prescribers, and interventions to target their antibiotic prescribing behaviour do not exist. Research objectives were to (1) use the Theoretical Domains Framework to identify the factors that influence nurse and pharmacist prescriber management of respiratory tract infections, (2) identify the Behaviour Change Techniques that can be used as the basis for the development of a theoretically informed intervention to support appropriate prescribing behaviour.

Design: Qualitative design comprising semi-structured interviews, using the Theoretical Domains Framework and Capability, Opportunity and Motivation for Behaviour (COM-B).

Setting: Primary care

Participants: Twenty one prescribers (4 pharmacists and 17 nurses)

Results: A range of factors across twelve domains of the TDF were found to influence prescriber behavior, and forty BCTs were identified as supporting appropriate prescribing. For example, patient expectations (social influence) was identified as a factor influencing prescribing decisions, and a number of BCTs (problem solving, goal setting, information about health consequences) were identified as supporting prescribers in managing these expectations.

Conclusion:. With increasing numbers of nurse and pharmacist prescribers managing infections in primary care, these findings will inform theoretically grounded interventions to support appropriate prescribing behaviour by these groups.

ARTICLE SUMMARY

Strengths and weaknesses

- Using an established framework to explore the theoretical mechanisms of action and mechanisms of change to understand the antibiotic prescribing behaviour of nurse and pharmacist prescribers is a key strength

- Although participants were a national sample, few were pharmacists and so our findings may not present an accurate picture of this population, however, this sample reflects UK primary care where most prescribers are nurses

- Although data saturation was achieved, participants were an opportunistic sample and may have been more motivated towards appropriate antibiotic prescribing.

INTRODUCTION

Multi-drug resistant infections are one of the greatest threats to human health, [1] responsible for an estimated 25,000 deaths and €1.5 billion in extra healthcare costs every year in the European Union (EU) alone.[2] Between 2000 and 2010 the global human consumption of antibiotics increased by 36%.[3] The inappropriate use of antimicrobials in humans, is a leading driver for the increase in antimicrobial resistance (AMR),[4] however, resistance is reversible [5] and strategies that support appropriate antibiotic use are crucial.[6]

Most antibiotcs are prescribed in primary care for respiratory tract infections (RTIs),[7-9] however, most RTIs spontaneously resolve without an antibiotic. Conserving antibiotic sensitivity through the management of RTIs without recourse to antibiotics is a global priority [5,7,10,11] and the antibiotic prescribing behaviour of healthcare professionals is a key target for intervention.

Existing research has focused upon understanding how General Practitioners (GPs) make prescribing decisions for patients with acute RTIs. Key influences include perceptions of patient expectations [12], patient pressure [13], diagnostic uncertainty,[14], factors imposed by healthcare systems and clinician characteristics [15]. Systematic reviews [16-17] have identified that effective interventions are those that target the broader patient population, are complex and multifaceted in addressing barriers to change in specific healthcare settings. Multifaceted interventions that promote shared decision-making [18] have also had promising results.

In the United Kingdom (UK), around 30,000 nurses and 4000 pharmacists have the same independent prescribing capability as doctors [19]. The numbers of these 'non-medical prescribers (NMPs)' is steadily increasing,[19] to fulfil the workforce needs of the National Health Service (NHS).[20-22] These prescribers frequently manage patients with RTIs and are responsible for 8% of all primary care antibiotic prescriptions

[15] however, few studies have explored their antibiotic prescribing practices. Like GPs, diagnostic ambiguity, and patient expectations can influence decision making.[23] Furthermore, NMPs perceive themselves to be open to scrutiny by medical prescribers, and are conscious of keeping to clinical guidelines.[23] Although NMPshave developed strategies for managing RTI consultations, there is scope for improvement.[24]

Interventions must be tailored to the population and context in which the target behaviours are delivered.[25,26] Although interventions exist to support the antimicrobial stewardship (AMS) activities in which NMPs are involved,[27] no interventions exist to target their antibiotic prescribing behaviour.

Growing evidence supports the use of theory to identify barriers and facilitators to changing practitioner behaviour.[17, 28] One such approach is the Behaviour Change Wheel (BCW).[26] The original BCW, encompasses three layers that should be considered when supporting behaviour change; 1) the determinants of behaviour (Capability, Opportunity and Motivation for Behaviour (COM)-B); 2) intervention functions with which to intervene with these determinants; 3) policy categories to support change on a more structural level. At the hub of the BCW, the COM-B model aims to facilitate a behavioural diagnosis by understanding the determinants of behaviour, highlighting an individual's Capability, both physical (such as skills) and psychological (such as knowledge); their Opportunity, both social (norms of practice) and physical (time/space); and Motivation, both reflective (influenced by beliefs such as confidence and intention) and automatic (influenced by emotion or habit). This model is helpful when developing an intervention, as it can be easily mapped to an Intervention Function (i.e. Education, Training, Enablement) using the table in Michie et al.[29] The Theoretical Domains Framework (TDF) [30] unpacks the COM-B further, as it seperates psycho-social drivers of behaviour into 14 domains covering a spectrum of theoretical determinants (knowledge, memory, skills and identity). This helps separate potential ambiguity when attempting to contextualise the determinants of COM-B; i.e. a Psychological Capability

barrier could be both a lack of Knowledge or poor Memory; each of which would require a different Intervention Function; e.g. Education to increase Knowledge or Enablement to enhance Memory, and in turn different Behaviour Change Techniques (BCTs) e.g. giving information to increase knowledge; using prompts and cues to enhance memory. As this science has developed, the TDF has been conceptualised as an additional layer to the BCW after the COM-B [28, 31] and COM-B has been mapped to the TDF [26] and a selection of BCTs from the BCT Taxonomy Version 1 [32] that can be selected as intervention components to change behaviour.[28]

However, there is another way to identify and code BCTs related to the facilitators of behaviour that lacks empirical evidence. Qualitative exploration, allows for both an in-depth COM-B/TDF behavioural diagnosis and the identification of naturally occurring BCTs used by the target population when the target baviour is facilitated.

Objectives

- To use a theoretical framework to identify the factors that influence management of RTIs
- To identify BCTs that can be used as the basis for the development of a theoretically informed intervention to support appropriate prescribing behaviour

METHODS

Design

A qualitative approach, utilising semi-structured interviews.

Recruitment of participants

NMPs work in a variety of roles in primary care across a range of settings [33, 34]. The uptake of prescribing amongst these healthcare professionals is inconsistent across organisations [33-34**]** and not all of these

professionals manage RTI's. Therefore, an opportunitic sample of primary care nurse and pharmacist independent prescribers, responsible for managing patients with RTIs, were recruited nationally. Recruitment occurred through the Royal College of Nursing General Practice (RCNGP) Nurse Forum (approximately 6000 members), the Royal Pharmaceutical Society (RPS) Pharmacist Prescribing Discussion Group (783 members), Prescribing and Medicines Management Discussion Group (520 members), Pharmacists working in GP practices Discussion Group (531 members), and the Queens Nurse Network (1200 members).

Messages were placed on the RCN GP Nurse Forum and the three RPS Pharmacist Prescribing Discussion Groups, describing the study and inviting eligible participants to contact the researchers. Details of the study were emailed to members of the Queens Nurse Network by the Director of Programmes. It is not known how many nurses and pharmacists across the forums, discussion groups, and network, are qualified prescribers or how many manage RTIs. Thirty one prescribers expressed an interest to take part, and 21 (4 pharmacists and 17 nurses) consented to participate.

Materials

An interview schedule was developed based on the TDF (see Table 1). This was a guide and the interviewer was responsive to answers from interviewees. The TDF, as opposed to the simpler COM-B, allowed a more detailed investigation of behavioural determinanats.

Table 1 – Interview schedule and questions under each Theoretical Domain

Theoretical domain	Interview questions
Knowledge	• What do you know about the use of antibiotics for self-limiting RTIs? • What knowledge do you draw upon when managing patients with RTIs?
Skills	• What skills do you think are needed/helpful in managing these consultations?

	• If you have decided not to prescribe an antibiotic, what skills are needed to help manage that consultation?
Social/professional role	• What do you think is your role in reducing antibiotic use and antimicrobial resistance? • To what extent do you see this as part of your job? • What is the role of other practitioners in reducing antibiotic use and antimicrobial resistance?
Beliefs about capabilities	• How confident do you feel that you are able to manage RTI consultations? • How confident do you feel in making decisions about whether to prescribe antibiotics? • What if you are unsure about a diagnosis?
Optimism	• How confident are you that your consultations with patients with RTIs will have a positive outcome? • How is this affected by whether an antibiotic is prescribed?
Beliefs about consequences	• What factors influence your decision to prescribe antibiotics? • What are the benefits and risks of not prescribing antibiotics for RTIs?
Goals	• What are your goals when managing patients within RTI consultations?
Reinforcement	• What factors may reinforce your decision to prescribe not to prescribe antibiotics? • What factors hinder this decision process?
Intentions	• What motivates you to prescribe or not?
Memory/attention/decision process	• How do you decide whether or not to prescribe an antibiotic to someone presenting with RTI? • What processes do you usually follow when managing patients with RTIs?
Environmental context and resources	• What factors support or hinder you to manage these consultations? (e.g. practice setting, community factors, available resources) • How do systems in place support you to prescribe appropriately?
Social influences	• How do patients influence the way you manage RTI consultations and whether you prescribe antibiotics? • How do the people you work with influence your management of RTIs and your decisions around whether to prescribe antibiotics? • How do you think you compare with other prescribers in terms of antibiotic prescribing for RTIs?

Emotion	• How do consultations with patients with RTIs make you feel? • Are there consultations that feel more difficult or uncomfortable? How do your feelings at the time (mood, feelings towards the patient, fatigue) affect whether or not you prescribe antibiotics?
Behavioural regulation	• What things could support you to manage RTI consultations more satisfactorily for you and the patient? • How do you ensure that your antibiotic prescribing is appropriate to the situation? • What things support you to make decisions about antibiotic prescribing?

Procedure

Prescribers who had expressed interest in the study were emailed a participant information sheet and a consent form. They were able to ask any questions prior to providing consent before their interview. Semi-structured telephone interviews were conducted by an experienced qualitative researcher (TC) and were audio-recorded and transcribed verbatim. Data collection was between June-July 2017. Mean interview time was 45 minutes (range 25-65 min).

Data analysis

Taking an inductive approach and drawing from thematic analysis,[35] two researchers (TC/MC) independently coded the transcripts using NVivo data management software. Initial codes and emerging themes were reviewed with a third qualitative researcher (SR). Saturation was achieved (later interview data were categorised within the coding frame with no new codes). In line with healthcare research that has utilised the TDF and COM-B in interviews with practitioners in general practice [36], the third researcher then deductively mapped codes to the appropriate 'domains' within the TDF with ongoing discussion with MC. All codes were mapped onto at least one domain. A further qualitative researcher with expertise in the BCW (AC), then checked and agreed initial codes and their relevance to each TDF domain. Using the BCTTv1,[32] quotes were then coded by AC for the BCTs that the population had described when discussing

what influences their behaviour, and subsequently checked by SR and MC. A member checking exercise was considered, but deemed unnecessary as the approach was deductive and required coding according to the TDF and BCT taxonomy.

Ethics approval and consent to participate

Ethical approval was provided by the School of Healthcare Sciences Research Governance and Ethics Committee, Cardiff University (4475REC).

Patient and Public Involvement

Patients were not involved in the development of the research question, outcome measures, design of the study, or, recruitment to, and conduct of, the study.

RESULTS

Participants

Twenty one prescribers (4 pharmacists and 17 nurses), with between 1-17 years prescribing experience (mean 8.5 years, SD 3.7) and between 2.5-32 years experience in their current role (mean 11 years, SD 8.5) took part in interviews. Most worked in general practice, had 15 minute consultations, and reported seeing around 25 patients a week with a RTIs (see Table 2) .

Table 2 – Demographic details

Interviewee	Role	Time qualified in current role	Time qualified as a prescriber	Clinical setting	No. of RTIs consultations a week	Length of appointment (minutes)
1	Nurse Practitioner	11	7	Out of hours walk in service	25 in summer months but many more in winter	15
2	Advanced Nurse Practitioner	5	5	General practice	20 summer months and	15

					40 winter months	
3	Advanced Nurse Practitioner	14	8	General practice	75 in the winter 30 in summer	15
4	Advanced Nurse Practitioner	2.5	17	General practice	25	10
5	Advanced Nurse Practitioner	24	14	Intermediate care (keep patients out of hospital)	25 in the summer more in winter	30-45
6	Lead nurse in a general practice walk-in centre	7	7	Walk in centre	30	15
7	Pharmacist	2		General practice	20	15
8	Advanced Nurse Practitioner	16	10	General practice	16-20	15
9	Advanced Nurse Practitioner	3	1	General practice	30	15
10	Nurse	32	3	Intermediate care (keep patients out of hospital)	(missing data)	30-120
11	Advanced Nurse Practitioner	6	7	General practice and out of hours service	50	15
12	Advanced Nurse Practitioner	4	6	General practice	40	15
13	Advanced Nurse Practitioner	11	11	(missing data)	Several a day	2 hours
14	Clinical pharmacist	3	10	General practice	16-20	15
15	Advanced Nurse Practitioner	7	13	General practice	20-50	10-15
16	General Practice Nurse	10	8	General practice	25	15
17	Nurse	25	10	Out of hours unscheduled care	1-6	20

18	Lead Practice Nurse	4	11	General practice	10	15
19	Lead nurse	18	10	General practice	30	15-20
20	Pharmacist	11	6	General practice	25	15
21	Pharmacist	24	6	General practice	Varied	20

Factors influencing the management of RTIs

Twenty six codes were inductively assigned to the data from the interview transcripts. Codes were then mapped to the TDF domains, whereby twelve domains were identified as factors that influence appropriate antibiotic prescribing. TDF domains were then mapped onto the COM-B model to enable future intervention design (see Supplementary Table 1).

The section below describes how data aligns within the TDF domains. Interview quotes are followed by letters and numbers in brackets that indicate the interviewee number (I=interviewee, N =nurse, P=pharmacist).

Knowledge [Psychological capability]

Influences on antibiotic prescribing included knowledge of current prescribing guidelines and AMS practices (with training mechanisms in place to facilitate this) and knowledge of AMR and its consequences at an individual and a population level. Awareness of own prescribing rate compared to other prescribers and national prescribing levels was another important influence.

> *"..we have a training session, like an audit with the local CCG [clinical commissioning group] team, in relation to our practices antibiotic prescribing and comparing it to the area in the north west… so that kind of helped influence and perhaps reduced my antibiotic prescribing".* (I13N)

Memory, attention and decision processes [Psychological Capability]

Treatment decisions were made by weighing up information from guidelines, patient pre-existing conditions, and illnesses present within the local community, and a full examination and point of care testing if appropriate.

> *"If we have decided that they do have an acute bacterial (infection) that would benefit from antimicrobial treatments, I would use the HPA guidelines, un-amended. So we follow the guidelines that are the national ones, and depending on the patient's situation because of the allergies, co-existing conditions, previous treatment perhaps, knowledge of locally circulating bugs, and I would choose according to that."* (I13N)

Behavioural Regulation [Psychological Capability]

Awareness of antibiotic prescribing rate in relation to colleagues and ability to self-regulate behaviour, influenced prescribing practice as described above. Self auditing of prescribing practice was also viewed as valuable.

> *"I am happy about that, because that is all about auditing your own practice and doing things like that yes. I mean I do go through periods where I audit people that I see, what's happened, did they come back, did they get better, did they get worse, and that also kind of reassures you as well that you are either doing the right or the wrong thing* (I3N), *…."*.

Skills [Physical Capability]

A range of skills were described as those required to manage the consultation, including physical examination and communication skills.

> *"Typically, the clinical examination would start with sats, move on to lymph's, then we would go to throat, we go to ear examination if it was indicated, then potentially shirt off, and we would do respiratory signs front and back oscultation, percussion… shirt back on, summary of assessments, patient's point of view, consider treatments or safety netting, whether it be immediate treatment or whether it be standby treatments or it would be no you have got a viral infection here, so we go through the signs and what to look out for. And then …. make sure that they knew what to do if things were to go badly, and when to seek review".* (I17N)

Competence in these skills, acquired through practice, was viewed as important

> *"…you have to be competent, not only with your history taking… But, examination skills; you have to be able to examine… The patient; you have to be able to relate those findings… to the patient in a language that they can understand."* (I15N)

Social/Professional role and identity [Reflective Motivation]

Elements of the NMP role (i.e.time to talk to patients, being up to date with guidelines, and the stringency of prescribing rules) supported appropriate antibiotic prescribing. Participants saw themselves as personally and professionally responsible for appropriate prescribing. Several highlighted their role as antibiotic guardians (i.e taken a pledge to prescribe responsibly) to manage patient expectation.

> *"..so I've got that responsibility to the health service and to society, and that partly comes with the privilege of being a prescriber. …I think this is definitely part of my role*." (I17N)

Beliefs about capabilities [Reflective Motivation]

Newly qualified prescribers reported how a lack of confidence meant advice from more senior colleagues could negatively influence prescribing decisions, whilst others indicated they were confident, recognising the limits of their role.

> *".. there is one drug that you used to prescribe for chest infections and it was always for 7 days and the guidelines now are actually for 5 days, and now I always check my guide …and now I am more confident to say no actually it should only be five but when I very first started prescribing I found that really difficult …because I felt maybe I should be prescribing longer than it says on the guide, because more experienced people are telling me that, so I think when you are a newly qualified prescriber, the more experienced people can have a strong influence over you and it is not always right*."(I10N)

Beliefs about consequences [Reflective Motivation]

Prescribers described 'managing risk' by being cautious about withholding antibiotics when managing patients at risk of developing complications, e.g. children, elderly patients, or those with pre-existing conditions, alongside those where there was diagnostic uncertainty due to a language barrier. In these cases they were more likely to prescribe antibiotics.

> *"I may treat someone who is very frail, but I wouldn't treat someone who is well… simply because the consequences of not treating would be more serious, with the risk of hospitalisation. So I am talking about a threshold prescribing, and I think I do adjust that threshold according to the individual… based on their risk."* (I10N)

The consequences of antibiotic use, at an individual and population level, influenced prescribing decisions. Prescribers believed that prescribing antibiotics unnecessarily reinforced patients' beliefs they were the appropriate treatment and influenced future expectations.

> *"Some GP's will just write a prescription for 7 days with 250mg of amoxicillin, three times a day. And it's a homeopathic dose it's a pat on the head and a piece of green paper, and the patient comes away from that consultation happy, they have got their antibiotics, they won't get better because of the antibiotics, they will get better because it is self-limiting, viral RTI. But what that health care professional is doing, is perpetuating the expectation of I am unwell, I will get antibiotics I will get better. The hard thing you have to do as a prescriber is to turn around and say you don't need antibiotics at this time".* (I11N)

Fear of a complaint as a consequence of not prescribing, sometimes influenced prescribing decisions, and some reported prescribing antibiotics in some cases because patients would just re-consult if they weren't given them.

Goals [Automatic Motivation]

Prescribing at an appropriate rate was a key goal for some prescribers. Audit and benchmarking practices were motivators to reduce prescribing, introducing competition to be the prescriber with the lowest rate.

> *"I am someone with lower antibiotic prescribing rates however, I only work part time. I wouldn't want my data to be high as this would look really bad amongst colleagues."* (I16N)

Reinforcement [Automatic Motivation]

Rewards were used by management teams to reinforce appropriate prescribing behavior for example in the prescribers use of cartain antibiotics.

> *"This year we have looked at the use of quinolones, ketasporines and Co-amoxiclav .. influenced by the national agenda but also our local medicines management team at the CCG, they push that agenda as one of their priorities for the year and resource it through the prescribing incentive scheme. So inevitably there were rewards available to practices and practitioners, so that will influence my prescribing for sure."* (I21P)

Auditing the prescription of antibiotics by management teams, and benchmarking against peers had a positive influence on prescribing practice and was viewed as necessary.

> *"So over in Bath and Somerset, that is what they (medicines management team) has been doing, so if you are over prescribing, against your peers, you are identified and you are invited to come down for a training day. It is a little bit heavy handed, but we are heading towards a very scary place and I think we need to be quite bold with our interventions".* (I2N)

Emotion [Automatic Motivation]

Antibiotics were sometimes prescribed to manage patients when explanations for a no-antibiotic decision had failed. Empathy for unwell patients could also make a no prescribing decision difficult. The time of day, day of the week, feeling stressed and tired, also influenced prescribing, prescribers, in these instances, being less conservative in their use of antibiotics.

> *"..towards the end of the day, I am a little bit more lenient, because you are tired and a bit stressed and you want to go home, and sometimes it can be an easy fix. I try not to, but sometimes, whether at the beginning of the day you weren't quite sure, you would rationalise it a bit more and explain it a bit more, whereas you might at the end of the day, you might sort of lean to like well I am not quite sure, ok just take them."(*I12N)

Environmental context and resources [Physical Opportunity]

Participants described how they used an array of accessible resources, including tailored and locally relevant information, local and national guidelines, point-of-care testing, decision support tools and information about patients (including co-morbidities, previous antibiotic use, and frequency of return visits), to inform treatment decisions and to communicate decisions to their patients. Time pressures was reported by some prescribers to impact negatively on prescribing. Many acknowledged that having longer appointment times (15 minutes) than GPs, facilitated patient education and discussions about treatment decisions.

> *"… so the GPs get 10 minutes… myself and some of theNurse Practitioners that I work with … in our practice have 15….. after a few years of experience, we kind of can do a respiratorytract infection consultation in 10 minutes… you can do it, so you still have that extra sort of like two to three, four minutes… Which we can spend on educating the patient* (I7P)

Time and resources to follow-up patients, encouraging patients to return if symptoms did not improve, and the ability to allow patients to contact them quickly, were highlighted as important by some prescribers. Patient features, such as age, influenced the ease with which it was possible to manage RTIs without antibiotics, with technological literacy cited as being helpful here. Language barriers were also reported to be a problem,while maintaining appropriate prescribing.

Social influences [Social Opportunity]

A range of strategies, including reassurance, education (including information on symptoms, length of time to get better, self-management and red flags) and active patient engagement in decision making, were used to manage patients' expectations.Patients pressure for an antibiotic was described as a key challenge and strategies to manage this included delayed prescribing, patient education, and consistency in antibiotic use. Public awareness campaigns and environmental prompts were also helpful. Good rapport and a trusting relationship wereimportant when communicating a 'no prescribing' decision. Most prescribers discussed the role of other prescribers in influencing their prescribing decisions, including the role of social and collaborative networks. Collaborative working helped avoid situations whereby patients try to obtain

an antibiotic from a different prescriber, and reassured prescribers that they were consistent in their decision making. However, such working occasionally led to problems, especially when disputes about the appropriateness of antibiotics arose and the other prescriber was a clinician.

> *"People (another prescriber) will say, just give them another one (different type of antibiotic) , and I will think that's not really what I am asking you, I just wanted to discuss it and see if we can do something else, because I am not really sure if it is going to do anything if I do take you know (different type of antibiotic)… But then you are arguing with another clinician and maybe that is a doctor versus another nurse practitioner, so there is a slightly different playing field there. So yes those are some of the things (that influence prescribing)".* (I3N)

Identification of behaviour change techniques

Forty naturally occurring BCTs (see Supplementary Table 1) were identified as used by nurse and pharmacist prescribers when the target behaviour (i.e. appropriate antibiotic prescribing) is facilitated. Two or more of these BCTs were coded within each TDF domain (see Table 3).

Table 3 – TDF domains and associated BCTs

Domain	**BCTs' suggested by nurse and pharmacist prescribers to support behaviour**
Knowledge	Instruction on how to perform the behaviour Information about health consequences Social comparison* Feedback on behaviour* Credible source
Skills	Instruction on how to perform a behaviour Demonstration of the behaviour
Social/professional role and identity	Identification of self as role model Social comparison Instruction on how to perform the behaviour
Beliefs about capabilities	Focus on past success* Verbal persuasion about capability Mental rehearsal of successful performance
Beliefs about consequences	Instruction on how to perform the behaviour Information about health consequences Information about social and environmental consequences* Demonstration of the behaviour
Reinforcement	Material reward (behaviour) Monitoring behaviour by others without feedback Feedback on behaviour
Goals	Self-monitoring of behaviour Goal setting (behaviour) *

	Review behaviour goal(s)
Memory, attention and decision processes	Problem solving Instruction on how to perform the behaviour
Environmental context and resources	Instruction on how to perform the behaviour Prompts and cues* Problem solving
Social influences	Social support (unspecified) * Problem solving Social comparison Restructuring the social environment Goal setting (behaviour) Information about health consequences
Emotion	Reduce negative emotions* Information about emotional consequences Monitoring of emotional consequences
Behavioral regulation	Self-monitoring of behaviour* Feedback on behaviour Social comparison

* BCT and associated TDF domains also identified by Cane et al (2015)

BCTs that occurred frequently across domains included 'Instruction on how to perform the behaviour,' (information on current guidelines, knowledge of patient self-management), 'Self monitoring of behaviour' (highlighting own prescribing behaviour), 'Feedback on behaviour' (the use of audit to scrutinise prescribing practice), Social comparison (comparison of behaviour to peers), 'Information about health consequences' (consequences of antimicrobial resistance), 'Demonstration of behaviour' (physical examination skills, no antibiotic prescribing behaviour), 'Problem solving' (patient engagement in decision making), and 'Goal setting' (reduce prescribing rate). These are therefore prime BCTs to use for future intervention.

DISCUSSION

Statement of principal findings

To our knowledge this is the first study to use a theoretical framework to identify the factors that influence the antibiotic prescribing behaviour for RTIs, by nurse and pharmacist prescribers, and examine how this

might inform the development of an intervention to support appropriate prescribing behaviour. Twelve TDF domains were found to influence the management of RTIs by these prescribers based on initial inductive analysis, and forty naturally occurring BCTs were identified to facilitate the behaviour.

Strengths and weaknesses

By using the TDF and the BCTTv1 we have identified core ingredients that can be used in interventions to support appropriate antibiotic prescribing by NMPs. A further key strength is that participants were a national sample. However, few were pharmacists, and most worked in general practice. The findings may therefore represent the views of nurses working in general practice. However, this picture reflects UK primary care where most prescribers are nurses [24] with high numbers working in general practice. [34]

Interviews were undertaken iteratively, with no new data relevant to the topic of interest generated in the latter interviews, suggesting data saturation. We did not use random sampling. Particpants were an opportunistic sample and therefore may have been more motivated towards appropriate antibiotic prescribing. Less motivated prescribers may have additional deterrents. Hence the identification of BCTs within the domain of 'motivation' may *overestimate* the occurenace of these features in the wider prescribing population.

Comparison with other studies

Our findings have identified that a broad range of factors influence the prescribing behaviour of nurse and pharmacist prescribers. The limited evidence available has identified some of these influences. Similar to findings reported previously [37, 23] we found that relationships with other prescribers and knowledge of current guidelines, influenced behaviour. Diagnostic uncertainty and the clinical condition of the patient, influences we identified, have also been reported. [23, 38,39] As in our research, patient expectations for an antibiotic, has also been cited.[23, 39] Interestingly, prescribers in our study reported that they saw

patient expectations for an antibiotic as an an opportunity to educate patients, and that having additional time enabled them to capitablise upon this teachable moment. [40]

The TDF has been used to examine the antibiotic prescribing behaviour of doctors working in long-term care facilities [41] and dental practitioners [42]. Studies have also explored GPs adherence to high impact indicators including avoidance of risky prescribing [43], GP prescribing for older patients in primary care [44], and inappropriate prescribing by hospital doctors [45]. As in our research a broad range of determinants were identified by each study. However, we are unaware of any research that has used the TDF to explore GPs antibiotic prescribing behaviour. Influencing factors identified by studies that are available, can broadly be categorised into five domains including social influences (patient expectations [12], pressure for an antibiotic [13, 46]), beliefs about consequences (diagnostic complexity [47], prognostic uncertainty [14], fear of complications [14]), Knowledge (lack of consistent treatment guidelines [15]), beliefs about capability (self-belief in decision making [15]), and environmental context and resources (time pressures [15]). Although these factors also influenced NMPs prescribing decisions, a further seven domains in the TDF (skills, social professional role and identity, reinforcement, goals, memory, attention and decision making, emotion, behaviour regulation) unique to NMPs, were identified as important determinants of behaviour. Furthermore, within these domains, NMPs used various strategies to overcome perceived barriers to inappropriate prescribing.

Our findings are in-line with expert consensus work [48] which has mapped BCTs to TDF domains for which they are most likely to be effective. Associations between 9 of the BCTs we identified with 7 TDF domains support the associations described by Cane et al [43] (See Table 3). Furthermore, a review of interventions, designed to increase public antimicrobial awareness and/or to improve AMS, [49] identified, as in our research, commonly used individual BCTs associated with the TDF domain Knowledge were 'Information about health consequences'and 'Instruction on how to perform a behaviour'. 'Prompts and cues' were similarly associated with the domain 'Environmental Context and Resources'. 'Monitoring of behaviour

without feedback', and 'Feedback on behaviour', also BCTs identified as important in our research, were reported by these researchers to be unique to the most successful interventions.

Meaning of the study: Possible explanations and implications for clinicians and policy makers

Our findings can be used as the basis for development of a theoretically informed intervention to support appropriate prescribing by nurse and pharmacist prescribers. They can also be used by practitioners to identify their individual facilitators and barriers to appropriate prescribing. Numerous intervention are available that target the antibiotic prescribing behaviour of GPs. Although these interventions could potentially target some of the drivers of behaviour amongst NMPs, they are unlikely to target all of these drivers. Future interventions should target the seven domains unique to NMPs that this study has identified.

Unanswered questions and future research

The next step is to develop an intervention based on our findings and test its feasibility and acceptability among nurse and pharmacist prescribers and whether it results in lasting changes to antibiotic prescribing behaviours.

CONCLUSION

Given that increasing numbers of NMPs working in primary care and managing infections, it is important that these findings are used to inform theoretically grounded interventions to support appropriate prescribing behaviour by these groups.

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COMPETING INTERESTS

All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf and declare: no support from any organisation for the submitted work, no financial relationships with any organisations that might have an interest in the submitted work in the previous three years, no other relationships or activities that could appear to have influenced the submitted work."

CONTRIBUTORSHHIP STATEMENT

MC made a substantial contribution to the conception and design of the work; the acquisition and interpretation of data, and drafting of the work. SR and AC made a substantial contribution to the design of the work, the acquisition, analysis and interpretation of data, and drafting of the work. RL, SP, KY, made a substantial contribution to the acquisition and interpretation of data, and critically revised drafts of the work. All authors approved the final version to be published and agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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INTEGRITY OF THE DATA AND ACCURACY OF THE DATA ANALYSIS

All authors had full access to all the data in the study and can take responsibility for the integrity of the data and the accuracy of the data analysis.

TRANSPARENCY DECLARATION

The lead author affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

DATA SHARING STATEMENT

No additional data available i.e. the dataset supporting the conclusions of this article are included within the article.

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Supplementary Table 1: Codes mapped to TDF, COM-B and BCTs

COM-B	Theoretical Domain	Codes and examples of interview quotes	BCTs
CAPABILITY (Psychological)	**Knowledge:** An awareness of the existence of something	**Training and knowledge around appropriate prescribing** *"We all need to make sure that we are aware of current guidelines, when to prescribe, and when you shouldn't … to ensure that you are giing safe care". (Interviewee 2 - nurse)* *"I think if they (practices) held 3 monthly or a yearly a sort of group session which they could invite local people to come to and people could give them a short presentation on you know winter is coming up, this is what you need to do to look after yourself, so you kind of educate the population beforehand". (Interviewee 7 – pharmacist)*	4.1 Instruction on how to perform the behaviour
		Knowledge of own prescribing rate *"..having your medicines management team come round and benchmark you against national standards, benchmark you against your peers, make you challenge and reflect on your clinical practice, I think those are all invaluable and should be encouraged." (Interviewee 2 – nurse).* *"Yes we have a local meeting, a training session, it was more like a meeting actually but like an audit with the local CCG team, in relation to our practices antibiotic prescribing and comparing it to the area in the north west and things like that, so that kind of helped influence and perhaps reduced my antibiotic prescribing, by having a bit more scrutiny in prescribing so*	6.2 Social comparison 2.2 Feedback on behaviour
		Knowledge of AB resistance *"I have sort of come from an area (practice) where they really are quite tough on it (resistance) and I can understand the consequences. And also, when you see people through and you see that those antibiotics are a quick fix of a consultation at a time, haven't made any difference, then you are dealing with something that is probably either not infective, or like you say, where the antibiotics are just not working, maybe because of resistance." (Interviewee 5 – nurse)* *"I can remember going to a few talks (by microbiologists) on those like god twenty odd years ago, and I have not been to anything recently and I don't know where the forum would be, to have those sort of discussions, so that would be really useful, but I haven't come across any of those". (Interviewee 5 – nurse)* *"I think they are important (training updates) there's e-learning which is useful as you can undertake this in your own time..you can sort of touch on the edges of this subject (antimicrobial resistance) when its e-learning..it helps to raise awareness."(Interviewee 6 – nurse)*	5.2. Information about health consequences 9.1. Credible source 4.1 Instructions on how to

			perform a behaviour
CAPABILITY (Physical)	**Skills:** An ability or proficiency acquired through practice	**Consultation skills** *"You have to be confident, and you have to be… be competent, not only with your history taking… But, um, also with, um, knowledge of guidelines, um, knowledge of, er… er… or examination skills; you have to be able to examine… The patient; you have to be able to relate those findings… to the patient in a language that they can understand." (Interviewee 15 – nurse)* *"Typically, the clinical examination would start with sats, move on to lymph's, then we would go to throat, we go to ear examination if it was indicated, then we would do potentially shirt off, and we would do respiratory signs front and back oscultation, percussion… shirt back on, summary of assessments, patient's point of view, consider treatments or safety netting, whether it be immediate treatment or whether it be standby treatments or it would be no you have got a viral infection here, so we go through the signs and what to look out for. And then they would be on their way (inaudible) to make sure that they knew what to do if things were to go badly, and when to seek review". (Interviewee 17 – nurse)*	4.1 Instruction on how to perform behaviour 6.1 Demonstration of the behaviour
CAPABILITY (Psychologicall)	**Memory, attention and decision processes:** The ability to retain information, focus selectively on aspects of the environment and choose between two or more alternatives	**Considering a range of factors in decision making** *"Looking at things like are they feverish, do they have other symptoms of being unwell, do you know what I mean, or is this just localised to the chest. We obviously do a full examination of the chest and look for signs, and see if we have got uneven signs, is it worse on the left or the right, which would indicate infection. We also much more than in general practice, which I find quite odd really, that I am still getting used to, do bloods. So if they have got a raised white cell count or they are CRP indicative as infection rather than as a disease process…." (Interviewee 21- pharmacist)* *"If we have decided that they do have an acute bacterial that would benefit from antimicrobial treatments, I would use the HPA guidelines, un-amended. So we follow the guidelines that are the national ones, and depending on the patient's situation because of the allergies, co-existing conditions, previous treatment perhaps, knowledge of locally circulating bugs, and I would choose according to that". (Interviewee 13 – nurse)*	1.2.Problem solving 4.1 Instructions on how to perform a behaviour
CAPABILITY (Psychological)	**Behavioural regulation:** (Anything aimed at managing or changing objectively	**Benchmarking and audit processes** *"Making sure that there are audits that you can do so that you can benchmark your work against your colleagues. If you are consistently prescribing too much, I think medicines management should identify you, and you should be asked to do a top-up course. You know when you get 3 points on your license, I think you need to do a half day training course. So over in Bath and Somerset, that is what they have been doing with her medicines management team, so if you are over prescribing, against your peers, you are identified and you are invited to come down for a training day. It is a little bit heavy handed, but we are heading towards a very scary place and I think we need to be quite bold with our interventions". Interviewee 2 – nurse)*	6.2 Social comparison *2.2* Feedback on behaviour

	observed or measured actions	*"I am happy about that, because that is all about auditing your own practice and doing things like that yes. I mean I do go through periods where I audit people that I see, what's happened, did they come back, did they get better, did they get worse, and that also kind of reassures you as well that you are either doing the right or the wrong thing, you know it is just... and you can do that at anytime, not just because you have been doing it for 14 years, but because you need to sort of turn the soil so to speak*". (Interviewee 3 – nurse)	2.3 Self-monitoring of behaviour
MOTIVATION (Reflective)	**Social/professional role and identity:** A coherent set of behaviours and displayed personal qualities of an individual in a social or work setting	**Responsibility for appropriate prescribing** *"I believe I have a responsibility to follow guidelines and not prescribe an antibiotic if it is not needed. I see this as part of my job. I believe that it is part of my role to prescribe antibiotics appropriately and so help to reduce antimicrobial resistance". (Interviewee 16 – nurse)"..so I've got that responsibility to the health service and to society, and that partly comes with the privilege of being a prescriber. …I think this is definitely part of my role, is…is managing antimicrobial prescribing". (Interviewee 17 – nurse)* *"….and also on the wall (poster) I have this pledge to care from Public Health England, I am an antibiotic guardian, so I point that to them (patients)as well, it has got my picture on it and I have signed it…*"(Interviewee 4 – nurse)	13.1 Identification of self as role model
		Value-add of non-medical prescriber role *"I do think as nurse prescribers, there is that added value from a nurse….I am probably more contentious and I am thinking more about what if this isn't right and, whereas GP's are very busy, they are doing lots of things… they have seen it before they have done this for a long long time, but we area much more updated on new guidance and much more aware of being up to date on new guidance …"(Interviewee 5 – nurse)* *"The non-medical prescribing course is so stringent and so strict that I don't think you will see non-medical prescribers doing this sort of thing [prescribing on the basis of patient expectation]".(Interviewee 2 – nurse)* *"there is that added value from a nurse prescriber….I am probably more contentious and I am thinking more about what if this isn't right and, whereas GP's are very busy, they are doing lots of things… they have seen it before they have done this for a long long time, but we are much more updated on new guidance…*"(Interviewee 5- nurse)	6.2 Social comparison 4.1 Instructions on how to perform a behaviour
	Beliefs about capabilities (Acceptance of the truth, reality or validity about an ability, talent or	**Confidence in own abilities and awareness of own limits/limits of NMP role** *"…so there is one drug that you used to prescribe for chest infections and it was always for 7 days and the guidelines now are actually for 5 days, and now I always check my guide because I am just like that and now I am more confident to say no actually it should only be five but when I very first started prescribing I found that really really difficult …because I felt maybe I should be prescribing longer than it says on the guide, because more experienced people are telling me that so I think when*	15.3 Focus on past success 15.1 Verbal persuasion

	facility that a person can put to constructive use	*you are a newly qualified prescriber, the more experienced people can have a strong influence over you and it is not always right..'(Interviewee 10 – nurse)* *"I think I am fairly confident, there is always that element of doubt, you know there are no certainties in this world but if you give a thorough examination, you safety net appropriately, you are aware of the guidelines, you should be fairly confident at what you are doing, but I think new patient diagnostics are incredibly important in general practice". (Interviewee 2 – nurse)*	about capability 15.2 Mental rehearsal of successful performance
	Beliefs about Consequences: Acceptance of the truth, reality, or validity about outcomes of a behaviour in a given situation	**Managing risk** *"It can be for instance if they have got COPD or any on going respiratory problems because we have to be guided by that as well, well obviously the physical examination if they come in with a temperature, low blood pressure or a high pulse, or their chest is really rattily, so it is guided by my clinical examination".* (Interviewee 7 – pharmacist) *"…and for me your level of frailty and how poorly you are are deciding factors, and I may choose to treat someone who is very frail, but I wouldn't treat someone who is well… simply because the consequences of not treating would be much more serious, with the risk of hospitalisation. So what I am talking about is almost a threshold prescribing, and I think I do adjust that threshold according to the individual… based on their risk". (Interviewee 10 – nurse))*	4.1 Instruction on how to perform the behaviour 5.1 Information about health consequences
		Consequences/risks of using antibiotics *"We know that it is on the increase, we know that it has been fuelled by the over prescription of antibiotics, we know that if we don't do anything about it, we are potentially heading to an antibiotic apocalypse. And we know by 2050, that more people will die of antimicrobial resistance disease than they do of cancers and car crashes today". (Interviewee 2 – nurse)* *"You know that prescribing certain antibiotics are going to make people actually feel more unwell "(Interviewee 15 – nurse)*	5.1 Information about health consequences
		Fear of complaint *"Some patients can be really quite demanding, um, and, er, well, make complaints as well. recently I'd had, in fact, two complaints that I had not prescribed antibiotics, which had then been prescribed by other clinicians". (Interviewee 4 – nurse)* *"The expectations are easier to manage these days, of course there are arguments, well heated discussions, occasionally with patients who insist they want antibiotics… but occasionally in that situation we may be adopt a delayed prescription strategy, which can be really valuable in terms of defusing that situation"'(Interviewee 10 – nurse)*	5.3 Information about social and environmental consequences
		Meeting expectations and satisfaction	

		"As long as you have met their expectations or challenged their concerns, and have given them an answer that they understand in a way that they understand it, then they will leave satisfied whether they have got antibiotics or not!. (Interviewee 2 – nurse) *"But it is if you leave a patient dissatisfied or with any unmet needs they are more likely to re-consult, to come back in to clinic, so they will either go to out of hours, A & E, or they will go and see another clinician in the GP practice, or you can end up with them having a long discussion about what antibiotics can and can't do". (Interviewee 2 – nurse)* *Patients will be satisfied if expectations are met but some patients will come back for antibiotics if you don't prescribe." (Interviewee 2 – nurse)*	5.3 Information about social and environmental consequences
		Prescribing antibiotics reinforces patient beliefs about their effectiveness *"…the GP saw them last week, saw that they had a chesty cough, they had a bit of a temperature and they were coughing up something green and they prescribed some amoxicillin, and they have safety netted and said if you are no better in a week come back. Guess what, the patient is going to come back. So they come back and see me, and they say right I was here last week I saw GP Y, they said I have got a chest infection, they gave me some antibiotics, they said come back if I am no better. I am no better. I need some stronger antibiotics". (Interviewee 2 – nurse)* *"Some GP's will just write a prescription for 7 days with 250mg of amoxicillin, three times a day. And it's a homeopathic dose it's a pat on the head and a piece of green paper, and the patient comes away from that consultation happy, they have got their antibiotics, they won't get better because of the antibiotics, they will get better because it is self-limiting, viral RTI. But what that health care professional is doing, is perpetuating the expectation of I am unwell, I will get antibiotics I will get better. The hard thing you have to do as a prescriber is to turn around and say you don't need antibiotics at this time" (Interviewee 11 – nurse)*	6.1 Demonstration of behaviour
MOTIVATION (Automatic)	**Goals:** Mental representations of outcomes or end states that an individual wants to achieve	**Maintain appropriate levels of prescribing** *"….whether you are doing it yourself (auditing) or someone else is and when you look in prescribing, when they send you the prescribing breakdown for the different practices within your area, you always want to try and be on the low side."' (Interviewee 3 – nurse)* *"I recently looked at some of our prescribing data and I am not doing badly. I am someone with lower antibiotic prescribing rates however, I only work part time. I wouldn't want my data to be high as this would look really bad amongst colleagues" (Interviewee 16 – nurse)* *"…in nurse meetings I am always banging on about it, they are probably sick of it now.. Just so that everyone doesn't over prescribe, and for all of my prescribing, for every antibiotic it is actually audited, so I can actually see if someone is overprescribing are there trends that are slightly out or who might be prescribing just for the sake of it because it is an easier life, and trying to eradicate it that way as well.."* (Interviewee 6 – nurse)	2.3 Self-monitoring of behaviour 1.1 Goal setting (behaviour) 1.5 Review behaviour goal

	Reinforcement: (Increasing the probability of a response by arranging a dependent relationship, or contingency, between the response and a given stimulus	**Audit and feedback as a mechanism for reinforcing appropriate prescribing** *"Specifically, this year we have looked at the use of quinolones, ketasporines and comoxiclad and that was influenced of course by the national agenda but also our local medicines management team at the CCG, they push that agenda as one of their priorities for the year and resource it through the prescribing incentive scheme. So inevitably there were rewards available to practices and practitioners, so that will influence my prescribing for sure" (Interviewee 21 – pharmacist)* *"So over in Bath and Somerset, that is what they (medicines management team) has been doing, so if you are over prescribing, against your peers, you are identified and you are invited to come down for a training day. It's a little bit heavy handed, but we are heading towards a very scary place and I think we need to be quite bold with our interventions".* (Interviewee 2 – nurse)	2.1 Monitoring of behaviour by others without feedback 10.2 Material reward (behaviour) 2.2 Feedback on behaviour
	Emotion: A complex reaction pattern, involving experiential, behavioural, and physiological elements, by which the individual attempts to deal with a personally significant matter or event	**Empathy for patient suffering** *"If they have got an infection and they have waited quite a long time in the delays coming in to see someone or, if it's a really busy day and they are sat there in the waiting room for hours and you can just see them getting worse and worse, and you are thinking someone needs to see this patient and get them in. You feel terrible for them, if you can give them… they are kind of looking at you wanting to be able to feel better and looking for that magic cure and you know it's going to take time, you do feel for them.."(Interviewee 6 – nurse)* *"They can be very angry, frustrated, annoyed, frightened as well. It is petrifying, if you live on your own and you think you have got a serious chest infection, what if there is not going to be anyone there in the middle of the night, that is frightening, you really feel for them. Relief as well, you've listened to my chest, there is nothing there, hopefully I can get on with my day" Interviewee 2 – nurse)* *"They might be waiting… And obviously sometimes they are not very happy about that so that can influence my decision, because actually if they have been waiting an hour and they feel poorly and they want antibiotics what am I going to do… Am I going to sit there and explain that they don't want it, or am I going to give it to them. That is a difficult scenario…". (Interviewee 9 – nurse)* **Influence of stress and fatigue on ability to make prescribing decisions** *"…you know it shouldn't but if you are tired and exhausted we know that quality and safety slips, we know that if you are in any profession, you miss your breaks, you are overtired, you've worked too long your head is somewhere else. Whether you are laying block, waiting on tables, nursing, you know a surgeon (a politician), you know if you are not there in present, you are going to let standards slip so you need to look after yourself". (Interviewee 2 – nurse)*	11.2 Reduce negative emotions (within the practitioner) 5.6 Information about emotional consequences 5.4 Monitoring of emotional consequences 11.2 Reduce negative emotions

		"Probably towards the end of the day, I am probably a little bit more lenient, because you are tired and a bit stressed and you want to go home, and sometimes it can be an easy fix. I try not to, but sometimes, whether at the beginning of the day you weren't quite sure, you would rationalise it a bit more and explain it a bit more, whereas you might at the end of the day, you might sort of lean to like well I am not quite sure, ok just take them.." (Interviewee 12 – nurse) **Influence of emotions on prescribing decisions** *"Of course, you are never perfect all the time, but yes there are certainly times when I can recall when I have just gone (sigh) look here you go, you are never going to believe me anyway, or I have not got got through to you, I have not done it, or it is too much of a fight to argue the other way. And that is really disappointing, you don't get any sort of pride in your work from that, it's very very disheartening". (Interviewee 6 – nurse)* *"So I use local guidelines but I also like I say because I know a lot of local guidelines, and obviously from reading up on things and looking at NICE guidelines, I use univadis and stuff like that, and I have been on the GP updates so I sort of use what I get from those as well, very much so I tend to, the local guidelines are there and I can see what neighbouring practices there and as I say the hospital seems to just give comoxiclad first thing, but I do what I think is the right thing through the different bits of evidence that there is around you know". (Interviewee 5 – nurse)* *"Diagnostics, patient diagnostics, I am going to go back to that one, I think our consultations can be very subjective, they can be influenced by so many different factors from the clinicians to the patients themselves, and having some objective measures in there can really tighten things up". (Interviewee 2 – nurse)* *"where you are seeing a patient every 15 minutes and half of them are all going to come in with the same thing, and you are going to have the same consultation, at repeated times throughout the day where this all looks really viral. I know you feel awful, but I don't think antibiotics are going to do anything for you, and then you have the conversation about the antibiotics, that was exhausting. That is why I got involved with the diagnostics because I couldn't emotionally go through another winter of listening to someone's chest, giving them my opinion and for them to throw it back at me". (Interviewee 4 – nurse)* *"It is very hard to divorce yourself from your feelings, and if you have had a long day and it is your last patient, it's a Friday evening and as I say it is usually Mrs Smith with twins aged 8 with snotty noses at quarter to six on a Friday evening. Your feelings are I want to go home and it shouldn't influence your decision making but I would be lying to you if it old you it didn't because it does influence your decision making". (Interviewee 11 – nurse)*	
OPPORTUNITY (Physical)	**Environmental context and resources:** Any	**Availability and accessibility of resources to make and communicate prescribing decisions** *"So I use local guidelines but I also like I say because I know a lot of local guidelines, and obviously from reading up on things and looking at NICE guidelines, I use univadis and stuff like that, and I have been on the GP updates so I sort of use what I*	4.1 Instruction on how to

	circumstance of a person's situation or environment that discourages or encourages the development of skills and abilities, independence, social competence and adaptive behaviour	*get from those as well, very much so I tend to, the local guidelines are there and I can see what neighbouring practices there and as I say the hospital seems to just give comoxiclad first thing, but I do what I think is the right thing through the different bits of evidence that there is around you know". (Interviewee 5 -nurse)* *"Diagnostics, patient diagnostics, I am going to go back to that one, I think our consultations can be very subjective, they can be influenced by so many different factors from the clinicians to the patients themselves, and having some objective measures in there can really tighten things up". (Interviewee 2 – nurse)* *"Obviously the PC will tell you you have notes on the PMR, about whether they have got these comorbidities and the system will also tell you when they last had an antibiotic, which one is being prescribed to and what they are doing with it, how often are they returning with these symptoms so the computer kind of helps you in that sense" (Interviewee 7 – pharmacist)* *"Then in your GP practices, making sure that you have got the posters up, I like the posters that tell patients it's normal to go on for X amount of time, ear infections, it's normal to go on for this amount of time…."(Interviewee 2 – nurse)* *"Massively helpful are the GP leaflets, you hand them to the patients, the reason why you are not prescribing and the safety net so that they feel reassured that they know precisely when they need to seek help". (Interviewee 21 – pharmacist)*	perform behaviour 7.1 Prompts and cues 7.1 Prompt and cue
		Time and workload pressures *"Yes but they might not have challenged the patient, they might not have really asked them are you really expecting antibiotics or do you just want me to check and makes sure you are ok, and that takes time … I have got the luxury of a 15 minute appointment. … I think you would struggle to give really good quality care under the pressures that current GPs have". (Intervviewee 12 – nurse)* *"So you still have that extra 2,3, 4 minutes we can spend on educating the patient. So I normally print off the antibiotic toolkit from I think the royal college of… the RCGP website, there is an antibiotics leaflet on there, so I will print the leaflet off and I will give it to them and explain to them, these are your symptoms, this is what you need to in case this happens you need to come back to us, so I think the time element is the restriction*". (Interviewee 7 pharmacist) *"I am really fortunate now and I would try to, and when I was I was in general practice, to offer a follow up appointment, say I will see you tomorrow or the next day, or when I was on triage, just give me a ring tomorrow morning if you have really had a bad night and we will take it from ther.."*e (Interviewee 5 – nurse) *"I think time is an element there… so the GPs get 10 minutes… myself and some of the… the Nurse Practitioners that I work with in… in our practice, they get 15 minutes as well… And I get 15 minutes, so, I mean, after… after a few years of experience, we… we… we kind of can do a respiratory tract… tract infection consultation in 10 minutes… you can do it, so you still have that extra sort of like two to three, four minutes… Which we can spend on educating the patient (Interviewee 7 – pharmaicst)*	

OPPORTUNITY (Social)		**Patient factors** *"Generally, I think some of the younger patients, some of them are a little bit more understanding when you give them the explanation you know, why you are not giving them the antibiotics, and we give them that sheet (patient information leaflet) and obviously they can go and google stuff their selves if they want .."(Interviewee 18 – nurse)* *"If there are any communication difficulties, so you know if they can't hear very well. If they can't understand me very well, if there are language problems, it is very difficult to manage patients who have learning difficulties, you might not be able to get a thorough story, they may be frightened by their examination as well, you have got patients who have got phobias as well, they don't want to come in, they will be forced to come in, and then they will tell you anything so they can get out as fast as they can, so all those things can hinder it and cloud your examination". (Interviewee 15 – nurse)* *"We have got quite a lot of eastern Europeans in the area and I assume from when they come in they always get antibiotics for whatever they go for, so they do come in expecting them and the because there is the language barrier, that creates quite a problem, explaining why you can't give them, and then they are not really understanding why you are not because they are just expecting them."* (Interviewee 12 – nurse) *"I have decision making support tools as well which allow me to text my management plan, so my consultation and my management plan I can text it straight to their phone. That is really handy if someone doesn't… for example a child has been bought in by a grandparent but the grandparents don't speak English, and the mum or dad is at work and I can text mum and dad and say look, I have seen your child, this is what I did, this is what I found out and this is what I've planned…"*(Interviewee 2 – nurse)	1.2 Problem solving
	Social influences (Those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviours	**Manage patient expectation and satisfaction while providing appropriate care** *"I get them to engage with making the decision, and sometimes they'll say oh well just leave it, you know, and if things get worse we'll come back, and sometimes they say, um, you know, I'm happy to take that risk of actually not having the antibiotics. And very often, they don't, you know, when you put it like that and you ask them to make the decision, the patient will choose not to have the antibiotics but come back if they get worse". (Interviewee 17 – nurse)* "My goals are that the patient gets the correct diagnosis at the correct time by the correct clinician, that's my goal. I don't want to see anyone going to hospital, I want people to be managed in the community, I want them to be seen at the right time, that's my goal, to get the correct diagnosis, and the correct management plan, that is absolutely my goal". (Interviewee 2 – nurse)	1.2 Problem solving 1.1 Goal setting (behaviour)

		Patient expectations and pressure for antibiotics *"I wouldn't prescribe if somebody asked me to, what I would do is sort of use that opportunity to give my rationale and sort of like maybe educate in terms of… so that next time they didn't ask somebody else…" . (Interviewee 10 nurse)* *"I think maybe just trying to increase the public's awareness of the appropriate use of antibiotics… that a viral cough can leave you with a cough for 6 weeks. Most people don't know that, …. So I think for me managing it nationally, if we could have better education". '(Interviewee 10 – nurse)* *"If you asked all the doctors nurses and pharmacists that I work with, they would all say I think for patients, that we all are singing from the same hymn sheet here and they are quickly getting used to the fact that antibiotics aren't just automatically given every time you have a bit of a cough or a splutter."* (Interviewee 21 - pharmacist) *"I refused, I said you really don't need any amoxicillin, you don't need anything, and he stood there, and he stood up above me, intimidating me saying you will give me what I want, and I said, I am really sorry but I will not. So what did he do, what did he do, he went out, he went outside, he phoned out of hours again and got another appointment and this time wouldn't come in and see me. So he spent 8 hours of boxing day in the out of hours service, in Weston-supermare to get the antibiotics..". (Interviewee 11 – nurse)*	5.1 Information about health consequences
		Patient-prescriber relationship *"I know in my head this is not a bacterial infection, and then it is that good communication, being open, friendly. So that the patients will then kind of listen and accept and trust what you are saying. I think gaining trust is really important". (Interviewee 9 – nurse)* *"I am lucky in my job I have got time to talk to people, but in general practice I think, often as a nurse practitioner you have often built up a trusting relationship, and I think on the whole people do find you easier to talk to than doctors. That is just so valuable, if you can use that to make an intervention if you like, to try and make a difference to expectations". (Interviewee 5 – nurse)* *"Yes you need a good rapport with that patient, you need to have them trust you in the first place so that they actually believe your judgement, and also to be able to feedback why you don't feel antibiotics are right at that time." (Interviewee 6 – nurse)*	3.1 Social support (unspecified)

		Relationships with other prescribers *"Sometimes there might be a clinical issue where there might be something going on here that I am missing, or it might be can you (colleague) come in and have a chat and really we can both decided that definitely we don't need to hand out an antibiotic, it can be something like, that's standard across the board for seeing patients anyway. It can be another tool you can use to avoid prescribing". (Interviewee 3 – nurse)* *"I will follow up or one of my colleagues, the three ANP's in the team, so we will follow people up and we would know if they are getting worse, I mean often in my current role, we have carers who will go in 4 times a day, we would definitely review people, so it's really useful actually you can see exactly how people are doing and whether it has made a difference or not". (Interviewee 5 – nurse)* *"People (another prescriber) will say, just give them another one (different type of antibiotic) and I will think that's not really what I am asking you, I just wanted to discuss it and see if we can do something else, because I am not really sure if it is going to do anything if I do take you know (different type of antibiotic)… But then you are arguing with another clinician and maybe that is a doctor versus another nurse practitioner, so there is a slightly different playing field there. So yes those are some of the things (that influence prescribing)". (Interviewee 3 – nurse)* *"I think you never work entirely alone in healthcare you have always got somebody to talk to and somebody to bounce it off, there are even things now you know like there is an ANP Facebook page, which is great because you will sit and you will mull over this in the evening and you will see all of these conversations going on, did I do the right thing here, what are the factors. You know it is easy to be critical of people for prescribing possibly inappropriately, but everybody understands the pressures that are there… " (Interviewee 5 – nurse)*	3.1 Social support (unspecified) 12.2 Restructuring the social environment 6.2 Social comparison

Standards for Reporting Qualitative Research (SRQR)*

http://www.equator-network.org/reporting-guidelines/srqr/

	Page/line no(s).
Title and abstract	
Title - Concise description of the nature and topic of the study Identifying the study as qualitative or indicating the approach (e.g., ethnography, grounded theory) or data collection methods (e.g., interview, focus group) is recommended	Page 1
Abstract - Summary of key elements of the study using the abstract format of the intended publication; typically includes background, purpose, methods, results, and conclusions	Page 2
Introduction	
Problem formulation - Description and significance of the problem/phenomenon studied; review of relevant theory and empirical work; problem statement	Page 4-6
Purpose or research question - Purpose of the study and specific objectives or questions	Page 6
Methods	
Qualitative approach and research paradigm - Qualitative approach (e.g., ethnography, grounded theory, case study, phenomenology, narrative research) and guiding theory if appropriate; identifying the research paradigm (e.g., postpositivist, constructivist/ interpretivist) is also recommended; rationale**	Page 6, 7, 9
Researcher characteristics and reflexivity - Researchers' characteristics that may influence the research, including personal attributes, qualifications/experience, relationship with participants, assumptions, and/or presuppositions; potential or actual interaction between researchers' characteristics and the research questions, approach, methods, results, and/or transferability	Page 9
Context - Setting/site and salient contextual factors; rationale**	Page 6-7
Sampling strategy - How and why research participants, documents, or events were selected; criteria for deciding when no further sampling was necessary (e.g., sampling saturation); rationale**	Pages 6-7
Ethical issues pertaining to human subjects - Documentation of approval by an appropriate ethics review board and participant consent, or explanation for lack thereof; other confidentiality and data security issues	Page 10
Data collection methods - Types of data collected; details of data collection procedures including (as appropriate) start and stop dates of data collection and analysis, iterative process, triangulation of sources/methods, and modification of procedures in response to evolving study findings; rationale**	Page 7-9

Data collection instruments and technologies - Description of instruments (e.g., interview guides, questionnaires) and devices (e.g., audio recorders) used for data collection; if/how the instrument(s) changed over the course of the study	Page 7-9
Units of study - Number and relevant characteristics of participants, documents, or events included in the study; level of participation (could be reported in results)	Pages 7-9
Data processing - Methods for processing data prior to and during analysis, including transcription, data entry, data management and security, verification of data integrity, data coding, and anonymization/de-identification of excerpts	Page 9-10
Data analysis - Process by which inferences, themes, etc., were identified and developed, including the researchers involved in data analysis; usually references a specific paradigm or approach; rationale**	Page 9-10
Techniques to enhance trustworthiness - Techniques to enhance trustworthiness and credibility of data analysis (e.g., member checking, audit trail, triangulation); rationale**	Page 9 -10

Results/findings

Synthesis and interpretation - Main findings (e.g., interpretations, inferences, and themes); might include development of a theory or model, or integration with prior research or theory	Page 10-19
Links to empirical data - Evidence (e.g., quotes, field notes, text excerpts, photographs) to substantiate analytic findings	Page 10-19

Discussion

Integration with prior work, implications, transferability, and contribution(s) to the field - Short summary of main findings; explanation of how findings and conclusions connect to, support, elaborate on, or challenge conclusions of earlier scholarship; discussion of scope of application/generalizability; identification of unique contribution(s) to scholarship in a discipline or field	Pages 20-22
Limitations - Trustworthiness and limitations of findings	Page 20

Other

Conflicts of interest - Potential sources of influence or perceived influence on study conduct and conclusions; how these were managed	N/A
Funding - Sources of funding and other support; role of funders in data collection, interpretation, and reporting	Page 24

*The authors created the SRQR by searching the literature to identify guidelines, reporting standards, and critical appraisal criteria for qualitative research; reviewing the reference lists of retrieved sources; and contacting experts to gain feedback. The SRQR aims to improve the transparency of all aspects of qualitative research by providing clear standards for reporting qualitative research.

**The rationale should briefly discuss the justification for choosing that theory, approach, method, or technique rather than other options available, the assumptions and limitations implicit in those choices, and how those choices influence study conclusions and transferability. As appropriate, the rationale for several items might be discussed together.

Reference:

O'Brien BC, Harris IB, Beckman TJ, Reed DA, Cook DA. **Standards for reporting qualitative research: a synthesis of recommendations.** *Academic Medicine*, Vol. 89, No. 9 / Sept 2014
DOI: 10.1097/ACM.0000000000000388

Correction: *Examining influences on antibiotic prescribing by nurse and pharmacist prescribers: a qualitative study using the Theoretical Domains Framework and COM-B*

Courtenay M, Rowbotham S, Lim R, *et al*. Examining influences on antibiotic prescribing by nurse and pharmacist prescribers: a qualitative study using the Theoretical Domains Framework and COM-B. *BMJ Open* 2019;9:e029177. doi: 10.1136/bmjopen-2019-029177

This article was previously published with errors in data and author affiliation.

- The correct author affiliations for Angel Chater are
  School of Sport Science and Physical Activity, University of Bedfordshire, Bedford, UK.
  University College London School of Pharmacy, London, UK.
- In the 'Introduction' section, fourth paragraph, the data should be '34 000 nurses and 8000 pharmacists' instead of '30 000 nurses and 4000 pharmacists'.
- The correct casing for 'Intervention Functions' is **Intervention Functions** throughout the article.
- The abbreviation for nurse in '(I=interviewee, n=nurse, P=pharmacist)' is **N** under 'Factors influencing the management of RTIs' subsection in 'Results'.
- Under the section 'Factors influencing the management of RTIs', the correct sub-heading is 'Goals (reflective motivation)' instead of 'Goals (automatic motivation)'.
- Under 'Comparison with other studies' in 'Discussion', the period should be removed before the word 'knowledge'. The correct statement is '… associated with the TDF domain knowledge, were 'Information about…'.
- In Supplementary Table 1, the Theoretical Domain 'Goals' is part of Motivation (Reflective) column instead of Motivation (Automatic). Motivation (Automatic) begins from 'Reinforcement'.

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