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## Risks of use and non-use of antibiotics in primary care. Qualitative study of prescribers' views

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## **Risks of use and non-use of antibiotics in primary care.**

### **Qualitative study of prescribers' views**

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**ABSTRACT**

**Purpose:** The emergence of antimicrobial resistance has led to increasing efforts to reduce unnecessary use of antibiotics in primary care, but potential hazards from bacterial infection continue to cause concern. This study investigated how primary care prescribers evaluate the risks of reduced antibiotic prescribing.

**Methods:** Qualitative study using semi-structured interviews conducted with primary care prescribers from 10 general practices in an urban area and a shire town in England. A thematic analysis was conducted.

**Results:** Thirty participants were recruited, including 23 general practitioners, 5 nurses and 2 pharmacists. Three main themes were identified: risk assessment; balancing treatment risks; and negotiating decisions and risks. Respondents indicated that their decisions were grounded in clinical risk assessment, but this was informed by different approaches to antibiotic use, with most leaning towards reduced prescribing. Prescribers' perceptions of risk included the consequences of both inappropriate prescribing and inappropriate withholding of antibiotics. Sepsis was viewed as the most concerning potential outcome of non-prescribing, leading to possible patient harm and potential litigation. Risks of antibiotic prescribing included antibiotic resistant and *C. difficile* infections, as well as side effects, such as rashes, that might lead to possible mislabelling as antibiotic allergy. Prescribers elicited patient preferences for use or avoidance of antibiotics to inform management strategies, which included educational advice, advice on self-management including warning signs, use of delayed prescriptions, and safety netting.

**Conclusions:** Attitudes towards antibiotic prescribing are evolving, with reduced antibiotic prescribing now being approached more systematically. The safety trade-offs associated with either use or non-use of antibiotics present difficulties especially when prescribing decisions are inconsistent with patients' expectations.

**Key words:** primary care, antibiotics, infections, sepsis, safety, patient preferences

### Strengths and limitations of this study

- The study provides an investigation of primary care prescribers' perceptions, emphasising safety perspectives in the context of antimicrobial stewardship.
- The main themes identified may inform the basis for future improvement and antimicrobial stewardship programs.
- The study is based on interviews with prescribers and may be susceptible to the limitations associated with qualitative interview studies
- The diverse sample of participants provide a good spread of opinions that are of a high validity and rigorously analysed.
- The study may lack generalisability beyond high-income countries.

## INTRODUCTION

Inappropriate antibiotic prescribing is widespread but may impose risks from drug side-effects as well as from the risks of antimicrobial resistance (AMR) for individual (1) and population health. (2) Non-use of antibiotics may be associated with risks from serious bacterial infections that could be avoided through earlier treatment of infection episodes. (3) Many studies have provided insights into the reasons for inappropriate antibiotic prescribing and several syntheses have been published (4-6), but the safety gradient associated with reducing antibiotic prescribing appears as a new and highly relevant area of research. In this paper, patient safety is understood as 'the avoidance, prevention and amelioration of adverse outcomes or injuries stemming from the process of healthcare'. (7) Risks associated with antibiotic prescribing decisions are a key component of patient safety concerns and require in-depth analysis. This paper addresses the gap in knowledge about prescribers' perceptions of potential adverse outcomes associated with reduced antibiotic prescribing.

In the UK, primary care services account for nearly 80% of all medical antibiotic use but antibiotic utilisation in primary care has been declining in recent years and choice of antimicrobial agents has become more selective. (8, 9) A national target proposes a further reduction in antimicrobial use of 15% by 2024 (10) with antimicrobial resistance making a legitimate case for the reduction in antibiotic prescribing. There were an estimated 60,788 antibiotic resistant infections in England in 2018 (9). Bacteria associated with AMR in primary care include *E. coli*, Group B streptococcus, *Klebsiella pneumoniae*, tuberculosis, typhoid fever and others (11), and the scale of the problem is also increasing across middle- and low-income countries. (12) Unnecessary exposure to antibiotics is itself potentially harmful. As a result of prescribing in the community, antibiotic-associated adverse events including allergic reactions lead to many emergency visits with antibiotics accounting for up to 20% of hospital admissions from drug reactions in the US. (13, 14) On the other hand, withholding antibiotics might potentially carry risks and reduced antibiotic prescribing in

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3 general practice is associated with a small increase in complications such as treatable  
4 pneumonia and peritonsillar abscess.(15) (16)  
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9 The perceived priority of risks from either prescribing or not prescribing antibiotics requires a  
10 nuanced explanation within the broader realm of professionals' perceptions of safety and  
11 associated risk management. Fear of the risk of bacterial complications (5, 17) and  
12 prognostic uncertainty about potential outcomes when not prescribing (4, 18) are reportedly  
13 among key factors that influence the prescription of antibiotics. Among hospital doctors,  
14 there is evidence that overtreatment is preferred to the potential for adverse patient  
15 outcomes from not prescribing.(19, 20) Klein et al (21) and Broniatowski et al (22) for  
16 example, demonstrate that medical decision-making tends to favour views that favour  
17 prescription ('why take risks') rather than on prescription avoidance ('antibiotics can be  
18 harmful'). In primary care, general practitioners and other prescribers also deal with safety  
19 concerns in their decision-making, and a better understanding needs to be developed  
20 concerning the balance of risk between prescribing or non-prescribing of antibiotics..  
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37 Patient factors influencing decision-making on antibiotic prescribing include compliance with  
38 patient expectations and pressures. (17, 23-25) Reducing AB prescribing in primary care is  
39 therefore highly dependent on successful management of patient expectations (26-28) and  
40 on shared decision-making. (29-32) It is known that clinicians weigh individual best practice  
41 against perceived patient satisfaction so that the complex balancing acts are enacted. (33)  
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43 Therefore, of research interest is also how the issues of safety and risk information are  
44 communicated to patients.  
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54 In the present study we investigate how primary care prescribers perceived risk and safety  
55 concerns associated with reduced antibiotic prescribing. The research is a part of the larger  
56 study to inform the safest way to reduction of antibiotic prescribing.  
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## METHOD

### Study design

Semi-structured interviews were conducted with primary care prescribers including general practitioners, nurses and pharmacists in two English regions, one an urban metropolitan area and the other shire-town in England with a high demand for primary care services. The study was approved by London Hampstead Research Ethics Committee 18/LO/1874 and participants gave written informed consent to participation.

### Interviews

The interview guide was piloted with three GPs to ensure that the questions were appropriate, understandable and covered relevant prescribing behaviours. All interviews were conducted by the first author to ensure consistent quality. The interviewer has a PhD in medical sociology and is an experienced qualitative researcher. All interviews apart from one telephone interview were conducted face-to-face on general practice (n=26) and University (n=4) premises in the period January-July 2019. The participants were offered £60 to acknowledge their contribution.

## Recruitment of participants

Metropolitan practices were invited to the study by the local Clinical Research Network who generated the expression of interest. A shire-town high demand practice was recruited through informal Clinical Research Network contact who also helped in liaising with potential respondents. Potential participants were then approached either directly via email using the study information pack or indirectly via the practice manager or lead GP. The information pack included the invitation letter and study information sheet. A reminder was sent out two weeks after the initial approach to those who had not responded. A purposive sampling approach was followed: all participants were prescribers. Forty-nine primary care prescribers from 10 GP practices were invited and 30 agreed to take part. The sample size was determined using the pragmatic concept of 'information power' [24], which proposes that the size of a sample with sufficient information power depends on (a) the aim of the study, (b) sample specificity, (c) use of established theory, (d) quality of dialogue, and (e) analysis strategy. The uptake varied between practices (in 5 practices only a single participant was interviewed).

## Analysis

The interviews were digitally recorded, transcribed by a professional transcriber, imported to an NVivo-12 project and coded through an iterative six phased process described in thematic analysis (37). Data analysis occurred iteratively and involved familiarisation, coding, theme searching, theme reviewing, theme defining and naming, producing the report. Repeated patterns in the data formed the basis for the codes, identified by the first author, and one single code for every different concept/idea was generated. To ensure that codes were applied consistently, a co-author (initials) independently coded a random sample of four interview transcripts. Coding was refined after discussion. Data identified by the same code was collated together and all different codes were sorted into potential subthemes and themes using NVivo options of tree building. Then, the potential themes were re-assessed

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3 and re-organised to reflect major narratives and themes in the coded data. Finally, (the first,  
4 second and the last authors, initials) refined and named the themes and sub-themes.  
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### 10 *Public and Patient Involvement*

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13 Participants' feedback on the transcripts or the summarised final findings was not sought,  
14 however, the process of developing subthemes and themes was discussed at a Patient and  
15 Public Involvement meeting.  
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## 22 **RESULTS**

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25 We recruited 30 participants from 10 general practices (Table 2. Characteristics of the  
26 participants). The interviews lasted between 24 minutes and 46 minutes. General  
27 practitioners', nurses' and pharmacists' responses were analysed as a single group because  
28 of the many commonalities. We found there were no discernible differences in participants'  
29 accounts between the shire town and metropolitan settings. We distinguished three major  
30 themes from the data: risk assessment; balancing treatment risks; and negotiating decisions  
31 and risks.  
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### 45 **Theme 1. Risk assessment**

#### 46 47 **1.1. Identifying treatment thresholds**

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49 The primary focus of diagnostic decision-making for participants was concerned with  
50 identifying major indications for antibiotic treatment. These were judged to include the  
51 severity of illness based on presentation of symptoms and signs, in the context of the  
52 patient's medical history. A majority of participants adopted a risk stratification approach in  
53 undertaking clinical assessment.  
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3 *'It's a combination of things... For example, for an upper respiratory tract infection,*  
4 *tonsillitis, pharyngitis, you know, there's a Centor guidance. So that's where you have*  
5 *a checklist of things. Does this person have cervical lymphadenopathy? Do they*  
6 *have a fever? Do they have like absence of a cough, you know. Do they have*  
7 *exudate on their tonsil? So, then if you have a score of 3 or more then they have*  
8 *antibiotics.'* (Int 1, GP).

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18 Risk stratification approaches included additional patient factors such as patient age and the  
19 presence of comorbidities including COPD, asthma, diabetes, cancer or a history of  
20 pneumonia. Whereas many followed risk assessment protocols based explicitly on local or  
21 national clinical guidelines, some participants stressed the importance of clinical judgement  
22 in making safety-driven decisions.

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29 *"You don't want to miss something very serious. So, that's where your clinical*  
30 *judgement and decision-making skills play a major role. And experience, obviously,*  
31 *because these are things I deal with every day".* (Int 14, Nurse)

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36 Threshold-guided decision-making spanned the continuum from 'I am prescribing' to 'I am  
37 not prescribing'. Diagnostic uncertainty was part and parcel of the threshold-guided decision-  
38 making: prescribers pointed to the difference between more and less obvious cases,  
39 characterised by equivocal, ambiguous and non-convincing evidence:

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44 *'...a patient with COPD, bronchiectasis, I may have a lower threshold for treating*  
45 *than a very fit and well 20-year-old, even if that 20-year-old had a productive cough*  
46 *with green sputum, their chest is clear, I'm not likely to give them antibiotics. Well*  
47 *they're not feverish, whereas if they're an 80 something with a history of COPD then*  
48 *I'd have a lower threshold for starting antibiotics because they're likely to have less*  
49 *reserve and more likely to have complications from an infection'* (Int 20, GP).

## 1.2. Confidence in prescribing

Appropriate prescribing and not just a reduction in antibiotics emerged as a priority for participants, who reflected on their own performance from different perspectives. Three participants expressed an overt avoidance of antibiotics, three others acknowledged over-prescribing, whilst most prescribers leaned towards reduced prescribing. In general, participants reported a high level of confidence in prescribing but also noted occasional limitations:

*"I feel confident but that doesn't mean necessarily that I think I'm making the right decision in every case. Sometimes when I'm making perhaps the wrong decision, I'm making that maybe because of patient pressure or because of my unwillingness to tolerate risk". (Int 22, GP).*

Many participants acknowledged changes towards less prescribing over the last few years:

*"I prescribe less because I guess we're more aware now of drug resistance than we were 5 years ago. It's much more talked about and we're seeing it more. But also, I'm now more confident in having that difficult discussion with the patient". (Int 5, GP)*

## Theme 2. Balancing treatment risks

### 2.1. Risks of prescribing and non-prescribing

Seven participants explicitly identified safety as a priority in infection management. All participants demonstrated vigilance to risks arising both from prescribing antibiotics and not prescribing. The fear was expressed of 'missing something' that could cause deterioration and consequently, participants admitted 'being cautious' and favoured prescribing antibiotics. At the same time, the common concern was also the avoidance of prescribing unnecessarily. Among the risks of prescribing, several side effects were reported, most commonly, gastrointestinal upsets, nausea, Clostridium difficile infection and thrush but also

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3 allergic, anaphylactic reactions, antibiotic resistance, and less common side effects such as  
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5 liver problems (failure). Participants also observed long-term adverse consequences of  
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7 inappropriate prescribing:  
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9 *“I think, certainly for children, I think if you prescribe antibiotics and they don’t need*  
10 *them and then they have a rash because they’ve got a virus and then a penicillin*  
11 *allergy on their notes for the rest of their lives... I think another consequence is that if*  
12 *you prescribe inappropriately, it’s very difficult for another healthcare professional,*  
13 *down the line, to explain to that patient, you’re almost saying the other person was*  
14 *wrong”.* (Int 15, Nurse)  
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24 Risks of non-prescribing generated a shorter list with sepsis being the most concerning  
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26 consequence.  
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29 *“Sepsis...that’s one thing I do worry about. If I see someone who’s got a high*  
30 *temperature and a high heart rate... then I think about those factors and I think*  
31 *actually if this was in my clinical judgement – if I left this for 2 days, then I think they*  
32 *would be crossing that line”* (Int 26, GP).  
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41 Three prescribers who acknowledged the tendency to overprescribe, did so, in one case,  
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43 because they assessed antibiotics’ benefits to exceed harms and in two cases because of  
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45 potential litigation following a missed serious bacterial infection:  
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47 *“Because medico-legally you’re much more likely to be brought up on missing*  
48 *something and not prescribing antibiotics than giving antibiotics when it wasn’t*  
49 *necessary... if there’s any uncertainty about prescribing antibiotics I would always err*  
50 *on the side of giving them because the risk, however small of missing an infection*  
51 *that then gets worse would be enough for me to give antibiotics”.* (Int 19, GP)  
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## 2.2. Facing antimicrobial resistance

Participants shared concern for the global rise in antimicrobial resistance. At the same time, they acknowledged lacking in-depth microbiological knowledge: *“we talk more about not prescribing and prescribing correctly than resistance itself* (Int 9, Pharmacist). Meanwhile, they had to deal with the consequences of the antimicrobial resistance in their daily practice:

*“I’ve had a few patients that have had MRSA [Methicillin-resistant Staphylococcus aureus]. I’ve had a few people who have had PVL [Panton-Valentine leukocidin form of MRSA] infections, skin infections with multiple resistance... So we can sometimes struggle to find an antibiotic that’s oral, that’s then suitable. I’ve got a Type 1 diabetic, young lady, who has very poorly controlled diabetes and recurrent boils and abscesses on her back. And we did a swab of that and yes, there was only one oral antibiotic that was sensitive - everything else was resistant”.* (Int 23, GP)

AMR was most commonly encountered in older women with urinary tract infections:

*‘I think sometimes you do see, for example, in the UTI breakdown, some people have quite resistant UTIs and that becomes difficult’.* (Int 15, Nurse)

*‘I’ve been a GP for about 10 years and you’ve already seen that certain antibiotics just aren’t working anymore, and we need to change the way that we’re doing things and you know we used to give trimethoprim locally first line for UTIs. Resistant in the majority of cases. So, we’re giving nitrofurantoin’.* (Int 10, GP)

There was mention of difficulties in conveying information about resistance to patients – discussing it in the encounters and emphasising community impact may have been less efficient than focussing on individual risks. There was also a worry that primary care is running out of antibiotics despite the strategies of second- and third-line antibiotics:

*“They [patients] literally cannot have any, they’ve got an E. coli infection that’s not sensitive to amoxicillin or nitrofurantoin or trimethoprim or even cefalexin or the cipro. It’s just like literally multiply-resistant. And there’s some quite virulent, my understanding is it is strains of bacteria where antibiotics will not work. And then you kind of get to the hard-core ones’.* (Int 11, GP)

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5 In such cases of failure of several course of antibiotics, referral to secondary care, possibly  
6 for intravenous therapy were reported as the only options. Other times, where the resistant  
7 organism could be tackled in primary care, the last resort was a longer course or long-term  
8 prophylactic antibiotics. More investigations and consultations with microbiologists about  
9 unresolved infections appeared to precede these decisions.  
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### 20 **Theme 3. Negotiating decisions and risks**

#### 21 **3.1. Managing patient expectations**

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24 Participants identified patient pressure as a factor in their decision-making but they shared  
25 the view that patients differ in terms of their expectations regarding antibiotics. On the one  
26 hand, increased knowledge of the appropriate indications for antibiotic therapy (not for  
27 viruses) and understanding of antimicrobial resistance from public health and media  
28 campaigns was noted. On the other hand, patient pressure in a form of implicit expectations  
29 or explicit demands remained frequent: readily prescribed in the past, antibiotics had a  
30 profile of immediate cure in large parts of patient population:  
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41 *“... so many people have been mis-prescribed antibiotics in the past that I*

*think they j*

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44 A GP summarised this ambivalence:

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46 *“There’s a reasonable cohort now who come in and say they don’t want them*  
47 *[antibiotics]. They’ve read, they’re educated, they know that they’re contributing*  
48 *potentially to resistance and they don’t want to risk the side effects. But there’s also a*  
49 *large cohort still who come in and say, “My cough’s gone to my chest, I need*  
50 *antibiotics.” So, it’s trying to often you know, get through those barriers and explain to*  
51 *them that their chest is clear.” (Int 10, GP)*  
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3 Eliciting expectations, educating patients, and delayed prescription were the key strategies  
4 for managing patient expectations. Explaining assessment results and positive language  
5 were deemed important for the success of the consultation; several participants preferred  
6 the time-saving mode of giving out written information about the expected length of illness  
7 (for example, about the duration of sinusitis with and without antibiotics) and about side  
8 effects of antibiotics. Elicitation of expectations included asking patients: “*What were you*  
9 *hoping for when you came in today?*” (Int 26, GP). Delayed prescriptions were used by all  
10 but three of the participants interviewed. This was considered as a form of partnership, of  
11 shared decision-making between the clinician and the patient:  
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23 *“... that helps patients because at least psychologically they have got an antibiotic, but*  
24 *they know they can't use it straightaway”.* (Int 25, GP)  
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### 32 **3.2. Communicating risks**

33 As above, participants demonstrated that the commitment to reduced prescribing was  
34 dependent on patient understanding of the need for antibiotics. This meant that at times  
35 building and maintaining relationships were prioritised and led to prescribing decisions, as an  
36 interviewee reported:  
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42 *“Much of my job is trying to build a rapport with someone and build a rapport so that*  
43 *we can have a conversation that's therapeutic. If someone has come in adamant that*  
44 *they want antibiotics there is some conversation to be had there. Why did you get*  
45 *this idea from? What is it that you believed this would do? And what is your previous*  
46 *experience? Now, if they're not willing to go into that today, I may actually give them*  
47 *a short course of antibiotics with the understanding that we have another*  
48 *conversation. This is a way of building some trust”* (Int 29).  
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57 The participants differed in terms of how they dealt with risk in encounters with patients:  
58 some were liberal prescribers who tended to avoid complaints and patient frustration, others  
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3 preferred having difficult conversations on non-antibiotics' course of actions. Among liberal  
4 prescribers, there was the notion of offering antibiotics in order to be safe. In the case of  
5 non-prescribing, prescribers sometimes delved into lengthy explanations in order to secure  
6 patient adherence:  
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11 *'When I'm explaining that there's no sign of bacterial infection and we don't want to*  
12 *give you antibiotics if we don't need to. Most people go, "Oh yes, yes, no, of course*  
13 *not." But some people might say, "Oh, well, you know." Then I will go into the*  
14 *reasons why, you know. "Well actually you might get side effects, you know, it can*  
15 *make you, give you diarrhoea, it can give you thrush. And things can become*  
16 *resistant to it and it won't be helpful for you in the future."* (Int 30, GP)  
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24 Advice on possible warning signs: 'safety netting' emerged as a dominant risk reduction  
25 strategy:  
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28 *"I will give them [patients] an awful lot of safety-netting, and tell them what, "If this*  
29 *doesn't get better, this is when you come back." You know, or "These are the signs of*  
30 *you getting worse," or what they do if they are getting worse".* (Int 16, GP)  
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## DISCUSSION

### Main findings in comparison with previous research

The study describes primary care prescribers' perceptions of safety and associated trade-offs in the context of reduced antibiotic prescribing. We identify three key themes with relevance to safety: risk assessment, balancing treatment risks, and negotiating decisions and risks. These accounts from primary care demonstrated variations in prescribers' approaches to decision-making behaviour, including perceptions of risks associated with prescribing or not prescribing antibiotics and in the communication of these decisions and risks to patients.

Decision-making for appropriate antibiotic prescribing was informed by safety considerations. Guideline-concordant risk assessment was generally preferred to tacit clinical judgement based on informal heuristics in line with previous research (38) Confidence in prescribing can be contrasted with views that accentuate diagnostic uncertainty. (4,18) In complex or uncertain cases, resolution was usually in favour of antibiotic prescribing, but this was in the context of a secular shift to generally more restrictive antibiotic prescribing behaviour. The reduction imperative co-exists with liberal prescribing, which was influenced by low tolerance of risks and patient pressures. This corresponds with extant literature that identifies the co-existence of different prescribing behaviours including antibiotic compromising, antibiotic delaying and antibiotic withholding. (25)

Safety trade-offs emerged from the respondents' perceptions of risk by lending support to recent qualitative research, which reported the complexity of balancing risks of antibiotic prescribing in hospitals. (39) In addition to anticipated benefits, respondents identified multiple risks associated with either prescribing or not prescribing antibiotics, so that the

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3 immediate and long-term adverse effects of prescribing, including AMR, were weighed  
4 against potential complications of non-prescribing such as sepsis. These untoward  
5 consequences rendered risk a double-edge sword. In the theory of social systems, such a  
6 conundrum can be described by the distinction *risk/danger*, rather than *risk/safety* because  
7 there is no absolute safety in prescribing decisions, hence the other side of risk remains  
8 danger not safety. (40, 41) We found variation in how the prescribers perceived this duality,  
9 with the safety argument contributing in both directions: prescribing and non-prescribing. In  
10 other words, professionals' acting on 'doing something' were juxtaposed against 'doing no  
11 harm' concerns. The participants were able to distinguish between short- term (e.g. side  
12 effects) and long-term (e.g. AMR, effect on doctor-patient relationship) trade-offs of  
13 prescribing. AMR was generally viewed as a standalone long-term adversity now being  
14 encountered in daily practice; it is gaining in prominence in contrast to findings from the  
15 earlier qualitative studies (43, 44) and now has a more personalised relevance and clinical  
16 significance than some recent reviews suggested. (45)

17  
18 Respondents negotiated safety in dealing with patients by rendering medical decision-  
19 making more explicitly during consultations. Patient expectations were found to be changing  
20 and so were the strategies employed in managing them. There was an emerging consensus  
21 on strategies to reduce antibiotic prescribing including patient education, improved self-  
22 management advice and delayed prescribing, supported by patient-centred communication  
23 emphasised in the other literature too. (46) At the same time, our study showed  
24 communication was primarily centred on warning signs, and on maintaining a clinician-  
25 patient relationship, rather than on the discussion of risks and benefits with patients. This is  
26 consistent with previous findings that explicit analysis of trade-offs is most often undertaken  
27 by physicians alone rather than as part of a dialogue with patients. (47) More explicit risk  
28 communication might become a focus of the consultations for (bacterial) infections.  
29 Systematic review evidence suggests that shared decision-making reduces prescribing (48)

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3 and our study also found that both delayed prescribing (49-52) and safety-netting appeared  
4 as effective strategies of shared decision making.  
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### 9 **Strengths and limitations**

10 We established several safety issues and risk management strategies as far as reduction in  
11 antibiotic prescribing is concerned. The study is a valuable investigation of primary care  
12 prescribers' perceptions and as such it emphasises the safety perspective within the current  
13 debate on antibiotic prescribing and antimicrobial stewardship. It is our belief that these  
14 dilemmas are recognisable in the course of daily primary care practice and can form the  
15 basis for future improvement and antimicrobial stewardship programs. The study is based on  
16 interviews with prescribers and may be prone to the limitations associated with qualitative  
17 studies, such as sample selection favouring GP interviews. Meanwhile, the sample of 30  
18 participants provide a good spread of opinions that are of a high validity and rigorously  
19 analysed. The study, however, may lack generalisability beyond high-income countries.  
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### 37 **Implications for further research and practice**

38 Our research paves the way for a cross-sectional survey of risk perceptions. It highlights the  
39 need for further development of risk stratification and risk communication tools such as  
40 decision-making checklists and evidence-based support tools. It also stresses the need for  
41 adequate training on AMR and reducing of antibiotics (such as GRACE-INTRO and  
42 REDUCE). (56, 57) . Safety netting had a strong presence in the interviews, however, as  
43 such is under-researched and requires further exploration. Our findings support the  
44 argument (32) that prescribers need more time to discuss the benefit-harm trade-off within  
45 shared decision making as this may help to reduce antibiotic prescribing in primary care.  
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## CONCLUSIONS

Attitudes towards antibiotic prescribing are changing and becoming more nuanced. There is growing confidence in the capacity to reduce the rate of prescribing and to manage patient expectations, which are themselves undergoing change. There is growing recognition that there may be safety trade-offs associated with antimicrobial stewardship and this is linked to concerns about sepsis and other serious bacterial infections. There is a need to develop better quantified estimates of risk that can inform clinical decision making and 'safety netting' advice given to patients. This will require further development of risk stratification estimates, as well as communication tools that enable these to be used in practice. Improved management of risks and benefits will help to inform future antimicrobial stewardship efforts.

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**Data availability statement:** The data that support the findings of this study are available from the corresponding author upon reasonable request.

## REFERENCES

1. Costelloe C, Metcalfe C, Lovering A, Mant D, Hay AD. Effect of antibiotic prescribing in primary care on antimicrobial resistance in individual patients: systematic review and meta-analysis. *BMJ (Clinical research ed)*. 2010;**340**:c2096.
2. Shallcross LJ, Davies SC. The World Health Assembly resolution on antimicrobial resistance. *J Antimicrobial Chemother*. 2014;**69**(11):2883-5.
3. Gulliford MC. Safety of reduced antibiotic prescribing. Serum procalcitonin can guide antibiotic administration for respiratory tract infections in primary care. *BMJ*. 2016;**354**:1.
4. Tonkin-Crine S, Yardley L, Little P. Antibiotic prescribing for acute respiratory tract infections in primary care: a systematic review and meta-ethnography. *J Antimicrobial Chemother*. 2011;**66**(10):2215-23.
5. Teixeira Rodrigues A, Roque F, Falcão A, Figueiras A, Herdeiro MT. Understanding physician antibiotic prescribing behaviour: a systematic review of qualitative studies. *Int J Antimicrobial Agents*. 2013;**41**(3):203-12.
6. Krockow EM, Colman AM, Chattoe-Brown E, Jenkins DR, Perera N, Mehtar S, et al. Balancing the risks to individual and society: a systematic review and synthesis of qualitative research on antibiotic prescribing behaviour in hospitals. *J Hospital Infection* 2019;**101**(4):428-39.
7. Vincent C. *Patient safety*. London: Churchill Livingstone Elsevier; 2006.
8. Sun X, Gulliford M. Reducing antibiotic prescribing in primary care in England from 2014 to 2017: Population-based cohort study. *BMJ Open*. 2019; **9**: e023989. doi: 10.1136/bmjopen-2018-023989

- 1  
2  
3 9. Public Health England. *English Surveillance Programme for Antimicrobial Utilisation*  
4 *and Resistance (ESPAUR) Report 2018 – 2019*. London: Public Health England, 2019.  
5  
6  
7
- 8 10. Department of Health. *Tackling antimicrobial resistance 2019–2024. The UK's five-*  
9 *year national action plan*. London: Department of Health, 2019.  
10  
11  
12
- 13 11. Llor C, Bjerrum L. Antimicrobial resistance: risk associated with antibiotic overuse  
14 and initiatives to reduce the problem. *Ther Adv Drug Safety*. 2014;**5**(6):229-41.  
15  
16  
17
- 18 12. World Health Organization. *Global Action Plan on Antimicrobial Resistance*. Geneva:  
19 WHO, 2015.  
20  
21  
22
- 23 13. Shehab N, Patel PR, Srinivasan A, Budnitz DS. Emergency department visits for  
24 antibiotic-associated adverse events. *Clin Inf Dis* 2008;**47**(6):735-43.  
25  
26  
27
- 28 14. Roehr B. Antibiotics account for 19% of emergency department visits in US for  
29 adverse events. *BMJ (Clinical research ed)*. 2008;**337**:a1324.  
30  
31  
32
- 33 15. Petersen I, Johnson AM, Islam A, Duckworth G, Livermore DM, Hayward AC.  
34 Protective effect of antibiotics against serious complications of common respiratory tract  
35 infections: retrospective cohort study with the UK General Practice Research Database. *BMJ*  
36 *(Clinical research ed)*. 2007;**335**(7627):982.  
37  
38  
39
- 40 16. Gulliford MC, Moore MV, Little P, Hay AD, Fox R, Prevost AT, et al. Safety of  
41 reduced antibiotic prescribing for self limiting respiratory tract infections in primary care:  
42 cohort study using electronic health records. *BMJ (Clinical research ed)*. 2016;**354**:i3410.  
43  
44  
45
- 46 17. Vazquez-Lago JM, Lopez-Vazquez P, Lopez-Duran A, Taracido-Trunk M, Figueiras  
47 A. Attitudes of primary care physicians to the prescribing of antibiotics and antimicrobial  
48 resistance: a qualitative study from Spain. *Fam Pract*. 2012;**29**(3):352-60.  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



- 1  
2  
3 18. Horwood J, Cabral C, Hay AD, Ingram J. Primary care clinician antibiotic prescribing  
4 decisions in consultations for children with RTIs: a qualitative interview study. *Br J Gen Pract*  
5 2016;**66**(644):e207-13.  
6  
7  
8  
9
- 10 19. Broom A, Broom J, Kirby E. Cultures of resistance? A Bourdieusian analysis of  
11 doctors' antibiotic prescribing. *Soc Sci Med* 2014;**110**:81-8.  
12  
13  
14
- 15 20. Livorsi D, Comer A, Matthias MS, Perencevich EN, Bair MJ. Factors Influencing  
16 Antibiotic-Prescribing Decisions Among Inpatient Physicians: A Qualitative Investigation.  
17 *Infection control and hospital epidemiology*. 2015;**36**(9):1065-72.  
18  
19  
20  
21
- 22 21. Klein EY, Martinez EM, May L, Saheed M, Reyna V, Broniatowski DA. Categorical  
23 Risk Perception Drives Variability in Antibiotic Prescribing in the Emergency Department: A  
24 Mixed Methods Observational Study. *J Gen Int Medicine*. 2017;**32**(10):1083-9.  
25  
26  
27  
28
- 29 22. Broniatowski DA, Klein EY, May L, Martinez EM, Ware C, Reyna VF. Patients' and  
30 Clinicians' Perceptions of Antibiotic Prescribing for Upper Respiratory Infections in the Acute  
31 Care Setting. *Medical Decision Making* 2018;**38**(5):547-61.  
32  
33  
34  
35
- 36 23. Yates TD, Davis ME, Taylor YJ, Davidson L, Connor CD, Buehler K, et al. Not a  
37 magic pill: a qualitative exploration of provider perspectives on antibiotic prescribing in the  
38 outpatient setting. *BMC Family Practice*. 2018;**19**(1):96.  
39  
40  
41  
42  
43
- 44 24. Coenen S, Francis N, Kelly M, Hood K, Nuttall J, Little P, et al. Are patient views  
45 about antibiotics related to clinician perceptions, management and outcome? A multi-country  
46 study in outpatients with acute cough. *PloS One*. 2013;**8**(10):e76691.  
47  
48  
49  
50
- 51 25. Fletcher-Lartey S, Yee M, Gaarslev C, Khan R. Why do general practitioners  
52 prescribe antibiotics for upper respiratory tract infections to meet patient expectations: a  
53 mixed methods study. *BMJ Open*. 2016;**6**(10):e012244.  
54  
55  
56  
57  
58  
59  
60

- 1  
2  
3 26. Lum EPM, Page K, Whitty JA, Doust J, Graves N. Antibiotic prescribing in primary  
4 healthcare: Dominant factors and trade-offs in decision-making. *Infection, Disease & Health*.  
5 2018;**23**(2):74-86.  
6  
7  
8  
9  
10 27. Mustafa M, Wood F, Butler CC, Elwyn G. Managing expectations of antibiotics for  
11 upper respiratory tract infections: a qualitative study. *Ann Fam Med*. 2014;**12**(1):29-36.  
12  
13  
14  
15 28. Altiner A, Knauf A, Moebes J, Sielk M, Wilm S. Acute cough: a qualitative analysis of  
16 how GPs manage the consultation when patients explicitly or implicitly expect antibiotic  
17 prescriptions. *Family Practice*. 2004;**21**(5):500-6.  
18  
19  
20  
21  
22  
23 29. Butler CC, Kinnersley P, Prout H, Rollnick S, Edwards A, Elwyn G. Antibiotics and  
24 shared decision-making in primary care. *J Antimicrobial Chemother* 2001;**48**(3):435-40.  
25  
26  
27  
28 30. Welschen I, Kuyvenhoven M, Hoes A, Verheij T. Antibiotics for acute respiratory tract  
29 symptoms: patients' expectations, GPs' management and patient satisfaction. *Family*  
30 *Practice*. 2004;**21**(3):234-7.  
31  
32  
33  
34  
35 31. Legare F, Labrecque M, Cauchon M, Castel J, Turcotte S, Grimshaw J. Training  
36 family physicians in shared decision-making to reduce the overuse of antibiotics in acute  
37 respiratory infections: a cluster randomized trial. *CMAJ* 2012;**184**(13):E726-34.  
38  
39  
40  
41  
42 32. Coxeter P, Del Mar CB, McGregor L, Beller EM, Hoffmann TC. Interventions to  
43 facilitate shared decision making to address antibiotic use for acute respiratory infections in  
44 primary care. *Cochrane Database Syst Rev* 2015(11):Cd010907.  
45  
46  
47  
48  
49 33. Hart AM, Pepper GA, Gonzales R. Balancing acts: deciding for or against antibiotics  
50 in acute respiratory infections. *J Fam Pract*. 2006;**55**(4):320-5.  
51  
52  
53  
54  
55 34. Michie S, Johnston M, Abraham C, Lawton R, Parker D, Walker A. Making  
56 psychological theory useful for implementing evidence based practice: a consensus  
57 approach. *Quality and Safety in Health Care*. 2005;**14**(1):26-33.  
58  
59  
60

- 1  
2  
3 35. Lorencatto F, Charani E, Sevdalis N, Tarrant C, Davey P. Driving sustainable change  
4 in antimicrobial prescribing practice: how can social and behavioural sciences help? *J*  
5 *Antimicrobial Chemother.* 2018;**73**(10):2613-24.  
6  
7  
8  
9  
10 36. Atkins L, Francis J, Islam R, O'Connor D, Patey A, Ivers N, et al. A guide to using the  
11 Theoretical Domains Framework of behaviour change to investigate implementation  
12 problems. *Implementation Science.* 2017;**12**(1):77.  
13  
14  
15  
16  
17 37. Braun V, Clarke V. Using thematic analysis in psychology. *Qualitative Research in*  
18 *Psychology.* 2006;**3**(2):77-101.  
19  
20  
21  
22  
23 38. Biezen R, Roberts C, Buising K, Thursky K, Boyle D, Lau P, et al. How do general  
24 practitioners access guidelines and utilise electronic medical records to make clinical  
25 decisions on antibiotic use? Results from an Australian qualitative study. *BMJ Open.*  
26 2019;**9**(8):e028329.  
27  
28  
29  
30  
31  
32 39. Broom J, Broom A, Kirby E. The drivers of antimicrobial use across institutions,  
33 stakeholders and economic settings: a paradigm shift is required for effective optimization. *J*  
34 *Antimicrobial Chemother.* 2019;**74**(9):2803-9.  
35  
36  
37  
38  
39 40. Luhmann N. *Risk: a Sociological Theory.* New York: Routledge; 2002.  
40  
41  
42 41. Boiko O, Sheaff R, Child S, Gericke CA. Risks, dangers and competing clinical  
43 decisions on venous thromboembolism prophylaxis in hospital care. *Sociology of health &*  
44 *illness.* 2014;**36**(6):932-47.  
45  
46  
47  
48  
49 42. Daker-White G, Hays R, Blakeman T, Croke S, Brown B, Esmail A, et al. Safety work  
50 and risk management as burdens of treatment in primary care: insights from a focused  
51 ethnographic study of patients with multimorbidity. *BMC Family Practice.* 2018;**19**(1):155-  
52  
53  
54  
55 43. Simpson SA, Wood F, Butler CC. General practitioners' perceptions of antimicrobial  
56 resistance: a qualitative study. *J Antimicrobial Chemother.* 2006;**59**(2):292-6.  
57  
58  
59  
60

- 1  
2  
3 44. Wood F, Phillips C, Brookes-Howell L, Hood K, Verheij T, Coenen S, et al. Primary  
4 care clinicians' perceptions of antibiotic resistance: a multi-country qualitative interview  
5 study. *J Antimicrobial Chemother.* 2012;**68**(1):237-43.  
6  
7  
8  
9  
10 45. McCullough AR, Rathbone J, Parekh S, Hoffmann TC, Del Mar CB. Not in my  
11 backyard: a systematic review of clinicians' knowledge and beliefs about antibiotic  
12 resistance. *J Antimicrobial Chemotherapy.* 2015;**70**(9):2465-73.  
13  
14  
15  
16  
17 46. O'Connor R, O'Doherty J, O'Regan A, Dunne C. Antibiotic use for acute respiratory  
18 tract infections (ARTI) in primary care; what factors affect prescribing and why is it  
19 important? A narrative review. *Irish J Med Sci.* 2018;**187**(4):969-86.  
20  
21  
22  
23  
24 47. Gregory R, Peters E, Slovic P. Making decisions about prescription drugs: A study of  
25 doctor–patient communication. *Health, Risk & Society.* 2011;**13**(4):347-71.  
26  
27  
28  
29  
30 48. Tonkin-Crine SK, Tan PS, van Hecke O, Wang K, Roberts NW, McCullough A, et al.  
31 Clinician-targeted interventions to influence antibiotic prescribing behaviour for acute  
32 respiratory infections in primary care: an overview of systematic reviews. *Cochrane*  
33 *Database Syst Rev* 2017;**9**:Cd012252.  
34  
35  
36  
37  
38  
39 49. Arroll B, Kenealy T, Kerse N. Do delayed prescriptions reduce antibiotic use in  
40 respiratory tract infections? A systematic review. *Br J Gen Pract* 2003;**53**(496):871-7.  
41  
42  
43  
44 50. Marchetti F, Ronfani L, Nibali SC, Tamburlini G. Delayed Prescription May Reduce  
45 the Use of Antibiotics for Acute Otitis Media: A Prospective Observational Study in Primary  
46 Care. *JAMA Pediatrics.* 2005;**159**(7):679-84.  
47  
48  
49  
50  
51  
52 51. Little P, Moore M, Kelly J, Williamson I, Leydon G, McDermott L, et al. Delayed  
53 antibiotic prescribing strategies for respiratory tract infections in primary care: pragmatic,  
54 factorial, randomised controlled trial. *BMJ* 2014;**348**:g1606.  
55  
56  
57  
58  
59  
60

- 1  
2  
3 52. Ryves R, Eyles C, Moore M, McDermott L, Little P, Leydon GM. Understanding the  
4 delayed prescribing of antibiotics for respiratory tract infection in primary care: a qualitative  
5 analysis. *BMJ Open*. 2016;**6**(11):e011882.  
6  
7  
8  
9  
10  
11 53. Courtenay M, Rowbotham S, Lim R, Peters S, Yates K, Chater A. Examining  
12 influences on antibiotic prescribing by nurse and pharmacist prescribers: a qualitative study  
13 using the Theoretical Domains Framework and COM-B. *BMJ Open*. 2019;**9**(6):e029177.  
14  
15  
16  
17 54. Riordan DO, Byrne S, Fleming A, Kearney PM, Galvin R, Sinnott C. GPs'  
18 perspectives on prescribing for older people in primary care: a qualitative study. *Br J Clin*  
19 *Pharmacol* 2017;**83**(7):1521-31.  
20  
21  
22  
23  
24  
25 55. Sargent L, McCullough A, Del Mar C, Lowe J. Using theory to explore facilitators and  
26 barriers to delayed prescribing in Australia: a qualitative study using the Theoretical Domains  
27 Framework and the Behaviour Change Wheel. *BMC Family Practice*. 2017;**18**(1):20.  
28  
29  
30  
31  
32 56. Gulliford MC, Prevost AT, Charlton J, Juszczuk D, Soames J, McDermott L, et al.  
33 Effectiveness and safety of electronically delivered prescribing feedback and decision  
34 support on antibiotic use for respiratory illness in primary care: REDUCE cluster randomised  
35 trial. *BMJ* 2019;**364**:l236.  
36  
37  
38  
39  
40  
41  
42 57. Yardley L, Douglas E, Anthierens S, Tonkin-Crine S, O'Reilly G, Stuart B, et al.  
43 Evaluation of a web-based intervention to reduce antibiotic prescribing for LRTI in six  
44 European countries: quantitative process analysis of the GRACE/INTRO randomised  
45 controlled trial. *Implementation Sci*. 2013;**8**(1):134.  
46  
47  
48  
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**Table 1. Interview guide.**

1	What are the indications for AB treatment?
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3	To what extent do NICE (or local) guidelines influence your AM prescribing?
4	
5	What are the risks of AB prescribing and non-prescribing?
6	
7	How do you differentiate between infections and patients?
8	
9	What are the common myths or stereotypes about antibiotics?
10	
11	Can you give me an example illustrating the inaccurate understanding of their purpose, mechanisms
12	of action, risks and consequences?
13	
14	In your view, is there the best way to elicit and manage patient expectations regarding antibiotics?
15	
16	How would you communicate the risks associated with both prescribing and non-prescribing
17	antibiotics?
18	
19	How confident are you in decision-making around AB prescribing?
20	
21	Would you assess your approach to AB prescribing as always adequate and if so, what makes you
22	think that?
23	
24	Could you describe consequences of inappropriate treatment for infections?
25	
26	What would be/were your actions following unresolved or repeated infections?
27	
28	What is your understanding of antimicrobial resistance?
29	
30	What are your goals and priorities in infection management?
31	
32	Are there any social norms or group pressures that affect your professional practice with regards to AB
33	prescribing and how?
34	
35	Has your prescribing practice for antibiotics changed over the recent years?
36	
37	Do you think patient expectations of AB treatment have changed over the recent years?
38	
39	Are you aware of the prescribing practice of other HCPs (your colleagues) in relation to antibiotics?
40	
41	Have you ever had to challenge their prescribing decisions?
42	
43	Has anyone challenged your own decisions?
44	
45	How hopeful are you usually that the AB treatment is the best course of action?
46	
47	Is it possible to assess both the short- and long-term impact of AB treatment on the patients?
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49	What is your decision-making strategy?
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51	How anxious do you feel about the uncertainty around prescribing?
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53	Which resources do you use to support your decisions on AB prescribing?
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**Table 2: Characteristics of participants. Figures are frequencies.**

<b>Characteristic</b>	<b>Variable</b>	<b>Number</b>
<b>Gender</b>	Male	8
	Female	22
<b>Location</b>	Metropolitan	21
	Shire town	9
<b>Occupation</b>	GPs	23
	Nurse prescriber	5
	Pharmacist	2
<b>Years of practice</b>	<10	16
	10-20	10
	>20	4

**Table 1** Consolidated criteria for reporting qualitative studies (COREQ): 32-item checklist

No	Item	Guide questions/description
<b>Domain 1: Research team and reflexivity</b>		
Personal Characteristics		
1.	Interviewer/facilitator	Which author/s conducted the interview or focus group? <b>P6</b>
2.	Credentials	What were the researcher's credentials? <i>E.g. PhD, MD</i> <b>P6</b>
3.	Occupation	What was their occupation at the time of the study? <b>P6</b>
4.	Gender	Was the researcher male or female? <b>P1</b>
5.	Experience and training	What experience or training did the researcher have? <b>P6</b>
Relationship with participants		
6.	Relationship established	Was a relationship established prior to study commencement? <b>P7</b>
7.	Participant knowledge of the interviewer	What did the participants know about the researcher? <i>e.g. personal goals, reasons for doing the research</i> <b>P7</b>
8.	Interviewer characteristics	What characteristics were reported about the interviewer/facilitator? <i>e.g. Bias, assumptions, reasons and interests in the research topic</i> <b>P7</b>
<b>Domain 2: study design</b>		



No	Item	Guide questions/description
	Theoretical framework	
9.	Methodological orientation and Theory	What methodological orientation was stated to underpin the study? <i>e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis</i> <b>P7</b>
	Participant selection	
10.	Sampling	How were participants selected? <i>e.g. purposive, convenience, consecutive, snowball</i> <b>P7</b>
11.	Method of approach	How were participants approached? <i>e.g. face-to-face, telephone, mail, email</i> <b>P7</b>
12.	Sample size	How many participants were in the study? <b>P7</b>
13.	Non-participation	How many people refused to participate or dropped out? Reasons? <b>P7</b>
	Setting	
14.	Setting of data collection	Where was the data collected? <i>e.g. home, clinic, workplace</i> <b>P6</b>
15.	Presence of non-participants	Was anyone else present besides the participants and researchers? <b>P6</b>
16.	Description of sample	What are the important characteristics of the sample? <i>e.g. demographic data, date</i> <b>Table 2</b>
	Data collection	

No	Item	Guide questions/description
17.	Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested? <b>Table 1 P6</b>
18.	Repeat interviews	Were repeat interviews carried out? If yes, how many? <b>N/A</b>
19.	Audio/visual recording	Did the research use audio or visual recording to collect the data? <b>P7</b>
20.	Field notes	Were field notes made during and/or after the interview or focus group? <b>P7</b>
21.	Duration	What was the duration of the interviews or focus group? <b>P8</b>
22.	Data saturation	Was data saturation discussed? <b>P7</b>
23.	Transcripts returned	Were transcripts returned to participants for comment and/or correction? <b>N/A</b>
<b>Domain 3: analysis and findings</b>		
Data analysis		
24.	Number of data coders	How many data coders coded the data? <b>P7</b>
25.	Description of the coding tree	Did authors provide a description of the coding tree? <b>P7</b>
26.	Derivation of themes	Were themes identified in advance or derived from the data? <b>P7</b>
27.	Software	What software, if applicable, was used to manage the data? <b>P7</b>

No	Item	Guide questions/description
28.	Participant checking	Did participants provide feedback on the findings? <b>N/A</b>
Reporting		
29.	Quotations presented	Were participant quotations presented to illustrate the themes / findings? Was each quotation identified? e.g. <i>participant number</i> <b>P8-P15</b>
30.	Data and findings consistent	Was there consistency between the data presented and the findings? <b>P8-P15</b>
31.	Clarity of major themes	Were major themes clearly presented in the findings? <b>P8-P15</b>
32.	Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes? <b>P8-P15</b>

# BMJ Open

## Risks of use and non-use of antibiotics in primary care. Qualitative study of prescribers' views

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**Risks of use and non-use of antibiotics in primary care.****Qualitative study of prescribers' views**

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**Short title: Risks of antibiotic use and non-use**

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## ABSTRACT

**Purpose:** The emergence of antimicrobial resistance has led to increasing efforts to reduce unnecessary use of antibiotics in primary care, but potential hazards from bacterial infection continue to cause concern. This study investigated how primary care prescribers perceive risk and safety concerns associated with reduced antibiotic prescribing.

**Methods:** Qualitative study using semi-structured interviews conducted with primary care prescribers from 10 general practices in an urban area and a shire town in England. A thematic analysis was conducted.

**Results:** Thirty participants were recruited, including 23 general practitioners, 5 nurses and 2 pharmacists. Three main themes were identified: risk assessment; balancing treatment risks; and negotiating decisions and risks. Respondents indicated that their decisions were grounded in clinical risk assessment, but this was informed by different approaches to antibiotic use, with most leaning towards reduced prescribing. Prescribers' perceptions of risk included the consequences of both inappropriate prescribing and inappropriate withholding of antibiotics. Sepsis was viewed as the most concerning potential outcome of non-prescribing, leading to possible patient harm and potential litigation. Risks of antibiotic prescribing included antibiotic resistant and *C. difficile* infections, as well as side effects, such as rashes, that might lead to possible mislabelling as antibiotic allergy. Prescribers elicited patient preferences for use or avoidance of antibiotics to inform management strategies, which included educational advice, advice on self-management including warning signs, use of delayed prescriptions, and safety netting.

**Conclusions:** Attitudes towards antibiotic prescribing are evolving, with reduced antibiotic prescribing now being approached more systematically. The safety trade-offs associated with either use or non-use of antibiotics present difficulties especially when prescribing decisions are inconsistent with patients' expectations.

**Key words:** primary care, antibiotics, infections, sepsis, safety, patient preferences

### Strengths and limitations of this study

- The sample of participants was diverse, including different groups of primary care prescribers drawn from urban and rural settings.
- The views of respondents who participated in the study may not be representative of non-participating practitioners.
- Participant responses may have been influenced by the interview setting
- Serious safety outcomes are infrequent and might not have been experienced by patients managed by participants in the study
- The study may have limited transferability beyond high-income countries.



## INTRODUCTION

Inappropriate antibiotic prescribing is widespread but may bring risks for individual (1, 2) and population health from drug side-effects as well as from growing antimicrobial resistance.

(3) Conversely, antibiotic avoidance may be associated with risks from serious bacterial infections that could be avoided through earlier treatment of infection episodes.(2) Many studies have provided insights into the reasons for inappropriate antibiotic prescribing and several syntheses have been published (4-6), but the safety gradient associated with reducing antibiotic prescribing has developed as a new and highly relevant area of research. In this paper, patient safety is understood as 'the avoidance, prevention and amelioration of adverse outcomes or injuries stemming from the process of healthcare'.(7) The risks associated with antibiotic prescribing decisions are a key element of patient safety and require in-depth analysis. This paper addresses the gap in knowledge about prescribers' perceptions of potential adverse outcomes associated with reduced antibiotic prescribing.

In the UK, primary care services account for nearly 80% of all medical antibiotic use but antibiotic utilisation in primary care has been declining in recent years and choice of antimicrobial agents has become more selective.(8, 9) A national target proposes a further reduction in antimicrobial use of 15% by 2024 (10) with antimicrobial resistance providing the rationale for the reduction in antibiotic prescribing. There were an estimated 60,788 antibiotic resistant infections in England in 2018 (9) resulting from infection with diverse bacterial pathogens, additionally super-infection with *Clostridium difficile* may cause illness. (11) The scale of antimicrobial resistance is increasing, especially across middle- and low-income countries. (12) Unnecessary exposure to antibiotics may also be associated with more immediate harms. As a result of prescribing in the community, antibiotic-associated adverse events including allergic reactions lead to many emergency visits with antibiotics accounting for up to 20% of hospital admissions from drug reactions in the US.(13, 14) On the other hand, withholding antibiotics might potentially carry risks and reduced antibiotic prescribing

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3 in general practice is associated with a small increase in complications such as treatable  
4 pneumonia and peritonsillar abscess.(2, 15)  
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9 The perceived priority of risks from either prescribing or not prescribing antibiotics requires a  
10 nuanced explanation within the broader realm of professionals' perceptions of safety and  
11 associated risk management. Fear of the risk of bacterial complications (5, 16) and  
12 prognostic uncertainty about potential outcomes when not prescribing (4, 17) are reportedly  
13 among key factors that influence the prescription of antibiotics. Among hospital doctors,  
14 there is evidence that overtreatment is preferred to the potential for adverse patient  
15 outcomes from not prescribing.(18, 19) Klein et al (20) and Broniatowski et al (21) for  
16 example, demonstrate that medical decision-making tends to favour views that favour  
17 prescription ('why take risks') rather than on prescription avoidance ('antibiotics can be  
18 harmful'). In primary care, general practitioners and other prescribers also deal with safety  
19 concerns in their decision-making, and a better understanding needs to be developed  
20 concerning the balance of risk between prescribing or non-prescribing of antibiotics.  
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37 Patient factors influencing decision-making on antibiotic prescribing include compliance with  
38 patient expectations and pressures. (16, 22-24) Reducing AB prescribing in primary care is  
39 therefore highly dependent on successful management of patient expectations (25-27) and  
40 on shared decision-making. (28-31) It is known that clinicians weigh individual best practice  
41 against perceived patient satisfaction so that complex trade-offs are enacted. (32) Therefore,  
42 of research interest is also how the issues of safety and risk information are communicated  
43 to patients.  
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52 In the present study we investigate how primary care prescribers perceive risk and safety  
53 concerns associated with reduced antibiotic prescribing.  
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## METHOD

### Study design

Semi-structured interviews were conducted with primary care prescribers including general practitioners, nurses and pharmacists in two English regions, one an urban metropolitan area and the other shire-town in England with a high demand for primary care services. The study was approved by London Hampstead Research Ethics Committee 18/LO/1874 and participants gave written informed consent to participation.

### Interviews

An interview guide was developed (Table 1), this was designed to address key elements of the substantive research topic; it was also loosely informed by elements of the Theoretical Domains Framework, which draws on behaviour change theory to understand factors influencing health care practice. (33-35) The interview guide was piloted with three GPs to ensure that the questions were appropriate, understandable and covered relevant prescribing behaviours. All interviews were conducted by the first author to ensure consistent quality. The interviewer has a PhD in medical sociology and is an experienced qualitative researcher. All interviews apart from one telephone interview were conducted face-to-face on general practice (n=26) and University (n=4) premises in the period January-July 2019. The participants were offered £60 to acknowledge their contribution.

### Recruitment of participants

Metropolitan practices were invited to the study by the local Clinical Research Network who generated the expression of interest. A shire-town high demand practice was recruited through informal Clinical Research Network contact who also helped in liaising with potential respondents. Potential participants were then approached either directly via email using the study information pack or indirectly via the practice manager or lead GP. The information pack included the invitation letter and study information sheet. A reminder was sent out two

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3 weeks after the initial approach to those who had not responded. A purposive sampling  
4 approach was followed: all participants were prescribers. Forty-nine primary care prescribers  
5 from 10 GP practices were invited and 30 agreed to take part. The sample size was  
6 determined using the pragmatic concept of 'information power' (36), taking into account the  
7 aim of the study, sample specificity, quality of dialogue, and analysis strategy. The uptake  
8 varied between practices (in 5 practices only a single participant was interviewed).  
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### 18 **Analysis**

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20 The interviews were digitally recorded, transcribed by a professional transcriber, imported to  
21 an NVivo-12 project and coded through an iterative six phased process described in  
22 thematic analysis.(37) Data analysis occurred iteratively and involved familiarisation, coding,  
23 theme searching, theme reviewing, theme defining and naming and producing the report.  
24 Repeated patterns in the data formed the basis for the codes, identified by the first author,  
25 and one single code for every different concept/idea was generated. To ensure that codes  
26 were applied consistently, a co-author (CB) independently coded a random sample of four  
27 interview transcripts. Coding was refined after discussion. Data identified by the same code  
28 was collated together and all different codes were sorted into potential subthemes and  
29 themes using NVivo options of tree building. Then, the potential themes were re-assessed  
30 and re-organised to reflect major narratives and themes in the coded data. Finally, the first,  
31 second and the last authors refined and named the themes and sub-themes.  
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### 49 *Public and Patient Involvement*

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51 Participants' feedback on the transcripts or the summarised final findings was not sought,  
52 however, the process of developing subthemes and themes was discussed at a Patient and  
53 Public Involvement meeting. The purpose of the meeting was to inform the research of  
54 patient and service user perspectives. The meeting was attended by six PPI members  
55 including four women and two men of diverse ages. The preliminary findings were  
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3 presented, and members were invited to discuss emerging themes and to review selected  
4 quotes from the interview transcripts for relevance. Feedback included comments on patient  
5 expectations, patient pressure for antibiotics, trust and communication with GPs leading to  
6 additional interpretation.  
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## 11 12 13 14 **RESULTS**

15 We recruited 30 participants from 10 general practices (Table 2. Characteristics of the  
16 participants), including 23 general practitioners, 5 nurses and 2 pharmacists. The interviews  
17 lasted between 24 minutes and 46 minutes. General practitioners', nurses' and pharmacists'  
18 responses were analysed as a single group because of the many commonalities and smaller  
19 number of non-medical respondents. We found there were no discernible differences in  
20 participants' accounts between the shire town and metropolitan settings. Overall, three  
21 participants expressed an overt avoidance of antibiotics, three others acknowledged over-  
22 prescribing, whilst most prescribers leaned towards reduced prescribing. We distinguished  
23 three major themes from the data: risk assessment; balancing treatment risks; and  
24 negotiating decisions and risks (Table 3).  
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### 39 **Theme 1. Risk assessment**

#### 40 41 **1.1. Identifying treatment thresholds**

42 The primary focus of diagnostic decision-making for participants was concerned with  
43 identifying major indications for antibiotic treatment. These were judged to include the nature  
44 and severity of illness based on presentation of symptoms and signs, in the context of the  
45 patient's medical history. A majority of participants adopted a risk stratification approach in  
46 undertaking clinical assessment.  
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54 *'It's a combination of things... For example, for an upper respiratory tract infection,*  
55 *tonsillitis, pharyngitis, you know, there's a Centor guidance. So that's where you have*  
56 *a checklist of things. Does this person have cervical lymphadenopathy? Do they*  
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3 *have a fever? Do they have like absence of a cough, you know. Do they have*  
4 *exudate on their tonsil? So, then if you have a score of 3 or more then they have*  
5 *antibiotics.’ (Int 1, GP).*  
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11 Risk stratification approaches included additional patient factors such as patient age and the  
12 presence of comorbidities including COPD, asthma, diabetes, cancer or a history of  
13 pneumonia. Whereas many followed risk assessment protocols based explicitly on local or  
14 national clinical guidelines, some participants stressed the importance of clinical judgement  
15 in making safety-driven decisions.  
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23 *“You don’t want to miss something very serious. So, that’s where your clinical*  
24 *judgement and decision-making skills play a major role. And experience, obviously,*  
25 *because these are things I deal with every day”.* (Int 14, Nurse)  
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29 Threshold-guided decision-making spanned the continuum from ‘I am prescribing’ to ‘I am  
30 not prescribing’. Diagnostic uncertainty was part and parcel of the threshold-guided decision-  
31 making: prescribers pointed to the difference between more and less obvious cases,  
32 characterised by equivocal, ambiguous and non-convincing evidence:  
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37 *‘...a patient with COPD, bronchiectasis, I may have a lower threshold for treating*  
38 *than a very fit and well 20-year-old, even if that 20-year-old had a productive cough*  
39 *with green sputum, their chest is clear, I’m not likely to give them antibiotics. Well*  
40 *they’re not feverish, whereas if they’re an 80 something with a history of COPD then*  
41 *I’d have a lower threshold for starting antibiotics because they’re likely to have less*  
42 *reserve and more likely to have complications from an infection’* (Int 20, GP).  
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## 53 **1.2. Confidence in prescribing**

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56 Appropriate prescribing and not just a reduction in antibiotics emerged as a priority for  
57 participants, who reflected on their own performance from different perspectives. In general,  
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3 participants reported a high level of confidence in prescribing but also noted occasional  
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5 limitations:

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8 *"I feel confident but that doesn't mean necessarily that I think I'm making the right*  
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10 *decision in every case. Sometimes when I'm making perhaps the wrong decision, I'm*  
11 *making that maybe because of patient pressure or because of my unwillingness to*  
12 *tolerate risk". (Int 22, GP).*  
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19 Many participants acknowledged changes towards less prescribing over the last few years:

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21 *"I prescribe less because I guess we're more aware now of drug resistance than we*  
22 *were 5 years ago. It's much more talked about and we're seeing it more. But also, I'm*  
23 *now more confident in having that difficult discussion with the patient". (Int 5, GP)*  
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## 31 **Theme 2. Balancing treatment risks**

### 32 **2.1. Risks of prescribing and non-prescribing**

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36 Seven participants explicitly identified safety as a priority in infection management. All  
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38 participants demonstrated vigilance to risks arising both from prescribing antibiotics and not  
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40 prescribing. The fear was expressed of 'missing something' that could cause deterioration  
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42 and consequently, participants admitted 'being cautious' and favoured prescribing  
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44 antibiotics. At the same time, the common concern was also the avoidance of prescribing  
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46 unnecessarily. Among the risks of prescribing, several side effects were reported, most  
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48 commonly, gastrointestinal upsets, nausea, Clostridium difficile infection and thrush but also  
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50 allergic, anaphylactic reactions, antibiotic resistance, and less common side effects such as  
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52 liver problems (failure). Participants also observed long-term adverse consequences of  
53  
54 inappropriate prescribing:  
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57 *"I think, certainly for children, I think if you prescribe antibiotics and they don't need*  
58 *them and then they have a rash because they've got a virus and then a penicillin*  
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3 *allergy on their notes for the rest of their lives... I think another consequence is that if*  
4 *you prescribe inappropriately, it's very difficult for another healthcare professional,*  
5 *down the line, to explain to that patient, you're almost saying the other person was*  
6 *wrong". (Int 15, Nurse)*  
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13 Risks of non-prescribing generated a shorter list with sepsis being the most concerning  
14 consequence.  
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18 *"Sepsis...that's one thing I do worry about. If I see someone who's got a high*  
19 *temperature and a high heart rate... then I think about those factors and I think*  
20 *actually if this was in my clinical judgement – if I left this for 2 days, then I think they*  
21 *would be crossing that line" (Int 26, GP).*  
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30 Three prescribers who acknowledged the tendency to overprescribe, did so, in one case,  
31 because they assessed antibiotics' benefits to exceed harms and in two cases because of  
32 potential litigation following a missed serious bacterial infection:  
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37 *"Because medico-legally you're much more likely to be brought up on missing*  
38 *something and not prescribing antibiotics than giving antibiotics when it wasn't*  
39 *necessary... if there's any uncertainty about prescribing antibiotics I would always err*  
40 *on the side of giving them because the risk, however small of missing an infection*  
41 *that then gets worse would be enough for me to give antibiotics". (Int 19, GP)*  
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## 50 **2.2. Facing antimicrobial resistance**

51 Participants shared concern for the global rise in antimicrobial resistance. At the same time,  
52 they acknowledged lacking in-depth microbiological knowledge: *"we talk more about not*  
53 *prescribing and prescribing correctly than resistance itself" (Int 9, Pharmacist).* Meanwhile,  
54 they had to deal with the consequences of the antimicrobial resistance in their daily practice:  
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3 *"I've had a few patients that have had MRSA [Methicillin-resistant Staphylococcus*  
4 *aureus]. I've had a few people who have had PVL [Panton-Valentine leukocidin form*  
5 *of MRSA] infections, skin infections with multiple resistance... So we can sometimes*  
6 *struggle to find an antibiotic that's oral, that's then suitable. I've got a Type 1 diabetic,*  
7 *young lady, who has very poorly controlled diabetes and recurrent boils and*  
8 *abscesses on her back. And we did a swab of that and yes, there was only one oral*  
9 *antibiotic that was sensitive - everything else was resistant". (Int 23, GP)*

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18 antimicrobial resistance was most commonly encountered in older women with urinary tract  
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20 infections:

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22 *'I think sometimes you do see, for example, in the UTI breakdown, some people have*  
23 *quite resistant UTIs and that becomes difficult'. (Int 15, Nurse)*

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26 *'I've been a GP for about 10 years and you've already seen that certain antibiotics just*  
27 *aren't working anymore, and we need to change the way that we're doing things and*  
28 *you know we used to give trimethoprim locally first line for UTIs. Resistant in the*  
29 *majority of cases. So, we're giving nitrofurantoin'. (Int 10, GP)*

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35 There was mention of difficulties in conveying information about resistance to patients –  
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37 discussing it in the encounters and emphasising community impact may have been less  
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39 efficient than focussing on individual risks. There was also a worry that primary care is  
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41 running out of antibiotics despite the strategies of second- and third-line antibiotics:

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43 *"They [patients] literally cannot have any, they've got an E. coli infection that's not*  
44 *sensitive to amoxicillin or nitrofurantoin or trimethoprim or even cefalexin or the cipro.*  
45 *It's just like literally multiply-resistant. And there's some quite virulent, my*  
46 *understanding is it is strains of bacteria where antibiotics will not work. And then you*  
47 *kind of get to the hard-core ones'. (Int 11, GP)*

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56 In such cases of failure of several course of antibiotics, referral to secondary care, possibly  
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58 for intravenous therapy were reported as the only options. Other times, where the resistant  
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60 organism could be tackled in primary care, the last resort was a longer course or long-term

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3 prophylactic antibiotics. More investigations and consultations with microbiologists about  
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5 unresolved infections appeared to precede these decisions.  
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### 9 **Theme 3. Negotiating decisions and risks**

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#### 13 **3.1. Managing patient expectations**

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15 Participants identified patient pressure as a factor in their decision-making but they shared  
16 the view that patients differ in terms of their expectations regarding antibiotics. On the one  
17 hand, increased knowledge of the appropriate indications for antibiotic therapy (not for  
18 viruses) and understanding of antimicrobial resistance from public health and media  
19 campaigns was noted. On the other hand, patient pressure in a form of implicit expectations  
20 or explicit demands remained frequent: readily prescribed in the past, antibiotics had a  
21 profile of immediate cure in large parts of patient population:  
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31 *“... so many people have been mis-prescribed antibiotics in the past that I think*  
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33 *they just won't believe you that they don't need them” (Int 25).*  
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36 A GP summarised this ambivalence:

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38 *“There's a reasonable cohort now who come in and say they don't want them*  
39 *[antibiotics]. They've read, they're educated, they know that they're contributing*  
40 *potentially to resistance and they don't want to risk the side effects. But there's also a*  
41 *large cohort still who come in and say, “My cough's gone to my chest, I need*  
42 *antibiotics.” So, it's trying to often you know, get through those barriers and explain to*  
43 *them that their chest is clear.” (Int 10, GP)*  
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52 Eliciting expectations, educating patients, and delayed prescription were the key strategies  
53 for managing patient expectations. Explaining assessment results and positive language  
54 were deemed important for the success of the consultation; several participants preferred  
55 the time-saving mode of giving out written information about the expected length of illness  
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3 (for example, about the duration of sinusitis with and without antibiotics) and about side  
4 effects of antibiotics. Elicitation of expectations included asking patients: “*What were you*  
5 *hoping for when you came in today?*” (Int 26, GP). Delayed prescriptions were used by all  
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8 but three of the participants interviewed. This was considered as a form of partnership, of  
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11 shared decision-making between the clinician and the patient:  
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14 *“... that helps patients because at least psychologically they have got an antibiotic, but*  
15 *they know they can't use it straightaway”.* (Int 25, GP)  
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### 23 **3.2. Communicating risks**

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25 As above, participants demonstrated that the commitment to reduced prescribing was  
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27 dependent on patient understanding of the need for antibiotics. This meant that at times  
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29 building and maintaining relationships were prioritised and led to prescribing decisions, as an  
30  
31 interviewee reported:  
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33 *“Much of my job is trying to build a rapport with someone and build a rapport so that*  
34 *we can have a conversation that's therapeutic. If someone has come in adamant that*  
35 *they want antibiotics there is some conversation to be had there. Why did you get*  
36 *this idea from? What is it that you believed this would do? And what is your previous*  
37 *experience? Now, if they're not willing to go into that today, I may actually give them*  
38 *a short course of antibiotics with the understanding that we have another*  
39 *conversation. This is a way of building some trust”* (Int 29, GP).  
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50 The participants differed in terms of how they dealt with risk in encounters with patients:  
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52 some were liberal prescribers who tended to avoid complaints and patient frustration, others  
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54 preferred having difficult conversations on non-antibiotics' course of actions. Among liberal  
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56 prescribers, there was the notion of offering antibiotics in order to be safe. In the case of  
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3 non-prescribing, prescribers sometimes delved into lengthy explanations in order to secure  
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5 patient adherence:  
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7 *‘When I’m explaining that there’s no sign of bacterial infection and we don’t want to*  
8 *give you antibiotics if we don’t need to. Most people go, “Oh yes, yes, no, of course*  
9 *not.” But some people might say, “Oh, well, you know.” Then I will go into the*  
10 *reasons why, you know. “Well actually you might get side effects, you know, it can*  
11 *make you, give you diarrhoea, it can give you thrush. And things can become*  
12 *resistant to it and it won’t be helpful for you in the future.” (Int 30, GP)*  
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20 Advice on possible warning signs: ‘safety netting’ emerged as a dominant risk reduction  
21  
22 strategy:  
23

24 *“I will give them [patients] an awful lot of safety-netting, and tell them what, “If this*  
25 *doesn’t get better, this is when you come back.” You know, or “These are the signs of*  
26 *you getting worse,” or what they do if they are getting worse”. (Int 16, GP)*  
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## 35 **DISCUSSION**

### 36 37 38 **Main findings in comparison with previous research**

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41 The study describes primary care prescribers’ perceptions of safety and associated trade-  
42 offs in the context of reduced antibiotic prescribing. We identify three key themes with  
43 relevance to safety: risk assessment, balancing treatment risks, and negotiating decisions  
44 and risks. These accounts from primary care demonstrated variations in prescribers’  
45 approaches to decision-making behaviour, including perceptions of risks associated with  
46 prescribing or not prescribing antibiotics and in the communication of these decisions and  
47 risks to patients.  
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57 Decision-making for appropriate antibiotic prescribing was informed by safety  
58 considerations. Guideline-concordant risk assessment was generally preferred to tacit  
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3 clinical judgement based on informal heuristics in line with previous research (38)  
4  
5 Confidence in prescribing can be contrasted with views that accentuate diagnostic  
6  
7 uncertainty. (4, 17) In complex or uncertain cases, resolution was usually in favour of  
8  
9 antibiotic prescribing, but this was in the context of a secular shift to generally more  
10  
11 restrictive antibiotic prescribing behaviour. The reduction imperative co-exists with liberal  
12  
13 prescribing, which was influenced by low tolerance of risks and patient pressures. This  
14  
15 corresponds with extant literature that identifies the co-existence of different prescribing  
16  
17 behaviours including antibiotic compromising, antibiotic delaying and antibiotic withholding.  
18  
19  
20 (24)

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23  
24 Safety trade-offs emerged from the respondents' perceptions of risk by lending support to  
25  
26 recent qualitative research, which reported the complexity of balancing risks of antibiotic  
27  
28 prescribing in hospitals. (39) In addition to anticipated benefits, respondents identified  
29  
30 multiple risks associated with either prescribing or not prescribing antibiotics, so that the  
31  
32 immediate and long-term adverse effects of prescribing, including antimicrobial resistance,  
33  
34 were weighed against potential complications of non-prescribing such as sepsis. These  
35  
36 untoward consequences rendered risk a double-edge sword. In the theory of social systems,  
37  
38 such a conundrum can be described by the distinction *risk/danger*, rather than *risk/safety*  
39  
40 because there is no absolute safety in prescribing decisions, hence the other side of risk  
41  
42 remains danger not safety. (40, 41) From Luhmann's (40) perspective, some distinctions are  
43  
44 two-sided forms of 'second-order' observations, where one side is actualised at any given  
45  
46 moment, but both sides may have equal relevance to the situation. Risk/danger represents  
47  
48 such a form which exemplifies the contingency associated with seemingly binary choices,  
49  
50 but which in itself represents actuality versus potentiality. According to this perspective,  
51  
52 safety experts are 'first-order' observers who may not account for the mutuality of  
53  
54 contingency because the other side is always present on the background. Boiko et al (41)  
55  
56 applied this understanding to the analysis of clinical risks associated with anticoagulant  
57  
58 prophylaxis, where risks of thrombosis were complemented by dangers of contraindications  
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3 (e.g. bleeding). In our situation of antibiotic prescribing, the 'risk' side is associated with  
4 prescribing potentially resulting in antimicrobial resistance and side effects, whilst the other  
5 side (danger) can be actualised if non-prescribing is chosen and can become the actual risk  
6 through complications such as sepsis. We found variation in how the prescribers perceived  
7 this duality, with the safety argument contributing in both directions: prescribing and non-  
8 prescribing. In other words, professionals' acting on 'doing something' were juxtaposed  
9 against 'doing no harm' concerns. The participants were able to distinguish between short-  
10 term (e.g. side effects) and long-term (e.g. antimicrobial resistance, effect on doctor-patient  
11 relationship) trade-offs of prescribing. antimicrobial resistance was generally viewed as a  
12 standalone long-term adversity now being encountered in daily practice; it is gaining in  
13 prominence in contrast to findings from the earlier qualitative studies (42, 43) and now has a  
14 more personalised relevance and clinical significance than some recent reviews suggested.  
15  
16 (44)

17  
18 Respondents negotiated safety in dealing with patients by rendering medical decision-  
19 making more explicitly during consultations. Patient expectations were found to be changing  
20 and so were the strategies employed in managing them. There was an emerging consensus  
21 on strategies to reduce antibiotic prescribing including patient education, improved self-  
22 management advice and delayed prescribing, supported by patient-centred communication  
23 emphasised in the other literature too. (45) At the same time, our study showed  
24 communication was primarily centred on warning signs, and on maintaining a clinician-  
25 patient relationship, rather than on the discussion of risks and benefits with patients. This is  
26 consistent with previous findings that explicit analysis of trade-offs is most often undertaken  
27 by physicians alone rather than as part of a dialogue with patients. (46) More explicit risk  
28 communication might become a focus of the consultations for (bacterial) infections.  
29  
30 Systematic review evidence suggests that shared decision-making reduces prescribing (47)  
31 and our study also found that both delayed prescribing (48-51) and safety-netting appeared  
32 as effective strategies of shared decision making.

## Strengths and limitations

The study provided a coherent analysis of the views of primary care prescribers. It drew on participants working in rural and urban settings and included a sample that was diverse with respect to professional training and years of experience. The size of the sample may not have been sufficient to distinguish differences in approach between groups with different professional training but this could be explored further in future studies. However, the study may have reduced transferability to other settings beyond UK primary care or beyond high-income countries. The study is based on interviews with prescribers and may be prone to the limitations associated with qualitative studies. Participants were necessarily informed of the nature and purpose of the research, consequently both their participation in the interview and the interview responses might have been influenced by research participation. It is possible that respondents who were less inclined to reduce antibiotic prescribing might have been less prepared to participate. Interview responses might have been inclined to give what they perceived as 'socially acceptable' responses. We employed a thematic analysis because this enables a flexible investigation of a complex topic without drawing on pre-existing theory. In order to reduce the possibility of inconsistency, we employed a systematic, staged approach to analysis and a sample of transcripts was repeat coded by a second analyst.

## Implications for further research and practice

This study explored and characterised primary care prescribers' perceptions of safety issues and risk management strategies relevant to reduced antibiotic prescribing. The study offers insights into primary care prescribers' perceptions and as such it emphasises the safety perspective within the current debate on antibiotic prescribing and antimicrobial stewardship. The study identified dilemmas that are recognisable in the course of daily primary care practice and can form the basis for future improvement and antimicrobial stewardship programs. Our research paves the way for a cross-sectional survey of risk perceptions. It

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2  
3 highlights the need for further development of risk stratification and risk communication tools  
4 such as decision-making checklists and evidence-based support tools. It also stresses the  
5 need for adequate training on antimicrobial resistance and reducing of antibiotics (such as  
6 GRACE-INTRO and REDUCE). (52, 53) . Safety netting had a strong presence in the  
7 interviews, however, as such is under-researched and requires further exploration. Our  
8 findings support the argument (31) that prescribers need more time to discuss the benefit-  
9 harm trade-off within shared decision making as this may help to  
10 reduce antibiotic prescribing in primary care.  
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## 24 **CONCLUSIONS**

25  
26 Attitudes towards antibiotic prescribing are changing and becoming more nuanced. There is  
27 growing confidence in the capacity to reduce the rate of prescribing and to manage patient  
28 expectations, which are themselves undergoing change. There is growing recognition that  
29 there may be safety trade-offs associated with antimicrobial stewardship and this is linked to  
30 concerns about sepsis and other serious bacterial infections. There is a need to develop  
31 better quantified estimates of risk that can inform clinical decision making and 'safety netting'  
32 advice given to patients. This will require further development of risk stratification estimates,  
33 as well as communication tools that enable these to be used in practice. Improved  
34 management of risks and benefits will help to inform future antimicrobial stewardship efforts.  
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3 **Contributorship:** OB and MG designed the study; CB advised on the development of the  
4 interview guide; MA and RF advised on the recruitment strategy and facilitated its  
5 implementation; OB conducted the analysis with support from CB; OB drafted the paper; all  
6 authors commented on and approved the paper.  
7  
8  
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34 **Data availability statement:** The data that support the findings of this study are available  
35 from the corresponding author upon reasonable request.  
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58  
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## REFERENCES

1. Costelloe C, Metcalfe C, Lovering A, Mant D, Hay AD. Effect of antibiotic prescribing in primary care on antimicrobial resistance in individual patients: systematic review and meta-analysis. *BMJ (Clinical research ed)*. 2010;**340**:c2096.
2. Gulliford MC, Moore MV, Little P, Hay AD, Fox R, Prevost AT, et al. Safety of reduced antibiotic prescribing for self limiting respiratory tract infections in primary care: cohort study using electronic health records. *BMJ (Clinical research ed)*. 2016;**354**:i3410.
3. Shallcross LJ, Davies SC. The World Health Assembly resolution on antimicrobial resistance. *J Antimicrobial Chemother*. 2014;**69**(11):2883-5.
4. Tonkin-Crine S, Yardley L, Little P. Antibiotic prescribing for acute respiratory tract infections in primary care: a systematic review and meta-ethnography. *J Antimicrobial Chemother*. 2011;**66**(10):2215-23.
5. Teixeira Rodrigues A, Roque F, Falcão A, Figueiras A, Herdeiro MT. Understanding physician antibiotic prescribing behaviour: a systematic review of qualitative studies. *Int J Antimicrobial Agents*. 2013;**41**(3):203-12.
6. Krockow EM, Colman AM, Chattoe-Brown E, Jenkins DR, Perera N, Mehtar S, et al. Balancing the risks to individual and society: a systematic review and synthesis of qualitative research on antibiotic prescribing behaviour in hospitals. *J Hospital Infection* 2019;**101**(4):428-39.
7. Vincent C. *Patient safety*. London: Churchill Livingstone Elsevier; 2006.
8. Sun X, Gulliford M. Reducing antibiotic prescribing in primary care in England from 2014 to 2017: Population-based cohort study. *BMJ Open*. 2019; **9**: e023989. doi: 10.1136/bmjopen-2018-023989

- 1  
2  
3 9. Public Health England. *English Surveillance Programme for Antimicrobial Utilisation*  
4 *and Resistance (ESPAUR) Report 2018 – 2019*. London: Public Health England, 2019.  
5  
6  
7
- 8 10. Department of Health. *Tackling antimicrobial resistance 2019–2024. The UK's five-*  
9 *year national action plan*. London: Department of Health, 2019.  
10  
11  
12
- 13 11. Llor C, Bjerrum L. Antimicrobial resistance: risk associated with antibiotic overuse  
14 and initiatives to reduce the problem. *Ther Adv Drug Safety*. 2014;**5**(6):229-41.  
15  
16  
17
- 18 12. World Health Organization. *Global Action Plan on Antimicrobial Resistance*. Geneva:  
19 WHO, 2015.  
20  
21  
22
- 23 13. Shehab N, Patel PR, Srinivasan A, Budnitz DS. Emergency department visits for  
24 antibiotic-associated adverse events. *Clin Inf Dis* 2008;**47**(6):735-43.  
25  
26  
27
- 28 14. Roehr B. Antibiotics account for 19% of emergency department visits in US for  
29 adverse events. *BMJ (Clinical research ed)*. 2008;**337**:a1324.  
30  
31  
32
- 33 15. Petersen I, Johnson AM, Islam A, Duckworth G, Livermore DM, Hayward AC.  
34 Protective effect of antibiotics against serious complications of common respiratory tract  
35 infections: retrospective cohort study with the UK General Practice Research Database. *BMJ*  
36 *(Clinical research ed)*. 2007;**335**(7627):982.  
37  
38  
39
- 40 16. Vazquez-Lago JM, Lopez-Vazquez P, Lopez-Duran A, Taracido-Trunk M, Figueiras  
41 A. Attitudes of primary care physicians to the prescribing of antibiotics and antimicrobial  
42 resistance: a qualitative study from Spain. *Fam Pract*. 2012;**29**(3):352-60.  
43  
44  
45
- 46 17. Horwood J, Cabral C, Hay AD, Ingram J. Primary care clinician antibiotic prescribing  
47 decisions in consultations for children with RTIs: a qualitative interview study. *Br J Gen Pract*  
48 2016;**66**(644):e207-13.  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

- 1  
2  
3 18. Broom A, Broom J, Kirby E. Cultures of resistance? A Bourdieusian analysis of  
4 doctors' antibiotic prescribing. *Soc Sci Med* 2014;**110**:81-8.  
5  
6  
7  
8 19. Livorsi D, Comer A, Matthias MS, Perencevich EN, Bair MJ. Factors Influencing  
9 Antibiotic-Prescribing Decisions Among Inpatient Physicians: A Qualitative Investigation.  
10 *Infection control and hospital epidemiology*. 2015;**36**(9):1065-72.  
11  
12  
13 20. Klein EY, Martinez EM, May L, Saheed M, Reyna V, Broniatowski DA. Categorical  
14 Risk Perception Drives Variability in Antibiotic Prescribing in the Emergency Department: A  
15 Mixed Methods Observational Study. *J Gen Int Medicine*. 2017;**32**(10):1083-9.  
16  
17  
18 21. Broniatowski DA, Klein EY, May L, Martinez EM, Ware C, Reyna VF. Patients' and  
19 Clinicians' Perceptions of Antibiotic Prescribing for Upper Respiratory Infections in the Acute  
20 Care Setting. *Medical Decision Making* 2018;**38**(5):547-61.  
21  
22  
23 22. Yates TD, Davis ME, Taylor YJ, Davidson L, Connor CD, Buehler K, et al. Not a  
24 magic pill: a qualitative exploration of provider perspectives on antibiotic prescribing in the  
25 outpatient setting. *BMC Family Practice*. 2018;**19**(1):96.  
26  
27  
28 23. Coenen S, Francis N, Kelly M, Hood K, Nuttall J, Little P, et al. Are patient views  
29 about antibiotics related to clinician perceptions, management and outcome? A multi-country  
30 study in outpatients with acute cough. *PloS One*. 2013;**8**(10):e76691.  
31  
32  
33 24. Fletcher-Lartey S, Yee M, Gaarslev C, Khan R. Why do general practitioners  
34 prescribe antibiotics for upper respiratory tract infections to meet patient expectations: a  
35 mixed methods study. *BMJ Open*. 2016;**6**(10):e012244.  
36  
37  
38 25. Lum EPM, Page K, Whitty JA, Doust J, Graves N. Antibiotic prescribing in primary  
39 healthcare: Dominant factors and trade-offs in decision-making. *Infection, Disease & Health*.  
40 2018;**23**(2):74-86.  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

- 1  
2  
3 26. Mustafa M, Wood F, Butler CC, Elwyn G. Managing expectations of antibiotics for  
4 upper respiratory tract infections: a qualitative study. *Ann Fam Med*. 2014;**12**(1):29-36.  
5  
6  
7
- 8 27. Altiner A, Knauf A, Moebes J, Sielk M, Wilm S. Acute cough: a qualitative analysis of  
9 how GPs manage the consultation when patients explicitly or implicitly expect antibiotic  
10 prescriptions. *Family Practice*. 2004;**21**(5):500-6.  
11  
12  
13
- 14 28. Butler CC, Kinnersley P, Prout H, Rollnick S, Edwards A, Elwyn G. Antibiotics and  
15 shared decision-making in primary care. *J Antimicrobial Chemother* 2001;**48**(3):435-40.  
16  
17  
18
- 19 29. Welschen I, Kuyvenhoven M, Hoes A, Verheij T. Antibiotics for acute respiratory tract  
20 symptoms: patients' expectations, GPs' management and patient satisfaction. *Family*  
21 *Practice*. 2004;**21**(3):234-7.  
22  
23  
24  
25  
26  
27
- 28 30. Legare F, Labrecque M, Cauchon M, Castel J, Turcotte S, Grimshaw J. Training  
29 family physicians in shared decision-making to reduce the overuse of antibiotics in acute  
30 respiratory infections: a cluster randomized trial. *CMAJ* 2012;**184**(13):E726-34.  
31  
32  
33  
34
- 35 31. Coxeter P, Del Mar CB, McGregor L, Beller EM, Hoffmann TC. Interventions to  
36 facilitate shared decision making to address antibiotic use for acute respiratory infections in  
37 primary care. *Cochrane Database Syst Rev* 2015(11):Cd010907.  
38  
39  
40  
41  
42
- 43 32. Hart AM, Pepper GA, Gonzales R. Balancing acts: deciding for or against antibiotics  
44 in acute respiratory infections. *J Fam Pract*. 2006;**55**(4):320-5.  
45  
46  
47
- 48 33. Michie S, Johnston M, Abraham C, Lawton R, Parker D, Walker A. Making  
49 psychological theory useful for implementing evidence based practice: a consensus  
50 approach. *Quality and Safety in Health Care*. 2005;**14**(1):26-33.  
51  
52  
53  
54
- 55 34. Lorencatto F, Charani E, Sevdalis N, Tarrant C, Davey P. Driving sustainable change  
56 in antimicrobial prescribing practice: how can social and behavioural sciences help? *J*  
57 *Antimicrobial Chemother*. 2018;**73**(10):2613-24.  
58  
59  
60

- 1  
2  
3 35. Atkins L, Francis J, Islam R, O'Connor D, Patey A, Ivers N, et al. A guide to using the  
4 Theoretical Domains Framework of behaviour change to investigate implementation  
5 problems. *Implementation Science*. 2017;**12**(1):77.  
6  
7  
8  
9  
10 36. Malterud K, Siersma VD, Guassora AD. Sample Size in Qualitative Interview  
11 Studies: Guided by Information Power. *Qualitative Health Research*. 2016;**26**(13):1753-60.  
12  
13  
14  
15 37. Braun V, Clarke V. Using thematic analysis in psychology. *Qualitative Research in*  
16 *Psychology*. 2006;**3**(2):77-101.  
17  
18  
19  
20  
21 38. Biezen R, Roberts C, Buising K, Thursky K, Boyle D, Lau P, et al. How do general  
22 practitioners access guidelines and utilise electronic medical records to make clinical  
23 decisions on antibiotic use? Results from an Australian qualitative study. *BMJ Open*.  
24 2019;**9**(8):e028329.  
25  
26  
27  
28  
29  
30 39. Broom J, Broom A, Kirby E. The drivers of antimicrobial use across institutions,  
31 stakeholders and economic settings: a paradigm shift is required for effective optimization. *J*  
32 *Antimicrobial Chemother*. 2019;**74**(9):2803-9.  
33  
34  
35  
36  
37 40. Luhmann N. *Risk: a Sociological Theory*. New York: Routledge; 2002.  
38  
39  
40  
41 41. Boiko O, Sheaff R, Child S, Gericke CA. Risks, dangers and competing clinical  
42 decisions on venous thromboembolism prophylaxis in hospital care. *Sociology of health &*  
43 *illness*. 2014;**36**(6):932-47.  
44  
45  
46  
47  
48 42. Simpson SA, Wood F, Butler CC. General practitioners' perceptions of antimicrobial  
49 resistance: a qualitative study. *J Antimicrobial Chemother*. 2006;**59**(2):292-6.  
50  
51  
52  
53 43. Wood F, Phillips C, Brookes-Howell L, Hood K, Verheij T, Coenen S, et al. Primary  
54 care clinicians' perceptions of antibiotic resistance: a multi-country qualitative interview  
55 study. *J Antimicrobial Chemother*. 2012;**68**(1):237-43.  
56  
57  
58  
59  
60

- 1  
2  
3 44. McCullough AR, Rathbone J, Parekh S, Hoffmann TC, Del Mar CB. Not in my  
4  
5 backyard: a systematic review of clinicians' knowledge and beliefs about antibiotic  
6  
7 resistance. *J Antimicrobial Chemotherapy*. 2015;**70**(9):2465-73.  
8  
9  
10 45. O'Connor R, O'Doherty J, O'Regan A, Dunne C. Antibiotic use for acute respiratory  
11  
12 tract infections (ARTI) in primary care; what factors affect prescribing and why is it  
13  
14 important? A narrative review. *Irish J Med Sci*. 2018;**187**(4):969-86.  
15  
16  
17 46. Gregory R, Peters E, Slovic P. Making decisions about prescription drugs: A study of  
18  
19 doctor-patient communication. *Health, Risk & Society*. 2011;**13**(4):347-71.  
20  
21  
22 47. Tonkin-Crine SK, Tan PS, van Hecke O, Wang K, Roberts NW, McCullough A, et al.  
23  
24 Clinician-targeted interventions to influence antibiotic prescribing behaviour for acute  
25  
26 respiratory infections in primary care: an overview of systematic reviews. *Cochrane*  
27  
28 *Database Syst Rev* 2017;**9**:Cd012252.  
29  
30  
31 48. Arroll B, Kenealy T, Kerse N. Do delayed prescriptions reduce antibiotic use in  
32  
33 respiratory tract infections? A systematic review. *Br J Gen Pract* 2003;**53**(496):871-7.  
34  
35  
36 49. Marchetti F, Ronfani L, Nibali SC, Tamburlini G. Delayed Prescription May Reduce  
37  
38 the Use of Antibiotics for Acute Otitis Media: A Prospective Observational Study in Primary  
39  
40 Care. *JAMA Pediatrics*. 2005;**159**(7):679-84.  
41  
42  
43 50. Little P, Moore M, Kelly J, Williamson I, Leydon G, McDermott L, et al. Delayed  
44  
45 antibiotic prescribing strategies for respiratory tract infections in primary care: pragmatic,  
46  
47 factorial, randomised controlled trial. *BMJ* 2014;**348**:g1606.  
48  
49  
50 51. Ryves R, Eyles C, Moore M, McDermott L, Little P, Leydon GM. Understanding the  
51  
52 delayed prescribing of antibiotics for respiratory tract infection in primary care: a qualitative  
53  
54 analysis. *BMJ Open*. 2016;**6**(11):e011882.  
55  
56  
57  
58  
59  
60

1  
2  
3 52. Gulliford MC, Prevost AT, Charlton J, Juszczuk D, Soames J, McDermott L, et al.  
4  
5 Effectiveness and safety of electronically delivered prescribing feedback and decision  
6  
7 support on antibiotic use for respiratory illness in primary care: REDUCE cluster randomised  
8  
9 trial. *BMJ* 2019;**364**:l236.  
10

11  
12 53. Yardley L, Douglas E, Anthierens S, Tonkin-Crine S, O'Reilly G, Stuart B, et al.  
13  
14 Evaluation of a web-based intervention to reduce antibiotic prescribing for LRTI in six  
15  
16 European countries: quantitative process analysis of the GRACE/INTRO randomised  
17  
18 controlled trial. *Implementation Sci.* 2013;**8**(1):134.  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
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**Table 1. Interview guide.**

1	What are the indications for AB treatment?
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3	To what extent do NICE (or local) guidelines influence your AM prescribing?
4	
5	What are the risks of AB prescribing and non-prescribing?
6	
7	How do you differentiate between infections and patients?
8	
9	What are the common myths or stereotypes about antibiotics?
10	
11	Can you give me an example illustrating the inaccurate understanding of their purpose, mechanisms
12	of action, risks and consequences?
13	
14	In your view, is there the best way to elicit and manage patient expectations regarding antibiotics?
15	
16	How would you communicate the risks associated with both prescribing and non-prescribing
17	antibiotics?
18	
19	How confident are you in decision-making around AB prescribing?
20	
21	Would you assess your approach to AB prescribing as always adequate and if so, what makes you
22	think that?
23	
24	Could you describe consequences of inappropriate treatment for infections?
25	
26	What would be/were your actions following unresolved or repeated infections?
27	
28	What is your understanding of antimicrobial resistance?
29	
30	What are your goals and priorities in infection management?
31	
32	Are there any social norms or group pressures that affect your professional practice with regards to AB
33	prescribing and how?
34	
35	Has your prescribing practice for antibiotics changed over the recent years?
36	
37	Do you think patient expectations of AB treatment have changed over the recent years?
38	
39	Are you aware of the prescribing practice of other HCPs (your colleagues) in relation to antibiotics?
40	
41	Have you ever had to challenge their prescribing decisions?
42	
43	Has anyone challenged your own decisions?
44	
45	How hopeful are you usually that the AB treatment is the best course of action?
46	
47	Is it possible to assess both the short- and long-term impact of AB treatment on the patients?
48	
49	What is your decision-making strategy?
50	
51	How anxious do you feel about the uncertainty around prescribing?
52	
53	Which resources do you use to support your decisions on AB prescribing?
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**Table 2: Characteristics of participants. Figures are frequencies.**

<b>Characteristic</b>	<b>Variable</b>	<b>Number</b>
<b>Gender</b>	Male	8
	Female	22
<b>Location</b>	Metropolitan	21
	Shire town	9
<b>Occupation</b>	GPs	23
	Nurse prescriber	5
	Pharmacist	2
<b>Years of practice</b>	<10	16
	10-20	10
	>20	4

**Table 3: Summary of main themes and sub-themes.**

Theme	Sub-themes
<b>Theme 1. Risk assessment</b>	Identifying treatment thresholds Confidence in prescribing
<b>Theme 2. Balancing treatment risks</b>	Risks of prescribing and non-prescribing Facing antimicrobial resistance
<b>Theme 3. Negotiating decisions and risks</b>	Managing patient expectations Communicating risks

For peer review only

**Table 1** Consolidated criteria for reporting qualitative studies (COREQ): 32-item checklist

No	Item	Guide questions/description
<b>Domain 1: Research team and reflexivity</b>		
Personal Characteristics		
1.	Interviewer/facilitator	Which author/s conducted the interview or focus group? <b>P6</b>
2.	Credentials	What were the researcher's credentials? <i>E.g. PhD, MD</i> <b>P6</b>
3.	Occupation	What was their occupation at the time of the study? <b>P6</b>
4.	Gender	Was the researcher male or female? <b>P1</b>
5.	Experience and training	What experience or training did the researcher have? <b>P6</b>
Relationship with participants		
6.	Relationship established	Was a relationship established prior to study commencement? <b>P7</b>
7.	Participant knowledge of the interviewer	What did the participants know about the researcher? <i>e.g. personal goals, reasons for doing the research</i> <b>P7</b>
8.	Interviewer characteristics	What characteristics were reported about the interviewer/facilitator? <i>e.g. Bias, assumptions, reasons and interests in the research topic</i> <b>P7</b>
<b>Domain 2: study design</b>		

No	Item	Guide questions/description
	Theoretical framework	
9.	Methodological orientation and Theory	What methodological orientation was stated to underpin the study? <i>e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis</i> <b>P7</b>
	Participant selection	
10.	Sampling	How were participants selected? <i>e.g. purposive, convenience, consecutive, snowball</i> <b>P7</b>
11.	Method of approach	How were participants approached? <i>e.g. face-to-face, telephone, mail, email</i> <b>P7</b>
12.	Sample size	How many participants were in the study? <b>P7</b>
13.	Non-participation	How many people refused to participate or dropped out? Reasons? <b>P7</b>
	Setting	
14.	Setting of data collection	Where was the data collected? <i>e.g. home, clinic, workplace</i> <b>P6</b>
15.	Presence of non-participants	Was anyone else present besides the participants and researchers? <b>P6</b>
16.	Description of sample	What are the important characteristics of the sample? <i>e.g. demographic data, date</i> <b>Table 2</b>
	Data collection	

No	Item	Guide questions/description
17.	Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested? <b>Table 1 P6</b>
18.	Repeat interviews	Were repeat interviews carried out? If yes, how many? <b>N/A</b>
19.	Audio/visual recording	Did the research use audio or visual recording to collect the data? <b>P7</b>
20.	Field notes	Were field notes made during and/or after the interview or focus group? <b>P7</b>
21.	Duration	What was the duration of the interviews or focus group? <b>P8</b>
22.	Data saturation	Was data saturation discussed? <b>P7</b>
23.	Transcripts returned	Were transcripts returned to participants for comment and/or correction? <b>N/A</b>
<b>Domain 3: analysis and findings</b>		
Data analysis		
24.	Number of data coders	How many data coders coded the data? <b>P7</b>
25.	Description of the coding tree	Did authors provide a description of the coding tree? <b>P7</b>
26.	Derivation of themes	Were themes identified in advance or derived from the data? <b>P7</b>
27.	Software	What software, if applicable, was used to manage the data? <b>P7</b>

No	Item	Guide questions/description
28.	Participant checking	Did participants provide feedback on the findings? <b>N/A</b>
Reporting		
29.	Quotations presented	Were participant quotations presented to illustrate the themes / findings? Was each quotation identified? e.g. <i>participant number</i> <b>P8-P15</b>
30.	Data and findings consistent	Was there consistency between the data presented and the findings? <b>P8-P15</b>
31.	Clarity of major themes	Were major themes clearly presented in the findings? <b>P8-P15</b>
32.	Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes? <b>P8-P15</b>

# BMJ Open

## Risks of use and non-use of antibiotics in primary care. Qualitative study of prescribers' views

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**Risks of use and non-use of antibiotics in primary care.****Qualitative study of prescribers' views**

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**Short title: Risks of antibiotic use and non-use**

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**ABSTRACT**

**Purpose:** The emergence of antimicrobial resistance has led to increasing efforts to reduce unnecessary use of antibiotics in primary care, but potential hazards from bacterial infection continue to cause concern. This study investigated how primary care prescribers perceive risk and safety concerns associated with reduced antibiotic prescribing.

**Methods:** Qualitative study using semi-structured interviews conducted with primary care prescribers from 10 general practices in an urban area and a shire town in England. A thematic analysis was conducted.

**Results:** Thirty participants were recruited, including 23 general practitioners, 5 nurses and 2 pharmacists. Three main themes were identified: risk assessment; balancing treatment risks; and negotiating decisions and risks. Respondents indicated that their decisions were grounded in clinical risk assessment, but this was informed by different approaches to antibiotic use, with most leaning towards reduced prescribing. Prescribers' perceptions of risk included the consequences of both inappropriate prescribing and inappropriate withholding of antibiotics. Sepsis was viewed as the most concerning potential outcome of non-prescribing, leading to possible patient harm and potential litigation. Risks of antibiotic prescribing included antibiotic resistant and *C. difficile* infections, as well as side effects, such as rashes, that might lead to possible mislabelling as antibiotic allergy. Prescribers elicited patient preferences for use or avoidance of antibiotics to inform management strategies, which included educational advice, advice on self-management including warning signs, use of delayed prescriptions, and safety netting.

**Conclusions:** Attitudes towards antibiotic prescribing are evolving, with reduced antibiotic prescribing now being approached more systematically. The safety trade-offs associated with either use or non-use of antibiotics present difficulties especially when prescribing decisions are inconsistent with patients' expectations.

**Key words:** primary care, antibiotics, infections, sepsis, safety, patient preferences

### Strengths and limitations of this study

- The sample of participants was diverse, including different groups of primary care prescribers drawn from urban and rural settings.
- The views of respondents who participated in the study may not be representative of non-participating practitioners.
- Participant responses may have been influenced by the interview setting
- Serious safety outcomes are infrequent and might not have been experienced by patients managed by participants in the study
- The study may have limited transferability beyond high-income countries.

## INTRODUCTION

Inappropriate antibiotic prescribing is widespread but may bring risks for individual (1, 2) and population health from drug side-effects as well as from growing antimicrobial resistance.

(3) Conversely, antibiotic avoidance may be associated with risks from serious bacterial infections that could be avoided through earlier treatment of infection episodes.(2) Many studies have provided insights into the reasons for inappropriate antibiotic prescribing and several syntheses have been published (4-6), but the safety gradient associated with reducing antibiotic prescribing has developed as a new and highly relevant area of research. In this paper, patient safety is understood as 'the avoidance, prevention and amelioration of adverse outcomes or injuries stemming from the process of healthcare'.(7) The risks associated with antibiotic prescribing decisions are a key element of patient safety and require in-depth analysis. This paper addresses the gap in knowledge about prescribers' perceptions of potential adverse outcomes associated with reduced antibiotic prescribing.

In the UK, primary care services account for nearly 80% of all medical antibiotic use but antibiotic utilisation in primary care has been declining in recent years and choice of antimicrobial agents has become more selective.(8, 9) A national target proposes a further reduction in antimicrobial use of 15% by 2024 (10) with antimicrobial resistance providing the rationale for the reduction in antibiotic prescribing. There were an estimated 60,788 antibiotic resistant infections in England in 2018 (9) resulting from infection with diverse bacterial pathogens, additionally super-infection with *Clostridium difficile* may cause illness. (11) The scale of antimicrobial resistance is increasing, especially across middle- and low-income countries. (12) Unnecessary exposure to antibiotics may also be associated with more immediate harms. As a result of prescribing in the community, antibiotic-associated adverse events including allergic reactions lead to many emergency visits with antibiotics accounting for up to 20% of hospital admissions from drug reactions in the US.(13, 14) On the other hand, withholding antibiotics might potentially carry risks and reduced antibiotic prescribing

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3 in general practice is associated with a small increase in complications such as treatable  
4 pneumonia and peritonsillar abscess.(2, 15)  
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9 The perceived priority of risks from either prescribing or not prescribing antibiotics requires a  
10 nuanced explanation within the broader realm of professionals' perceptions of safety and  
11 associated risk management. Fear of the risk of bacterial complications (5, 16) and  
12 prognostic uncertainty about potential outcomes when not prescribing (4, 17) are reportedly  
13 among key factors that influence the prescription of antibiotics. Among hospital doctors,  
14 there is evidence that overtreatment is preferred to the potential for adverse patient  
15 outcomes from not prescribing.(18, 19) Klein et al (20) and Broniatowski et al (21) for  
16 example, demonstrate that medical decision-making tends to favour views that favour  
17 prescription ('why take risks') rather than on prescription avoidance ('antibiotics can be  
18 harmful'). In primary care, general practitioners and other prescribers also deal with safety  
19 concerns in their decision-making, and a better understanding needs to be developed  
20 concerning the balance of risk between prescribing or non-prescribing of antibiotics.  
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37 Patient factors influencing decision-making on antibiotic prescribing include compliance with  
38 patient expectations and pressures. (16, 22-24) Reducing AB prescribing in primary care is  
39 therefore highly dependent on successful management of patient expectations (25-27) and  
40 on shared decision-making. (28-31) It is known that clinicians weigh individual best practice  
41 against perceived patient satisfaction so that complex trade-offs are enacted. (32) Therefore,  
42 of research interest is also how the issues of safety and risk information are communicated  
43 to patients.  
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54 In the present study we investigate how primary care prescribers perceive risk and safety  
55 concerns associated with reduced antibiotic prescribing.  
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## METHOD

### Study design

Semi-structured interviews were conducted with primary care prescribers including general practitioners, nurses and pharmacists in two English regions, one an urban metropolitan area and the other shire-town in England with a high demand for primary care services. The study was approved by London Hampstead Research Ethics Committee 18/LO/1874 and participants gave written informed consent to participation.

### Interviews

An interview guide was developed (Table 1), this was designed to address key elements of the substantive research topic; it was also loosely informed by elements of the Theoretical Domains Framework, which draws on behaviour change theory to understand factors influencing health care practice. (33-35) The interview guide was piloted with three GPs to ensure that the questions were appropriate, understandable and covered relevant prescribing behaviours. All interviews were conducted by the first author to ensure consistent quality. The interviewer has a PhD in medical sociology and is an experienced qualitative researcher. All interviews apart from one telephone interview were conducted face-to-face on general practice (n=26) and University (n=4) premises in the period January-July 2019. The participants were offered £60 to acknowledge their contribution.

### Recruitment of participants

Metropolitan practices were invited to the study by the local Clinical Research Network who generated the expression of interest. A shire-town high demand practice was recruited through informal Clinical Research Network contact who also helped in liaising with potential respondents. Potential participants were then approached either directly via email using the study information pack or indirectly via the practice manager or lead GP. The information pack included the invitation letter and study information sheet. A reminder was sent out two

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3 weeks after the initial approach to those who had not responded. A purposive sampling  
4 approach was followed: all participants were prescribers. Forty-nine primary care prescribers  
5 from 10 GP practices were invited and 30 agreed to take part. The sample size was  
6 determined using the pragmatic concept of 'information power' (36), taking into account the  
7 aim of the study, sample specificity, quality of dialogue, and analysis strategy. The uptake  
8 varied between practices (in 5 practices only a single participant was interviewed).  
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### 18 **Analysis**

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20 The interviews were digitally recorded, transcribed by a professional transcriber, imported to  
21 an NVivo-12 project and coded through an iterative six phased process described in  
22 thematic analysis.(37) Data analysis occurred iteratively and involved familiarisation, coding,  
23 theme searching, theme reviewing, theme defining and naming and producing the report.  
24 Repeated patterns in the data formed the basis for the codes, identified by the first author,  
25 and one single code for every different concept/idea was generated. To ensure that codes  
26 were applied consistently, a co-author (CB) independently coded a random sample of four  
27 interview transcripts. Coding was refined after discussion. Data identified by the same code  
28 was collated together and all different codes were sorted into potential subthemes and  
29 themes using NVivo options of tree building. Then, the potential themes were re-assessed  
30 and re-organised to reflect major narratives and themes in the coded data. Finally, the first,  
31 second and the last authors refined and named the themes and sub-themes.  
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### 49 *Public and Patient Involvement*

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51 Participants' feedback on the transcripts or the summarised final findings was not sought,  
52 however, the process of developing subthemes and themes was discussed at a Patient and  
53 Public Involvement meeting. The purpose of the meeting was to inform the research of  
54 patient and service user perspectives. The meeting was attended by six PPI members  
55 including four women and two men of diverse ages. The preliminary findings were  
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3 presented, and members were invited to discuss emerging themes and to review selected  
4 quotes from the interview transcripts for relevance. Feedback included comments on patient  
5 expectations, patient pressure for antibiotics, trust and communication with GPs leading to  
6 additional interpretation.  
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## 11 12 13 **RESULTS**

14 We recruited 30 participants from 10 general practices (Table 2. Characteristics of the  
15 participants), including 23 general practitioners, 5 nurses and 2 pharmacists. The interviews  
16 lasted between 24 minutes and 46 minutes. General practitioners', nurses' and pharmacists'  
17 responses were analysed as a single group because of the many commonalities and smaller  
18 number of non-medical respondents. We found there were no discernible differences in  
19 participants' accounts between the shire town and metropolitan settings. Overall, three  
20 participants expressed an overt avoidance of antibiotics, three others acknowledged over-  
21 prescribing, whilst most prescribers leaned towards reduced prescribing. We distinguished  
22 three major themes from the data: risk assessment; balancing treatment risks; and  
23 negotiating decisions and risks (Table 3).  
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### 39 **Theme 1. Risk assessment**

#### 40 41 **1.1. Identifying treatment thresholds**

42 The primary focus of diagnostic decision-making for participants was concerned with  
43 identifying major indications for antibiotic treatment. These were judged to include the nature  
44 and severity of illness based on presentation of symptoms and signs, in the context of the  
45 patient's medical history. A majority of participants adopted a risk stratification approach in  
46 undertaking clinical assessment.  
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54 *'It's a combination of things... For example, for an upper respiratory tract infection,*  
55 *tonsillitis, pharyngitis, you know, there's a Centor guidance. So that's where you have*  
56 *a checklist of things. Does this person have cervical lymphadenopathy? Do they*  
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3 *have a fever? Do they have like absence of a cough, you know. Do they have*  
4 *exudate on their tonsil? So, then if you have a score of 3 or more then they have*  
5 *antibiotics.’ (Int 1, GP).*  
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11 Risk stratification approaches included additional patient factors such as patient age and the  
12 presence of comorbidities including COPD, asthma, diabetes, cancer or a history of  
13 pneumonia. Whereas many followed risk assessment protocols based explicitly on local or  
14 national clinical guidelines, some participants stressed the importance of clinical judgement  
15 in making safety-driven decisions.  
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23 *“You don’t want to miss something very serious. So, that’s where your clinical*  
24 *judgement and decision-making skills play a major role. And experience, obviously,*  
25 *because these are things I deal with every day”.* (Int 14, Nurse)  
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30 Threshold-guided decision-making spanned the continuum from ‘I am prescribing’ to ‘I am  
31 not prescribing’. Diagnostic uncertainty was part and parcel of the threshold-guided decision-  
32 making: prescribers pointed to the difference between more and less obvious cases,  
33 characterised by equivocal, ambiguous and non-convincing evidence. One participant  
34 contrasted several hypothetical scenarios:  
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40 *‘...a patient with COPD, bronchiectasis, I may have a lower threshold for treating*  
41 *than a very fit and well 20-year-old, even if that 20-year-old had a productive cough*  
42 *with green sputum, their chest is clear, I’m not likely to give them antibiotics. Well*  
43 *they’re not feverish, whereas if they’re an 80 something with a history of COPD then*  
44 *I’d have a lower threshold for starting antibiotics because they’re likely to have less*  
45 *reserve and more likely to have complications from an infection’* (Int 20, GP).  
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### 53 **1.2. Confidence in prescribing**

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56 Appropriate prescribing and not just a reduction in antibiotics emerged as a priority for  
57 participants, who reflected on their own performance from different perspectives. In general,  
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3 participants reported a high level of confidence in prescribing but also noted occasional  
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5 limitations:

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8 *"I feel confident but that doesn't mean necessarily that I think I'm making the right*  
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10 *decision in every case. Sometimes when I'm making perhaps the wrong decision, I'm*  
11 *making that maybe because of patient pressure or because of my unwillingness to*  
12 *tolerate risk". (Int 22, GP).*  
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19 Many participants acknowledged changes towards less prescribing over the last few years:

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21 *"I prescribe less because I guess we're more aware now of drug resistance than we*  
22 *were 5 years ago. It's much more talked about and we're seeing it more. But also, I'm*  
23 *now more confident in having that difficult discussion with the patient". (Int 5, GP)*  
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## 31 **Theme 2. Balancing treatment risks**

### 32 **2.1. Risks of prescribing and non-prescribing**

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36 Seven participants explicitly identified safety as a priority in infection management. All  
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38 participants demonstrated vigilance to risks arising both from prescribing antibiotics and not  
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40 prescribing. The fear was expressed of 'missing something' that could cause deterioration  
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42 and consequently, participants admitted 'being cautious' and favoured prescribing  
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44 antibiotics. At the same time, the common concern was also the avoidance of prescribing  
45  
46 unnecessarily. Among the risks of prescribing, several side effects were reported, most  
47  
48 commonly, gastrointestinal upsets, nausea, Clostridium difficile infection and thrush but also  
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50 allergic, anaphylactic reactions, antibiotic resistance, and less common side effects such as  
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52 liver problems (failure). Participants also observed long-term adverse consequences of  
53  
54 inappropriate prescribing:  
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57 *"I think, certainly for children, I think if you prescribe antibiotics and they don't need*  
58 *them and then they have a rash because they've got a virus and then a penicillin*  
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3 *allergy on their notes for the rest of their lives... I think another consequence is that if*  
4 *you prescribe inappropriately, it's very difficult for another healthcare professional,*  
5 *down the line, to explain to that patient, you're almost saying the other person was*  
6 *wrong". (Int 15, Nurse)*  
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13 Risks of non-prescribing generated a shorter list with sepsis being the most concerning  
14 consequence.  
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18 *"Sepsis...that's one thing I do worry about. If I see someone who's got a high*  
19 *temperature and a high heart rate... then I think about those factors and I think*  
20 *actually if this was in my clinical judgement – if I left this for 2 days, then I think they*  
21 *would be crossing that line" (Int 26, GP).*  
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30 Three prescribers who acknowledged the tendency to overprescribe, did so, in one case,  
31 because they assessed antibiotics' benefits to exceed harms and in two cases because of  
32 potential litigation following a missed serious bacterial infection:  
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37 *"Because medico-legally you're much more likely to be brought up on missing*  
38 *something and not prescribing antibiotics than giving antibiotics when it wasn't*  
39 *necessary... if there's any uncertainty about prescribing antibiotics I would always err*  
40 *on the side of giving them because the risk, however small of missing an infection*  
41 *that then gets worse would be enough for me to give antibiotics". (Int 19, GP)*  
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## 50 **2.2. Facing antimicrobial resistance**

51 Participants shared concern for the global rise in antimicrobial resistance. At the same time,  
52 they acknowledged lacking in-depth microbiological knowledge: *"we talk more about not*  
53 *prescribing and prescribing correctly than resistance itself" (Int 9, Pharmacist).* Meanwhile,  
54 they had to deal with the consequences of the antimicrobial resistance in their daily practice:  
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3 *"I've had a few patients that have had MRSA [Methicillin-resistant Staphylococcus*  
4 *aureus]. I've had a few people who have had PVL [Panton-Valentine leukocidin form*  
5 *of MRSA] infections, skin infections with multiple resistance... So we can sometimes*  
6 *struggle to find an antibiotic that's oral, that's then suitable. I've got a Type 1 diabetic,*  
7 *young lady, who has very poorly controlled diabetes and recurrent boils and*  
8 *abscesses on her back. And we did a swab of that and yes, there was only one oral*  
9 *antibiotic that was sensitive - everything else was resistant". (Int 23, GP)*

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18 antimicrobial resistance was most commonly encountered in older women with urinary tract  
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20 infections:

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22 *'I think sometimes you do see, for example, in the UTI breakdown, some people have*  
23 *quite resistant UTIs and that becomes difficult'. (Int 15, Nurse)*

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26 *'I've been a GP for about 10 years and you've already seen that certain antibiotics just*  
27 *aren't working anymore, and we need to change the way that we're doing things and*  
28 *you know we used to give trimethoprim locally first line for UTIs. Resistant in the*  
29 *majority of cases. So, we're giving nitrofurantoin'. (Int 10, GP)*

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35 There was mention of difficulties in conveying information about resistance to patients –  
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37 discussing it in the encounters and emphasising community impact may have been less  
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39 efficient than focussing on individual risks. There was also a worry that primary care is  
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41 running out of antibiotics despite the strategies of second- and third-line antibiotics:

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43 *"They [patients] literally cannot have any, they've got an E. coli infection that's not*  
44 *sensitive to amoxicillin or nitrofurantoin or trimethoprim or even cefalexin or the cipro.*  
45 *It's just like literally multiply-resistant. And there's some quite virulent, my*  
46 *understanding is it is strains of bacteria where antibiotics will not work. And then you*  
47 *kind of get to the hard-core ones'. (Int 11, GP)*

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56 In such cases of failure of several course of antibiotics, referral to secondary care, possibly  
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58 for intravenous therapy were reported as the only options. Other times, where the resistant  
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60 organism could be tackled in primary care, the last resort was a longer course or long-term

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3 prophylactic antibiotics. More investigations and consultations with microbiologists about  
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5 unresolved infections appeared to precede these decisions.  
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### 9 **Theme 3. Negotiating decisions and risks**

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#### 13 **3.1. Managing patient expectations**

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15  
16 Participants identified patient pressure as a factor in their decision-making but they shared  
17  
18 the view that patients differ in terms of their expectations regarding antibiotics. On the one  
19  
20 hand, increased knowledge of the appropriate indications for antibiotic therapy (not for  
21  
22 viruses) and understanding of antimicrobial resistance from public health and media  
23  
24 campaigns was noted. On the other hand, patient pressure in a form of implicit expectations  
25  
26 or explicit demands remained frequent: readily prescribed in the past, antibiotics had a  
27  
28 profile of immediate cure in large parts of patient population:  
29

30  
31 *“... so many people have been mis-prescribed antibiotics in the past that I think*  
32  
33 *they just won't believe you that they don't need them” (Int 25).*  
34

35  
36 A GP summarised this ambivalence:  
37

38  
39 *“There's a reasonable cohort now who come in and say they don't want them*  
40  
41 *[antibiotics]. They've read, they're educated, they know that they're contributing*  
42  
43 *potentially to resistance and they don't want to risk the side effects. But there's also a*  
44  
45 *large cohort still who come in and say, “My cough's gone to my chest, I need*  
46  
47 *antibiotics.” So, it's trying to often you know, get through those barriers and explain to*  
48  
49 *them that their chest is clear.” (Int 10, GP)*  
50

51  
52 Eliciting expectations, educating patients, and delayed prescription were the key strategies  
53  
54 for managing patient expectations. Explaining assessment results and positive language  
55  
56 were deemed important for the success of the consultation; several participants preferred  
57  
58 the time-saving mode of giving out written information about the expected length of illness  
59  
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3 (for example, about the duration of sinusitis with and without antibiotics) and about side  
4 effects of antibiotics. Elicitation of expectations included asking patients: “*What were you*  
5 *hoping for when you came in today?*” (Int 26, GP). Delayed prescriptions were used by all  
6  
7  
8 but three of the participants interviewed. This was considered as a form of partnership, of  
9  
10  
11 shared decision-making between the clinician and the patient:  
12

13  
14 *“... that helps patients because at least psychologically they have got an antibiotic, but*  
15 *they know they can't use it straightaway”.* (Int 25, GP)  
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### 23 **3.2. Communicating risks**

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25 As above, participants demonstrated that the commitment to reduced prescribing was  
26  
27 dependent on patient understanding of the need for antibiotics. This meant that at times  
28  
29 building and maintaining relationships were prioritised and led to prescribing decisions, as an  
30  
31 interviewee reported:  
32

33  
34 *“Much of my job is trying to build a rapport with someone and build a rapport so that*  
35 *we can have a conversation that's therapeutic. If someone has come in adamant that*  
36 *they want antibiotics there is some conversation to be had there. Why did you get*  
37 *this idea from? What is it that you believed this would do? And what is your previous*  
38 *experience? Now, if they're not willing to go into that today, I may actually give them*  
39 *a short course of antibiotics with the understanding that we have another*  
40 *conversation. This is a way of building some trust”* (Int 29, GP).  
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50  
51 The participants differed in terms of how they dealt with risk in encounters with patients:  
52  
53 some were liberal prescribers who tended to avoid complaints and patient frustration, others  
54  
55 preferred having difficult conversations on non-antibiotics' course of actions. Among liberal  
56  
57 prescribers, there was the notion of offering antibiotics in order to be safe. In the case of  
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3 non-prescribing, prescribers sometimes delved into lengthy explanations in order to secure  
4 patient adherence:  
5

6  
7 *‘When I’m explaining that there’s no sign of bacterial infection and we don’t want to*  
8 *give you antibiotics if we don’t need to. Most people go, “Oh yes, yes, no, of course*  
9 *not.” But some people might say, “Oh, well, you know.” Then I will go into the*  
10 *reasons why, you know. “Well actually you might get side effects, you know, it can*  
11 *make you, give you diarrhoea, it can give you thrush. And things can become*  
12 *resistant to it and it won’t be helpful for you in the future.” (Int 30, GP)*  
13  
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20 Advice on possible warning signs: ‘safety netting’ emerged as a dominant risk reduction  
21 strategy:  
22

23  
24 *“I will give them [patients] an awful lot of safety-netting, and tell them what, “If this*  
25 *doesn’t get better, this is when you come back.” You know, or “These are the signs of*  
26 *you getting worse,” or what they do if they are getting worse”. (Int 16, GP)*  
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## 35 **DISCUSSION**

### 36 **Main findings in comparison with previous research**

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41 The study describes primary care prescribers’ perceptions of safety and associated trade-  
42 offs in the context of reduced antibiotic prescribing. We identify three key themes with  
43 relevance to safety: risk assessment, balancing treatment risks, and negotiating decisions  
44 and risks. These accounts from primary care demonstrated variations in prescribers’  
45 approaches to decision-making behaviour, including perceptions of risks associated with  
46 prescribing or not prescribing antibiotics and in the communication of these decisions and  
47 risks to patients.  
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58 Decision-making for appropriate antibiotic prescribing was informed by safety  
59 considerations. Guideline-concordant risk assessment was generally preferred to tacit  
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3 clinical judgement based on informal heuristics in line with previous research (38)  
4  
5 Confidence in prescribing can be contrasted with views that accentuate diagnostic  
6  
7 uncertainty. (4, 17) In complex or uncertain cases, resolution was usually in favour of  
8  
9 antibiotic prescribing, but this was in the context of a secular shift to generally more  
10  
11 restrictive antibiotic prescribing behaviour. The reduction imperative co-exists with liberal  
12  
13 prescribing, which was influenced by low tolerance of risks and patient pressures. This  
14  
15 corresponds with extant literature that identifies the co-existence of different prescribing  
16  
17 behaviours including antibiotic compromising, antibiotic delaying and antibiotic withholding.  
18  
19  
20 (24)

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23  
24 Safety trade-offs emerged from the respondents' perceptions of risk by lending support to  
25  
26 recent qualitative research, which reported the complexity of balancing risks of antibiotic  
27  
28 prescribing in hospitals. (39) In addition to anticipated benefits, respondents identified  
29  
30 multiple risks associated with either prescribing or not prescribing antibiotics, so that the  
31  
32 immediate and long-term adverse effects of prescribing, including antimicrobial resistance,  
33  
34 were weighed against potential complications of non-prescribing such as sepsis. These  
35  
36 untoward consequences rendered risk a double-edge sword. In the theory of social systems,  
37  
38 such a conundrum can be described by the distinction *risk/danger*, rather than *risk/safety*  
39  
40 because there is no absolute safety in prescribing decisions, hence the other side of risk  
41  
42 remains danger not safety. (40, 41) From Luhmann's (40) perspective, some distinctions are  
43  
44 two-sided forms of 'second-order' observations, where one side is actualised at any given  
45  
46 moment, but both sides may have equal relevance to the situation. Risk/danger represents  
47  
48 such a form which exemplifies the contingency associated with seemingly binary choices,  
49  
50 but which in itself represents actuality versus potentiality. According to this perspective,  
51  
52 safety experts are 'first-order' observers who may not account for the mutuality of  
53  
54 contingency because the other side is always present on the background. Boiko et al (41)  
55  
56 applied this understanding to the analysis of clinical risks associated with anticoagulant  
57  
58 prophylaxis, where risks of thrombosis were complemented by dangers of contraindications  
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3 (e.g. bleeding). In our situation of antibiotic prescribing, the 'risk' side is associated with  
4 prescribing potentially resulting in antimicrobial resistance and side effects, whilst the other  
5 side (danger) can be actualised if non-prescribing is chosen and can become the actual risk  
6 through complications such as sepsis. We found variation in how the prescribers perceived  
7 this duality, with the safety argument contributing in both directions: prescribing and non-  
8 prescribing. In other words, professionals' acting on 'doing something' were juxtaposed  
9 against 'doing no harm' concerns. The participants were able to distinguish between short-  
10 term (e.g. side effects) and long-term (e.g. antimicrobial resistance, effect on doctor-patient  
11 relationship) trade-offs of prescribing. antimicrobial resistance was generally viewed as a  
12 standalone long-term adversity now being encountered in daily practice; it is gaining in  
13 prominence in contrast to findings from the earlier qualitative studies (42, 43) and now has a  
14 more personalised relevance and clinical significance than some recent reviews suggested.  
15  
16 (44)

17  
18 Respondents negotiated safety in dealing with patients by rendering medical decision-  
19 making more explicitly during consultations. Patient expectations were found to be changing  
20 and so were the strategies employed in managing them. There was an emerging consensus  
21 on strategies to reduce antibiotic prescribing including patient education, improved self-  
22 management advice and delayed prescribing, supported by patient-centred communication  
23 emphasised in the other literature too. (45) At the same time, our study showed  
24 communication was primarily centred on warning signs, and on maintaining a clinician-  
25 patient relationship, rather than on the discussion of risks and benefits with patients. This is  
26 consistent with previous findings that explicit analysis of trade-offs is most often undertaken  
27 by physicians alone rather than as part of a dialogue with patients. (46) More explicit risk  
28 communication might become a focus of the consultations for (bacterial) infections.  
29  
30 Systematic review evidence suggests that shared decision-making reduces prescribing (47)  
31 and our study also found that both delayed prescribing (48-51) and safety-netting appeared  
32 as effective strategies of shared decision making.

## Strengths and limitations

The study provided a coherent analysis of the views of primary care prescribers drawing on the responses of participants working in rural and urban settings and including a sample that was diverse with respect to professional training and years of experience. The size of the sample may not have been sufficient to distinguish differences in approach between groups with different professional training, but this could be explored further in future studies. The study may possibly have reduced transferability to other settings beyond UK primary care or beyond high-income countries. Participants were necessarily informed of the nature and purpose of the research, consequently both their participation in the interview and the interview responses might have been influenced by research participation. It is possible that respondents who were less inclined to reduce antibiotic prescribing might have been less prepared to participate. Interview responses might have been inclined to give what they perceived as 'socially acceptable' responses. We employed a thematic analysis because this enables a flexible investigation of a complex topic without drawing on pre-existing theory. In order to reduce the possibility of inconsistency, we employed a systematic, staged approach to analysis and a sample of transcripts was repeat coded by a second analyst. A patient group was involved in the research, but we acknowledge that patient involvement contribution must be managed carefully to avoid introducing bias. The thematic analysis was completed by experienced qualitative researchers using participant data; PPI input did not in this case lead to any modification of themes identified. This paper should be read in conjunction with our companion study, which explored the views of patients as participants.(52)

## Implications for further research and practice

This study explored and characterised primary care prescribers' perceptions of safety issues and risk management strategies relevant to reduced antibiotic prescribing. The study offers insights into primary care prescribers' perceptions and as such it emphasises the safety

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3 perspective within the current debate on antibiotic prescribing and antimicrobial stewardship.  
4  
5 The study identified dilemmas that are recognisable in the course of daily primary care  
6  
7 practice and can form the basis for future improvement and antimicrobial stewardship  
8  
9 programs. Our research paves the way for a cross-sectional survey of risk perceptions. It  
10  
11 highlights the need for further development of risk stratification and risk communication tools  
12  
13 such as decision-making checklists and evidence-based support tools. It also stresses the  
14  
15 need for adequate training on antimicrobial resistance and reducing of antibiotics (such as  
16  
17 GRACE-INTRO and REDUCE). (53, 54) . Safety netting had a strong presence in the  
18  
19 interviews, however, as such is under-researched and requires further exploration. Our  
20  
21 findings support the argument (31) that prescribers need more time to discuss the benefit-  
22  
23 harm trade-off within shared decision making as this may help to  
24  
25 reduce antibiotic prescribing in primary care.  
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### 33 **CONCLUSIONS**

34 Attitudes towards antibiotic prescribing are changing and becoming more nuanced. There is  
35  
36 growing confidence in the capacity to reduce the rate of prescribing and to manage patient  
37  
38 expectations, which are themselves undergoing change. There is growing recognition that  
39  
40 there may be safety trade-offs associated with antimicrobial stewardship and this is linked to  
41  
42 concerns about sepsis and other serious bacterial infections. There is a need to develop  
43  
44 better quantified estimates of risk that can inform clinical decision making and 'safety netting'  
45  
46 advice given to patients. This will require further development of risk stratification estimates,  
47  
48 as well as communication tools that enable these to be used in practice. Improved  
49  
50 management of risks and benefits will help to inform future antimicrobial stewardship efforts.  
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4 interview guide; MA and RF advised on the recruitment strategy and facilitated its  
5 implementation; OB conducted the analysis with support from CB; OB drafted the paper; all  
6 authors commented on and approved the paper.  
7  
8  
9  
10

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14  
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34 **Data availability statement:** The data that support the findings of this study are available  
35 from the corresponding author upon reasonable request.  
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## REFERENCES

1. Costelloe C, Metcalfe C, Lovering A, Mant D, Hay AD. Effect of antibiotic prescribing in primary care on antimicrobial resistance in individual patients: systematic review and meta-analysis. *BMJ (Clinical research ed)*. 2010;**340**:c2096.
2. Gulliford MC, Moore MV, Little P, Hay AD, Fox R, Prevost AT, et al. Safety of reduced antibiotic prescribing for self limiting respiratory tract infections in primary care: cohort study using electronic health records. *BMJ (Clinical research ed)*. 2016;**354**:i3410.
3. Shallcross LJ, Davies SC. The World Health Assembly resolution on antimicrobial resistance. *J Antimicrobial Chemother*. 2014;**69**(11):2883-5.
4. Tonkin-Crine S, Yardley L, Little P. Antibiotic prescribing for acute respiratory tract infections in primary care: a systematic review and meta-ethnography. *J Antimicrobial Chemother*. 2011;**66**(10):2215-23.
5. Teixeira Rodrigues A, Roque F, Falcão A, Figueiras A, Herdeiro MT. Understanding physician antibiotic prescribing behaviour: a systematic review of qualitative studies. *Int J Antimicrobial Agents*. 2013;**41**(3):203-12.
6. Krockow EM, Colman AM, Chattoe-Brown E, Jenkins DR, Perera N, Mehtar S, et al. Balancing the risks to individual and society: a systematic review and synthesis of qualitative research on antibiotic prescribing behaviour in hospitals. *J Hospital Infection* 2019;**101**(4):428-39.
7. Vincent C. *Patient safety*. London: Churchill Livingstone Elsevier; 2006.
8. Sun X, Gulliford M. Reducing antibiotic prescribing in primary care in England from 2014 to 2017: Population-based cohort study. *BMJ Open*. 2019; **9**: e023989. doi: 10.1136/bmjopen-2018-023989

- 1  
2  
3 9. Public Health England. *English Surveillance Programme for Antimicrobial Utilisation*  
4 *and Resistance (ESPAUR) Report 2018 – 2019*. London: Public Health England, 2019.  
5  
6  
7
- 8 10. Department of Health. *Tackling antimicrobial resistance 2019–2024. The UK's five-*  
9 *year national action plan*. London: Department of Health, 2019.  
10  
11  
12
- 13 11. Llor C, Bjerrum L. Antimicrobial resistance: risk associated with antibiotic overuse  
14 and initiatives to reduce the problem. *Ther Adv Drug Safety*. 2014;**5**(6):229-41.  
15  
16  
17
- 18 12. World Health Organization. *Global Action Plan on Antimicrobial Resistance*. Geneva:  
19 WHO, 2015.  
20  
21  
22
- 23 13. Shehab N, Patel PR, Srinivasan A, Budnitz DS. Emergency department visits for  
24 antibiotic-associated adverse events. *Clin Inf Dis* 2008;**47**(6):735-43.  
25  
26  
27
- 28 14. Roehr B. Antibiotics account for 19% of emergency department visits in US for  
29 adverse events. *BMJ (Clinical research ed)*. 2008;**337**:a1324.  
30  
31  
32
- 33 15. Petersen I, Johnson AM, Islam A, Duckworth G, Livermore DM, Hayward AC.  
34 Protective effect of antibiotics against serious complications of common respiratory tract  
35 infections: retrospective cohort study with the UK General Practice Research Database. *BMJ*  
36 *(Clinical research ed)*. 2007;**335**(7627):982.  
37  
38  
39
- 40 16. Vazquez-Lago JM, Lopez-Vazquez P, Lopez-Duran A, Taracido-Trunk M, Figueiras  
41 A. Attitudes of primary care physicians to the prescribing of antibiotics and antimicrobial  
42 resistance: a qualitative study from Spain. *Fam Pract*. 2012;**29**(3):352-60.  
43  
44  
45
- 46 17. Horwood J, Cabral C, Hay AD, Ingram J. Primary care clinician antibiotic prescribing  
47 decisions in consultations for children with RTIs: a qualitative interview study. *Br J Gen Pract*  
48 2016;**66**(644):e207-13.  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

- 1  
2  
3 18. Broom A, Broom J, Kirby E. Cultures of resistance? A Bourdieusian analysis of  
4 doctors' antibiotic prescribing. *Soc Sci Med* 2014;**110**:81-8.  
5  
6  
7  
8 19. Livorsi D, Comer A, Matthias MS, Perencevich EN, Bair MJ. Factors Influencing  
9 Antibiotic-Prescribing Decisions Among Inpatient Physicians: A Qualitative Investigation.  
10 *Infection control and hospital epidemiology*. 2015;**36**(9):1065-72.  
11  
12  
13 20. Klein EY, Martinez EM, May L, Saheed M, Reyna V, Broniatowski DA. Categorical  
14 Risk Perception Drives Variability in Antibiotic Prescribing in the Emergency Department: A  
15 Mixed Methods Observational Study. *J Gen Int Medicine*. 2017;**32**(10):1083-9.  
16  
17  
18 21. Broniatowski DA, Klein EY, May L, Martinez EM, Ware C, Reyna VF. Patients' and  
19 Clinicians' Perceptions of Antibiotic Prescribing for Upper Respiratory Infections in the Acute  
20 Care Setting. *Medical Decision Making* 2018;**38**(5):547-61.  
21  
22  
23 22. Yates TD, Davis ME, Taylor YJ, Davidson L, Connor CD, Buehler K, et al. Not a  
24 magic pill: a qualitative exploration of provider perspectives on antibiotic prescribing in the  
25 outpatient setting. *BMC Family Practice*. 2018;**19**(1):96.  
26  
27  
28 23. Coenen S, Francis N, Kelly M, Hood K, Nuttall J, Little P, et al. Are patient views  
29 about antibiotics related to clinician perceptions, management and outcome? A multi-country  
30 study in outpatients with acute cough. *PloS One*. 2013;**8**(10):e76691.  
31  
32  
33 24. Fletcher-Lartey S, Yee M, Gaarslev C, Khan R. Why do general practitioners  
34 prescribe antibiotics for upper respiratory tract infections to meet patient expectations: a  
35 mixed methods study. *BMJ Open*. 2016;**6**(10):e012244.  
36  
37  
38 25. Lum EPM, Page K, Whitty JA, Doust J, Graves N. Antibiotic prescribing in primary  
39 healthcare: Dominant factors and trade-offs in decision-making. *Infection, Disease & Health*.  
40 2018;**23**(2):74-86.  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



- 1  
2  
3 26. Mustafa M, Wood F, Butler CC, Elwyn G. Managing expectations of antibiotics for  
4 upper respiratory tract infections: a qualitative study. *Ann Fam Med*. 2014;**12**(1):29-36.  
5  
6  
7  
8 27. Altiner A, Knauf A, Moebes J, Sielk M, Wilm S. Acute cough: a qualitative analysis of  
9 how GPs manage the consultation when patients explicitly or implicitly expect antibiotic  
10 prescriptions. *Family Practice*. 2004;**21**(5):500-6.  
11  
12  
13  
14  
15 28. Butler CC, Kinnersley P, Prout H, Rollnick S, Edwards A, Elwyn G. Antibiotics and  
16 shared decision-making in primary care. *J Antimicrobial Chemother* 2001;**48**(3):435-40.  
17  
18  
19  
20 29. Welschen I, Kuyvenhoven M, Hoes A, Verheij T. Antibiotics for acute respiratory tract  
21 symptoms: patients' expectations, GPs' management and patient satisfaction. *Family*  
22 *Practice*. 2004;**21**(3):234-7.  
23  
24  
25  
26  
27  
28 30. Legare F, Labrecque M, Cauchon M, Castel J, Turcotte S, Grimshaw J. Training  
29 family physicians in shared decision-making to reduce the overuse of antibiotics in acute  
30 respiratory infections: a cluster randomized trial. *CMAJ* 2012;**184**(13):E726-34.  
31  
32  
33  
34  
35 31. Coxeter P, Del Mar CB, McGregor L, Beller EM, Hoffmann TC. Interventions to  
36 facilitate shared decision making to address antibiotic use for acute respiratory infections in  
37 primary care. *Cochrane Database Syst Rev* 2015(11):Cd010907.  
38  
39  
40  
41  
42 32. Hart AM, Pepper GA, Gonzales R. Balancing acts: deciding for or against antibiotics  
43 in acute respiratory infections. *J Fam Pract*. 2006;**55**(4):320-5.  
44  
45  
46  
47  
48 33. Michie S, Johnston M, Abraham C, Lawton R, Parker D, Walker A. Making  
49 psychological theory useful for implementing evidence based practice: a consensus  
50 approach. *Quality and Safety in Health Care*. 2005;**14**(1):26-33.  
51  
52  
53  
54  
55 34. Lorencatto F, Charani E, Sevdalis N, Tarrant C, Davey P. Driving sustainable change  
56 in antimicrobial prescribing practice: how can social and behavioural sciences help? *J*  
57 *Antimicrobial Chemother*. 2018;**73**(10):2613-24.  
58  
59  
60

- 1  
2  
3 35. Atkins L, Francis J, Islam R, O'Connor D, Patey A, Ivers N, et al. A guide to using the  
4 Theoretical Domains Framework of behaviour change to investigate implementation  
5 problems. *Implementation Science*. 2017;**12**(1):77.  
6  
7  
8  
9  
10 36. Malterud K, Siersma VD, Guassora AD. Sample Size in Qualitative Interview  
11 Studies: Guided by Information Power. *Qualitative Health Research*. 2016;**26**(13):1753-60.  
12  
13  
14  
15 37. Braun V, Clarke V. Using thematic analysis in psychology. *Qualitative Research in*  
16 *Psychology*. 2006;**3**(2):77-101.  
17  
18  
19  
20  
21 38. Biezen R, Roberts C, Buising K, Thursky K, Boyle D, Lau P, et al. How do general  
22 practitioners access guidelines and utilise electronic medical records to make clinical  
23 decisions on antibiotic use? Results from an Australian qualitative study. *BMJ Open*.  
24 2019;**9**(8):e028329.  
25  
26  
27  
28  
29  
30 39. Broom J, Broom A, Kirby E. The drivers of antimicrobial use across institutions,  
31 stakeholders and economic settings: a paradigm shift is required for effective optimization. *J*  
32 *Antimicrobial Chemother*. 2019;**74**(9):2803-9.  
33  
34  
35  
36  
37 40. Luhmann N. *Risk: a Sociological Theory*. New York: Routledge; 2002.  
38  
39  
40  
41 41. Boiko O, Sheaff R, Child S, Gericke CA. Risks, dangers and competing clinical  
42 decisions on venous thromboembolism prophylaxis in hospital care. *Sociology of health &*  
43 *illness*. 2014;**36**(6):932-47.  
44  
45  
46  
47  
48 42. Simpson SA, Wood F, Butler CC. General practitioners' perceptions of antimicrobial  
49 resistance: a qualitative study. *J Antimicrobial Chemother*. 2006;**59**(2):292-6.  
50  
51  
52  
53 43. Wood F, Phillips C, Brookes-Howell L, Hood K, Verheij T, Coenen S, et al. Primary  
54 care clinicians' perceptions of antibiotic resistance: a multi-country qualitative interview  
55 study. *J Antimicrobial Chemother*. 2012;**68**(1):237-43.  
56  
57  
58  
59  
60

- 1  
2  
3 44. McCullough AR, Rathbone J, Parekh S, Hoffmann TC, Del Mar CB. Not in my  
4  
5 backyard: a systematic review of clinicians' knowledge and beliefs about antibiotic  
6  
7 resistance. *J Antimicrobial Chemotherapy*. 2015;**70**(9):2465-73.  
8  
9  
10 45. O'Connor R, O'Doherty J, O'Regan A, Dunne C. Antibiotic use for acute respiratory  
11  
12 tract infections (ARTI) in primary care; what factors affect prescribing and why is it  
13  
14 important? A narrative review. *Irish J Med Sci*. 2018;**187**(4):969-86.  
15  
16  
17 46. Gregory R, Peters E, Slovic P. Making decisions about prescription drugs: A study of  
18  
19 doctor-patient communication. *Health, Risk & Society*. 2011;**13**(4):347-71.  
20  
21  
22 47. Tonkin-Crine SK, Tan PS, van Hecke O, Wang K, Roberts NW, McCullough A, et al.  
23  
24 Clinician-targeted interventions to influence antibiotic prescribing behaviour for acute  
25  
26 respiratory infections in primary care: an overview of systematic reviews. *Cochrane*  
27  
28 *Database Syst Rev* 2017;**9**:Cd012252.  
29  
30  
31 48. Arroll B, Kenealy T, Kerse N. Do delayed prescriptions reduce antibiotic use in  
32  
33 respiratory tract infections? A systematic review. *Br J Gen Pract* 2003;**53**(496):871-7.  
34  
35  
36 49. Marchetti F, Ronfani L, Nibali SC, Tamburlini G. Delayed Prescription May Reduce  
37  
38 the Use of Antibiotics for Acute Otitis Media: A Prospective Observational Study in Primary  
39  
40 Care. *JAMA Pediatrics*. 2005;**159**(7):679-84.  
41  
42  
43 50. Little P, Moore M, Kelly J, Williamson I, Leydon G, McDermott L, et al. Delayed  
44  
45 antibiotic prescribing strategies for respiratory tract infections in primary care: pragmatic,  
46  
47 factorial, randomised controlled trial. *BMJ* 2014;**348**:g1606.  
48  
49  
50 51. Ryves R, Eyles C, Moore M, McDermott L, Little P, Leydon GM. Understanding the  
51  
52 delayed prescribing of antibiotics for respiratory tract infection in primary care: a qualitative  
53  
54 analysis. *BMJ Open*. 2016;**6**(11):e011882.  
55  
56  
57  
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59  
60

1  
2  
3 52. Boiko, O, Gulliford, MC, Burgess, C. Revisiting patient expectations and experiences of  
4 antibiotics in an era of antimicrobial resistance: Qualitative study. *Health Expect.* 2020; 00:  
5 1– 9. <https://doi.org/10.1111/hex.13102>  
6  
7  
8

9  
10 53. Gulliford MC, Prevost AT, Charlton J, Juszczuk D, Soames J, McDermott L, et al.  
11 Effectiveness and safety of electronically delivered prescribing feedback and decision  
12 support on antibiotic use for respiratory illness in primary care: REDUCE cluster randomised  
13 trial. *BMJ* 2019;**364**:l236.  
14  
15  
16  
17

18  
19 54. Yardley L, Douglas E, Anthierens S, Tonkin-Crine S, O'Reilly G, Stuart B, et al.  
20 Evaluation of a web-based intervention to reduce antibiotic prescribing for LRTI in six  
21 European countries: quantitative process analysis of the GRACE/INTRO randomised  
22 controlled trial. *Implementation Sci.* 2013;**8**(1):134.  
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**Table 1. Interview guide.**

1	What are the indications for AB treatment?
2	
3	To what extent do NICE (or local) guidelines influence your AM prescribing?
4	
5	What are the risks of AB prescribing and non-prescribing?
6	
7	How do you differentiate between infections and patients?
8	
9	What are the common myths or stereotypes about antibiotics?
10	
11	Can you give me an example illustrating the inaccurate understanding of their purpose, mechanisms
12	of action, risks and consequences?
13	
14	In your view, is there the best way to elicit and manage patient expectations regarding antibiotics?
15	
16	How would you communicate the risks associated with both prescribing and non-prescribing
17	antibiotics?
18	
19	How confident are you in decision-making around AB prescribing?
20	
21	Would you assess your approach to AB prescribing as always adequate and if so, what makes you
22	think that?
23	
24	Could you describe consequences of inappropriate treatment for infections?
25	
26	What would be/were your actions following unresolved or repeated infections?
27	
28	What is your understanding of antimicrobial resistance?
29	
30	What are your goals and priorities in infection management?
31	
32	Are there any social norms or group pressures that affect your professional practice with regards to AB
33	prescribing and how?
34	
35	Has your prescribing practice for antibiotics changed over the recent years?
36	
37	Do you think patient expectations of AB treatment have changed over the recent years?
38	
39	Are you aware of the prescribing practice of other HCPs (your colleagues) in relation to antibiotics?
40	
41	Have you ever had to challenge their prescribing decisions?
42	
43	Has anyone challenged your own decisions?
44	
45	How hopeful are you usually that the AB treatment is the best course of action?
46	
47	Is it possible to assess both the short- and long-term impact of AB treatment on the patients?
48	
49	What is your decision-making strategy?
50	
51	How anxious do you feel about the uncertainty around prescribing?
52	
53	Which resources do you use to support your decisions on AB prescribing?
54	
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**Table 2: Characteristics of participants. Figures are frequencies.**

<b>Characteristic</b>	<b>Variable</b>	<b>Number</b>
<b>Gender</b>	Male	8
	Female	22
<b>Location</b>	Metropolitan	21
	Shire town	9
<b>Occupation</b>	GPs	23
	Nurse prescriber	5
	Pharmacist	2
<b>Years of practice</b>	<10	16
	10-20	10
	>20	4

**Table 3: Summary of main themes and sub-themes.**

Theme	Sub-themes
<b>Theme 1. Risk assessment</b>	Identifying treatment thresholds Confidence in prescribing
<b>Theme 2. Balancing treatment risks</b>	Risks of prescribing and non-prescribing Facing antimicrobial resistance
<b>Theme 3. Negotiating decisions and risks</b>	Managing patient expectations Communicating risks

For peer review only

**Table 1** Consolidated criteria for reporting qualitative studies (COREQ): 32-item checklist

No	Item	Guide questions/description
<b>Domain 1: Research team and reflexivity</b>		
Personal Characteristics		
1.	Interviewer/facilitator	Which author/s conducted the interview or focus group? <b>P6</b>
2.	Credentials	What were the researcher's credentials? <i>E.g. PhD, MD</i> <b>P6</b>
3.	Occupation	What was their occupation at the time of the study? <b>P6</b>
4.	Gender	Was the researcher male or female? <b>P1</b>
5.	Experience and training	What experience or training did the researcher have? <b>P6</b>
Relationship with participants		
6.	Relationship established	Was a relationship established prior to study commencement? <b>P7</b>
7.	Participant knowledge of the interviewer	What did the participants know about the researcher? <i>e.g. personal goals, reasons for doing the research</i> <b>P7</b>
8.	Interviewer characteristics	What characteristics were reported about the interviewer/facilitator? <i>e.g. Bias, assumptions, reasons and interests in the research topic</i> <b>P7</b>
<b>Domain 2: study design</b>		



No	Item	Guide questions/description
	Theoretical framework	
9.	Methodological orientation and Theory	What methodological orientation was stated to underpin the study? <i>e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis</i> <b>P7</b>
	Participant selection	
10.	Sampling	How were participants selected? <i>e.g. purposive, convenience, consecutive, snowball</i> <b>P7</b>
11.	Method of approach	How were participants approached? <i>e.g. face-to-face, telephone, mail, email</i> <b>P7</b>
12.	Sample size	How many participants were in the study? <b>P7</b>
13.	Non-participation	How many people refused to participate or dropped out? Reasons? <b>P7</b>
	Setting	
14.	Setting of data collection	Where was the data collected? <i>e.g. home, clinic, workplace</i> <b>P6</b>
15.	Presence of non-participants	Was anyone else present besides the participants and researchers? <b>P6</b>
16.	Description of sample	What are the important characteristics of the sample? <i>e.g. demographic data, date</i> <b>Table 2</b>
	Data collection	

No	Item	Guide questions/description
17.	Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested? <b>Table 1 P6</b>
18.	Repeat interviews	Were repeat interviews carried out? If yes, how many? <b>N/A</b>
19.	Audio/visual recording	Did the research use audio or visual recording to collect the data? <b>P7</b>
20.	Field notes	Were field notes made during and/or after the interview or focus group? <b>P7</b>
21.	Duration	What was the duration of the interviews or focus group? <b>P8</b>
22.	Data saturation	Was data saturation discussed? <b>P7</b>
23.	Transcripts returned	Were transcripts returned to participants for comment and/or correction? <b>N/A</b>
<b>Domain 3: analysis and findingsz</b>		
Data analysis		
24.	Number of data coders	How many data coders coded the data? <b>P7</b>
25.	Description of the coding tree	Did authors provide a description of the coding tree? <b>P7</b>
26.	Derivation of themes	Were themes identified in advance or derived from the data? <b>P7</b>
27.	Software	What software, if applicable, was used to manage the data? <b>P7</b>

No	Item	Guide questions/description
28.	Participant checking	Did participants provide feedback on the findings? <b>N/A</b>
Reporting		
29.	Quotations presented	Were participant quotations presented to illustrate the themes / findings? Was each quotation identified? e.g. <i>participant number</i> <b>P8-P15</b>
30.	Data and findings consistent	Was there consistency between the data presented and the findings? <b>P8-P15</b>
31.	Clarity of major themes	Were major themes clearly presented in the findings? <b>P8-P15</b>
32.	Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes? <b>P8-P15</b>

# BMJ Open

## Risks of use and non-use of antibiotics in primary care. Qualitative study of prescribers' views

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**Risks of use and non-use of antibiotics in primary care.****Qualitative study of prescribers' views**

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**Short title: Risks of antibiotic use and non-use**

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	<b>Tables</b>	<b>3</b>
	<b>Figures</b>	<b>0</b>

## ABSTRACT

**Purpose:** The emergence of antimicrobial resistance has led to increasing efforts to reduce unnecessary use of antibiotics in primary care, but potential hazards from bacterial infection continue to cause concern. This study investigated how primary care prescribers perceive risk and safety concerns associated with reduced antibiotic prescribing.

**Methods:** Qualitative study using semi-structured interviews conducted with primary care prescribers from 10 general practices in an urban area and a shire town in England. A thematic analysis was conducted.

**Results:** Thirty participants were recruited, including 23 general practitioners, 5 nurses and 2 pharmacists. Three main themes were identified: risk assessment; balancing treatment risks; and negotiating decisions and risks. Respondents indicated that their decisions were grounded in clinical risk assessment, but this was informed by different approaches to antibiotic use, with most leaning towards reduced prescribing. Prescribers' perceptions of risk included the consequences of both inappropriate prescribing and inappropriate withholding of antibiotics. Sepsis was viewed as the most concerning potential outcome of non-prescribing, leading to possible patient harm and potential litigation. Risks of antibiotic prescribing included antibiotic resistant and *C. difficile* infections, as well as side effects, such as rashes, that might lead to possible mislabelling as antibiotic allergy. Prescribers elicited patient preferences for use or avoidance of antibiotics to inform management strategies, which included educational advice, advice on self-management including warning signs, use of delayed prescriptions, and safety netting.

**Conclusions:** Attitudes towards antibiotic prescribing are evolving, with reduced antibiotic prescribing now being approached more systematically. The safety trade-offs associated with either use or non-use of antibiotics present difficulties especially when prescribing decisions are inconsistent with patients' expectations.

**Key words:** primary care, antibiotics, infections, sepsis, safety, patient preferences

### Strengths and limitations of this study

- The sample of participants was diverse, including different groups of primary care prescribers drawn from urban and rural settings.
- The views of respondents who participated in the study may not be representative of non-participating practitioners.
- Participant responses may have been influenced by the interview setting
- Serious safety outcomes are infrequent and might not have been experienced by patients managed by participants in the study
- The study may have limited transferability beyond high-income countries.



## INTRODUCTION

Inappropriate antibiotic prescribing is widespread but may bring risks for individual (1, 2) and population health from drug side-effects as well as from growing antimicrobial resistance.

(3) Conversely, antibiotic avoidance may be associated with risks from serious bacterial infections that could be avoided through earlier treatment of infection episodes.(2) Many studies have provided insights into the reasons for inappropriate antibiotic prescribing and several syntheses have been published (4-6), but the safety gradient associated with reducing antibiotic prescribing has developed as a new and highly relevant area of research. In this paper, patient safety is understood as 'the avoidance, prevention and amelioration of adverse outcomes or injuries stemming from the process of healthcare'.(7) The risks associated with antibiotic prescribing decisions are a key element of patient safety and require in-depth analysis. This paper addresses the gap in knowledge about prescribers' perceptions of potential adverse outcomes associated with reduced antibiotic prescribing.

In the UK, primary care services account for nearly 80% of all medical antibiotic use but antibiotic utilisation in primary care has been declining in recent years and choice of antimicrobial agents has become more selective.(8, 9) A national target proposes a further reduction in antimicrobial use of 15% by 2024 (10) with antimicrobial resistance providing the rationale for the reduction in antibiotic prescribing. There were an estimated 60,788 antibiotic resistant infections in England in 2018 (9) resulting from infection with diverse bacterial pathogens, additionally super-infection with *Clostridium difficile* may cause illness. (11) The scale of antimicrobial resistance is increasing, especially across middle- and low-income countries. (12) Unnecessary exposure to antibiotics may also be associated with more immediate harms. As a result of prescribing in the community, antibiotic-associated adverse events including allergic reactions lead to many emergency visits with antibiotics accounting for up to 20% of hospital admissions from drug reactions in the US.(13, 14) On the other hand, withholding antibiotics might potentially carry risks and reduced antibiotic prescribing

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3 in general practice is associated with a small increase in complications such as treatable  
4 pneumonia and peritonsillar abscess.(2, 15)  
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9 The perceived priority of risks from either prescribing or not prescribing antibiotics requires a  
10 nuanced explanation within the broader realm of professionals' perceptions of safety and  
11 associated risk management. Fear of the risk of bacterial complications (5, 16) and  
12 prognostic uncertainty about potential outcomes when not prescribing (4, 17) are reportedly  
13 among key factors that influence the prescription of antibiotics. Among hospital doctors,  
14 there is evidence that overtreatment is preferred to the potential for adverse patient  
15 outcomes from not prescribing.(18, 19) Klein et al (20) and Broniatowski et al (21) for  
16 example, demonstrate that medical decision-making tends to favour views that favour  
17 prescription ('why take risks') rather than on prescription avoidance ('antibiotics can be  
18 harmful'). In primary care, general practitioners and other prescribers also deal with safety  
19 concerns in their decision-making, and a better understanding needs to be developed  
20 concerning the balance of risk between prescribing or non-prescribing of antibiotics.  
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37 Patient factors influencing decision-making on antibiotic prescribing include compliance with  
38 patient expectations and pressures. (16, 22-24) Reducing AB prescribing in primary care is  
39 therefore highly dependent on successful management of patient expectations (25-27) and  
40 on shared decision-making. (28-31) It is known that clinicians weigh individual best practice  
41 against perceived patient satisfaction so that complex trade-offs are enacted. (32) Therefore,  
42 of research interest is also how the issues of safety and risk information are communicated  
43 to patients.  
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54 In the present study we investigate how primary care prescribers perceive risk and safety  
55 concerns associated with reduced antibiotic prescribing.  
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## METHOD

### Study design

Semi-structured interviews were conducted with primary care prescribers including general practitioners, nurses and pharmacists in two English regions, one an urban metropolitan area and the other shire-town in England with a high demand for primary care services. The study was approved by London Hampstead Research Ethics Committee 18/LO/1874 and participants gave written informed consent to participation.

### Interviews

An interview guide was developed (Table 1), this was designed to address key elements of the substantive research topic; it was also loosely informed by elements of the Theoretical Domains Framework, which draws on behaviour change theory to understand factors influencing health care practice. (33-35) The interview guide was piloted with three GPs to ensure that the questions were appropriate, understandable and covered relevant prescribing behaviours. All interviews were conducted by the first author to ensure consistent quality. The interviewer has a PhD in medical sociology and is an experienced qualitative researcher. All interviews apart from one telephone interview were conducted face-to-face on general practice (n=26) and University (n=4) premises in the period January-July 2019. The participants were offered £60 to acknowledge their contribution.

### Recruitment of participants

Metropolitan practices were invited to the study by the local Clinical Research Network who generated the expression of interest. A shire-town high demand practice was recruited through informal Clinical Research Network contact who also helped in liaising with potential respondents. Potential participants were then approached either directly via email using the study information pack or indirectly via the practice manager or lead GP. The information pack included the invitation letter and study information sheet. A reminder was sent out two

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3 weeks after the initial approach to those who had not responded. A purposive sampling  
4 approach was followed: all participants were prescribers. Forty-nine primary care prescribers  
5 from 10 GP practices were invited and 30 agreed to take part. The sample size was  
6 determined using the pragmatic concept of 'information power' (36), taking into account the  
7 aim of the study, sample specificity, quality of dialogue, and analysis strategy. The uptake  
8 varied between practices (in 5 practices only a single participant was interviewed).  
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## 18 **Analysis**

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20 The interviews were digitally recorded, transcribed by a professional transcriber, imported to  
21 an NVivo-12 project and coded through an iterative six phased process described in  
22 thematic analysis.(37) Data analysis occurred iteratively and involved familiarisation, coding,  
23 theme searching, theme reviewing, theme defining and naming and producing the report.  
24 Repeated patterns in the data formed the basis for the codes, identified by the first author,  
25 and one single code for every different concept/idea was generated. To ensure that codes  
26 were applied consistently, a co-author (CB) independently coded a random sample of four  
27 interview transcripts. Coding was refined after discussion. Data identified by the same code  
28 was collated together and all different codes were sorted into potential subthemes and  
29 themes using NVivo options of tree building. Then, the potential themes were re-assessed  
30 and re-organised to reflect major narratives and themes in the coded data. Finally, the first,  
31 second and the last authors refined and named the themes and sub-themes.  
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## 50 *Public and Patient Involvement*

51 Participants' feedback on the transcripts or the summarised final findings was not sought,  
52 however, the process of developing subthemes and themes was discussed at a Patient and  
53 Public Involvement meeting. The purpose of the meeting was to inform the research of  
54 patient and service user perspectives. The meeting was attended by six PPI members  
55 including four women and two men of diverse ages. The preliminary findings were  
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3 presented, and members were invited to discuss emerging themes and to review selected  
4 quotes from the interview transcripts for relevance. Feedback included comments on patient  
5 expectations, patient pressure for antibiotics, trust and communication with GPs leading to  
6 additional interpretation.  
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## 11 12 13 **RESULTS**

14 We recruited 30 participants from 10 general practices (Table 2. Characteristics of the  
15 participants), including 23 general practitioners, 5 nurses and 2 pharmacists. The interviews  
16 lasted between 24 minutes and 46 minutes. General practitioners', nurses' and pharmacists'  
17 responses were analysed as a single group because of the many commonalities and smaller  
18 number of non-medical respondents. We found there were no discernible differences in  
19 participants' accounts between the shire town and metropolitan settings. Overall, three  
20 participants expressed an overt avoidance of antibiotics, three others acknowledged over-  
21 prescribing, whilst most prescribers leaned towards reduced prescribing. We distinguished  
22 three major themes from the data: risk assessment; balancing treatment risks; and  
23 negotiating decisions and risks (Table 3).  
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### 39 **Theme 1. Risk assessment**

#### 40 41 **1.1. Identifying treatment thresholds**

42 The primary focus of diagnostic decision-making for participants was concerned with  
43 identifying major indications for antibiotic treatment. These were judged to include the nature  
44 and severity of illness based on presentation of symptoms and signs, in the context of the  
45 patient's medical history. A majority of participants adopted a risk stratification approach in  
46 undertaking clinical assessment.  
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54 *'It's a combination of things... For example, for an upper respiratory tract infection,*  
55 *tonsillitis, pharyngitis, you know, there's a Centor guidance. So that's where you have*  
56 *a checklist of things. Does this person have cervical lymphadenopathy? Do they*  
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3 *have a fever? Do they have like absence of a cough, you know. Do they have*  
4 *exudate on their tonsil? So, then if you have a score of 3 or more then they have*  
5 *antibiotics.’ (Int 1, GP).*  
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11 Risk stratification approaches included additional patient factors such as patient age and the  
12 presence of comorbidities including COPD, asthma, diabetes, cancer or a history of  
13 pneumonia. Whereas many followed risk assessment protocols based explicitly on local or  
14 national clinical guidelines, some participants stressed the importance of clinical judgement  
15 in making safety-driven decisions.  
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23 *“You don’t want to miss something very serious. So, that’s where your clinical*  
24 *judgement and decision-making skills play a major role. And experience, obviously,*  
25 *because these are things I deal with every day”.* (Int 14, Nurse)  
26  
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29 Threshold-guided decision-making spanned the continuum from ‘I am prescribing’ to ‘I am  
30 not prescribing’. Diagnostic uncertainty was part and parcel of the threshold-guided decision-  
31 making: prescribers pointed to the difference between more and less obvious cases,  
32 characterised by equivocal, ambiguous and non-convincing evidence. One participant  
33 contrasted several hypothetical scenarios:  
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40 *‘...a patient with COPD, bronchiectasis, I may have a lower threshold for treating*  
41 *than a very fit and well 20-year-old, even if that 20-year-old had a productive cough*  
42 *with green sputum, their chest is clear, I’m not likely to give them antibiotics. Well*  
43 *they’re not feverish, whereas if they’re an 80 something with a history of COPD then*  
44 *I’d have a lower threshold for starting antibiotics because they’re likely to have less*  
45 *reserve and more likely to have complications from an infection’* (Int 20, GP).  
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### 53 **1.2. Confidence in prescribing**

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55 Appropriate prescribing and not just a reduction in antibiotics emerged as a priority for  
56 participants, who reflected on their own performance from different perspectives. In general,  
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3 participants reported a high level of confidence in prescribing but also noted occasional  
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5 limitations:

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8 *"I feel confident but that doesn't mean necessarily that I think I'm making the right*  
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10 *decision in every case. Sometimes when I'm making perhaps the wrong decision, I'm*  
11 *making that maybe because of patient pressure or because of my unwillingness to*  
12 *tolerate risk". (Int 22, GP).*  
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19 Many participants acknowledged changes towards less prescribing over the last few years:

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21 *"I prescribe less because I guess we're more aware now of drug resistance than we*  
22 *were 5 years ago. It's much more talked about and we're seeing it more. But also, I'm*  
23 *now more confident in having that difficult discussion with the patient". (Int 5, GP)*  
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## 31 **Theme 2. Balancing treatment risks**

### 32 **2.1. Risks of prescribing and non-prescribing**

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36 Seven participants explicitly identified safety as a priority in infection management. All  
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38 participants demonstrated vigilance to risks arising both from prescribing antibiotics and not  
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40 prescribing. The fear was expressed of 'missing something' that could cause deterioration  
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42 and consequently, participants admitted 'being cautious' and favoured prescribing  
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44 antibiotics. At the same time, the common concern was also the avoidance of prescribing  
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46 unnecessarily. Among the risks of prescribing, several side effects were reported, most  
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48 commonly, gastrointestinal upsets, nausea, Clostridium difficile infection and thrush but also  
49  
50 allergic, anaphylactic reactions, antibiotic resistance, and less common side effects such as  
51  
52 liver problems (failure). Participants also observed long-term adverse consequences of  
53  
54 inappropriate prescribing:  
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56  
57 *"I think, certainly for children, I think if you prescribe antibiotics and they don't need*  
58 *them and then they have a rash because they've got a virus and then a penicillin*  
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3 *allergy on their notes for the rest of their lives... I think another consequence is that if*  
4 *you prescribe inappropriately, it's very difficult for another healthcare professional,*  
5 *down the line, to explain to that patient, you're almost saying the other person was*  
6 *wrong". (Int 15, Nurse)*  
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12  
13 Risks of non-prescribing generated a shorter list with sepsis being the most concerning  
14 consequence.  
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17  
18 *"Sepsis...that's one thing I do worry about. If I see someone who's got a high*  
19 *temperature and a high heart rate... then I think about those factors and I think*  
20 *actually if this was in my clinical judgement – if I left this for 2 days, then I think they*  
21 *would be crossing that line" (Int 26, GP).*  
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28  
29 Three prescribers who acknowledged the tendency to overprescribe, did so, in one case,  
30 because they assessed antibiotics' benefits to exceed harms and in two cases because of  
31 potential litigation following a missed serious bacterial infection:  
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36  
37 *"Because medico-legally you're much more likely to be brought up on missing*  
38 *something and not prescribing antibiotics than giving antibiotics when it wasn't*  
39 *necessary... if there's any uncertainty about prescribing antibiotics I would always err*  
40 *on the side of giving them because the risk, however small of missing an infection*  
41 *that then gets worse would be enough for me to give antibiotics". (Int 19, GP)*  
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## 49 **2.2. Facing antimicrobial resistance**

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51 Participants shared concern for the global rise in antimicrobial resistance. At the same time,  
52 they acknowledged lacking in-depth microbiological knowledge: *"we talk more about not*  
53 *prescribing and prescribing correctly than resistance itself" (Int 9, Pharmacist).* Meanwhile,  
54 they had to deal with the consequences of the antimicrobial resistance in their daily practice:  
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3 *"I've had a few patients that have had MRSA [Methicillin-resistant Staphylococcus*  
4 *aureus]. I've had a few people who have had PVL [Panton-Valentine leukocidin form*  
5 *of MRSA] infections, skin infections with multiple resistance... So we can sometimes*  
6 *struggle to find an antibiotic that's oral, that's then suitable. I've got a Type 1 diabetic,*  
7 *young lady, who has very poorly controlled diabetes and recurrent boils and*  
8 *abscesses on her back. And we did a swab of that and yes, there was only one oral*  
9 *antibiotic that was sensitive - everything else was resistant". (Int 23, GP)*

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17  
18 antimicrobial resistance was most commonly encountered in older women with urinary tract  
19  
20 infections:

21  
22 *'I think sometimes you do see, for example, in the UTI breakdown, some people have*  
23 *quite resistant UTIs and that becomes difficult'. (Int 15, Nurse)*

24  
25  
26 *'I've been a GP for about 10 years and you've already seen that certain antibiotics just*  
27 *aren't working anymore, and we need to change the way that we're doing things and*  
28 *you know we used to give trimethoprim locally first line for UTIs. Resistant in the*  
29 *majority of cases. So, we're giving nitrofurantoin'. (Int 10, GP)*

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35 There was mention of difficulties in conveying information about resistance to patients –  
36  
37 discussing it in the encounters and emphasising community impact may have been less  
38  
39 efficient than focussing on individual risks. There was also a worry that primary care is  
40  
41 running out of antibiotics despite the strategies of second- and third-line antibiotics:

42  
43 *"They [patients] literally cannot have any, they've got an E. coli infection that's not*  
44 *sensitive to amoxicillin or nitrofurantoin or trimethoprim or even cefalexin or the cipro.*  
45 *It's just like literally multiply-resistant. And there's some quite virulent, my*  
46 *understanding is it is strains of bacteria where antibiotics will not work. And then you*  
47 *kind of get to the hard-core ones'. (Int 11, GP)*

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56 In such cases of failure of several course of antibiotics, referral to secondary care, possibly  
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58 for intravenous therapy were reported as the only options. Other times, where the resistant  
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60 organism could be tackled in primary care, the last resort was a longer course or long-term

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3 prophylactic antibiotics. More investigations and consultations with microbiologists about  
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5 unresolved infections appeared to precede these decisions.  
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### 9 **Theme 3. Negotiating decisions and risks**

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#### 13 **3.1. Managing patient expectations**

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15 Participants identified patient pressure as a factor in their decision-making but they shared  
16 the view that patients differ in terms of their expectations regarding antibiotics. On the one  
17 hand, increased knowledge of the appropriate indications for antibiotic therapy (not for  
18 viruses) and understanding of antimicrobial resistance from public health and media  
19 campaigns was noted. On the other hand, patient pressure in a form of implicit expectations  
20 or explicit demands remained frequent: readily prescribed in the past, antibiotics had a  
21 profile of immediate cure in large parts of patient population:  
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31 *“... so many people have been mis-prescribed antibiotics in the past that I think*  
32  
33 *they just won't believe you that they don't need them” (Int 25).*  
34

35  
36 A GP summarised this ambivalence:  
37

38  
39 *“There's a reasonable cohort now who come in and say they don't want them*  
40 *[antibiotics]. They've read, they're educated, they know that they're contributing*  
41 *potentially to resistance and they don't want to risk the side effects. But there's also a*  
42 *large cohort still who come in and say, “My cough's gone to my chest, I need*  
43 *antibiotics.” So, it's trying to often you know, get through those barriers and explain to*  
44 *them that their chest is clear.” (Int 10, GP)*  
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52 Eliciting expectations, educating patients, and delayed prescription were the key strategies  
53 for managing patient expectations. Explaining assessment results and positive language  
54 were deemed important for the success of the consultation; several participants preferred  
55 the time-saving mode of giving out written information about the expected length of illness  
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3 (for example, about the duration of sinusitis with and without antibiotics) and about side  
4 effects of antibiotics. Elicitation of expectations included asking patients: “*What were you*  
5 *hoping for when you came in today?*” (Int 26, GP). Delayed prescriptions were used by all  
6  
7  
8 but three of the participants interviewed. This was considered as a form of partnership, of  
9  
10  
11 shared decision-making between the clinician and the patient:  
12

13  
14 *“... that helps patients because at least psychologically they have got an antibiotic, but*  
15 *they know they can't use it straightaway”.* (Int 25, GP)  
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### 23 **3.2. Communicating risks**

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25 As above, participants demonstrated that the commitment to reduced prescribing was  
26  
27 dependent on patient understanding of the need for antibiotics. This meant that at times  
28  
29 building and maintaining relationships were prioritised and led to prescribing decisions, as an  
30  
31 interviewee reported:  
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33  
34 *“Much of my job is trying to build a rapport with someone and build a rapport so that*  
35 *we can have a conversation that's therapeutic. If someone has come in adamant that*  
36 *they want antibiotics there is some conversation to be had there. Why did you get*  
37 *this idea from? What is it that you believed this would do? And what is your previous*  
38 *experience? Now, if they're not willing to go into that today, I may actually give them*  
39 *a short course of antibiotics with the understanding that we have another*  
40 *conversation. This is a way of building some trust”* (Int 29, GP).  
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51 The participants differed in terms of how they dealt with risk in encounters with patients:  
52  
53 some were liberal prescribers who tended to avoid complaints and patient frustration, others  
54  
55 preferred having difficult conversations on non-antibiotics' course of actions. Among liberal  
56  
57 prescribers, there was the notion of offering antibiotics in order to be safe. In the case of  
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3 non-prescribing, prescribers sometimes delved into lengthy explanations in order to secure  
4  
5 patient adherence:  
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7 *‘When I’m explaining that there’s no sign of bacterial infection and we don’t want to*  
8 *give you antibiotics if we don’t need to. Most people go, “Oh yes, yes, no, of course*  
9 *not.” But some people might say, “Oh, well, you know.” Then I will go into the*  
10 *reasons why, you know. “Well actually you might get side effects, you know, it can*  
11 *make you, give you diarrhoea, it can give you thrush. And things can become*  
12 *resistant to it and it won’t be helpful for you in the future.” (Int 30, GP)*  
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20 Advice on possible warning signs: ‘safety netting’ emerged as a dominant risk reduction  
21  
22 strategy:  
23

24 *“I will give them [patients] an awful lot of safety-netting, and tell them what, “If this*  
25 *doesn’t get better, this is when you come back.” You know, or “These are the signs of*  
26 *you getting worse,” or what they do if they are getting worse”. (Int 16, GP)*  
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## 35 **DISCUSSION**

### 36 37 38 **Main findings in comparison with previous research**

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41 The study describes primary care prescribers’ perceptions of safety and associated trade-  
42 offs in the context of reduced antibiotic prescribing. We identify three key themes with  
43 relevance to safety: risk assessment, balancing treatment risks, and negotiating decisions  
44 and risks. These accounts from primary care demonstrated variations in prescribers’  
45 approaches to decision-making behaviour, including perceptions of risks associated with  
46 prescribing or not prescribing antibiotics and in the communication of these decisions and  
47 risks to patients.  
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57 Decision-making for appropriate antibiotic prescribing was informed by safety  
58 considerations. Guideline-concordant risk assessment was generally preferred to tacit  
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3 clinical judgement based on informal heuristics in line with previous research (38)  
4  
5 Confidence in prescribing can be contrasted with views that accentuate diagnostic  
6  
7 uncertainty. (4, 17) In complex or uncertain cases, resolution was usually in favour of  
8  
9 antibiotic prescribing, but this was in the context of a secular shift to generally more  
10  
11 restrictive antibiotic prescribing behaviour. The reduction imperative co-exists with liberal  
12  
13 prescribing, which was influenced by low tolerance of risks and patient pressures. This  
14  
15 corresponds with extant literature that identifies the co-existence of different prescribing  
16  
17 behaviours including antibiotic compromising, antibiotic delaying and antibiotic withholding.  
18  
19  
20 (24)  
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23

24 Safety trade-offs emerged from the respondents' perceptions of risk by lending support to  
25  
26 recent qualitative research, which reported the complexity of balancing risks of antibiotic  
27  
28 prescribing in hospitals. (39) In addition to anticipated benefits, respondents identified  
29  
30 multiple risks associated with either prescribing or not prescribing antibiotics, so that the  
31  
32 immediate and long-term adverse effects of prescribing, including antimicrobial resistance,  
33  
34 were weighed against potential complications of non-prescribing such as sepsis. These  
35  
36 untoward consequences rendered risk a double-edge sword. In the theory of social systems,  
37  
38 such a conundrum can be described by the distinction *risk/danger*, rather than *risk/safety*  
39  
40 because there is no absolute safety in prescribing decisions, hence the other side of risk  
41  
42 remains danger not safety. (40, 41) From Luhmann's (40) perspective, some distinctions are  
43  
44 two-sided forms of 'second-order' observations, where one side is actualised at any given  
45  
46 moment, but both sides may have equal relevance to the situation. Risk/danger represents  
47  
48 such a form which exemplifies the contingency associated with seemingly binary choices,  
49  
50 but which in itself represents actuality versus potentiality. According to this perspective,  
51  
52 safety experts are 'first-order' observers who may not account for the mutuality of  
53  
54 contingency because the other side is always present on the background. Boiko et al (41)  
55  
56 applied this understanding to the analysis of clinical risks associated with anticoagulant  
57  
58 prophylaxis, where risks of thrombosis were complemented by dangers of contraindications  
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3 (e.g. bleeding). In our situation of antibiotic prescribing, the 'risk' side is associated with  
4 prescribing potentially resulting in antimicrobial resistance and side effects, whilst the other  
5 side (danger) can be actualised if non-prescribing is chosen and can become the actual risk  
6 through complications such as sepsis. We found variation in how the prescribers perceived  
7 this duality, with the safety argument contributing in both directions: prescribing and non-  
8 prescribing. In other words, professionals' acting on 'doing something' were juxtaposed  
9 against 'doing no harm' concerns. The participants were able to distinguish between short-  
10 term (e.g. side effects) and long-term (e.g. antimicrobial resistance, effect on doctor-patient  
11 relationship) trade-offs of prescribing. antimicrobial resistance was generally viewed as a  
12 standalone long-term adversity now being encountered in daily practice; it is gaining in  
13 prominence in contrast to findings from the earlier qualitative studies (42, 43) and now has a  
14 more personalised relevance and clinical significance than some recent reviews suggested.  
15  
16 (44)

17  
18 Respondents negotiated safety in dealing with patients by rendering medical decision-  
19 making more explicitly during consultations. Patient expectations were found to be changing  
20 and so were the strategies employed in managing them. There was an emerging consensus  
21 on strategies to reduce antibiotic prescribing including patient education, improved self-  
22 management advice and delayed prescribing, supported by patient-centred communication  
23 emphasised in the other literature too. (45) At the same time, our study showed  
24 communication was primarily centred on warning signs, and on maintaining a clinician-  
25 patient relationship, rather than on the discussion of risks and benefits with patients. This is  
26 consistent with previous findings that explicit analysis of trade-offs is most often undertaken  
27 by physicians alone rather than as part of a dialogue with patients. (46) More explicit risk  
28 communication might become a focus of the consultations for (bacterial) infections.  
29  
30 Systematic review evidence suggests that shared decision-making reduces prescribing (47)  
31 and our study also found that both delayed prescribing (48-51) and safety-netting appeared  
32 as effective strategies of shared decision making.

## Strengths and limitations

The study provided a coherent analysis of the views of primary care prescribers drawing on the responses of participants working in rural and urban settings and including a sample that was diverse with respect to professional training and years of experience. The size of the sample may not have been sufficient to distinguish differences in approach between groups with different professional training, but this could be explored further in future studies. The study may possibly have reduced transferability to other settings beyond UK primary care or beyond high-income countries. Participants were necessarily informed of the nature and purpose of the research, consequently both their participation in the interview and the interview responses might have been influenced by research participation. It is possible that respondents who were less inclined to reduce antibiotic prescribing might have been less prepared to participate. Interview responses might have been inclined to give what they perceived as 'socially acceptable' responses. We employed a thematic analysis because this enables a flexible investigation of a complex topic without drawing on pre-existing theory. In order to reduce the possibility of inconsistency, we employed a systematic, staged approach to analysis and a sample of transcripts was repeat coded by a second analyst. A patient group was involved in the research, but we acknowledge that patient involvement contribution must be managed carefully to avoid introducing bias. The thematic analysis was completed by experienced qualitative researchers using participant data; PPI input did not in this case lead to any modification of themes identified. It might be argued that if the PPI group did not materially influence the eventual data presentation, then the information about PPI involvement could be removed from the paper. However, the funders, the journal and the authors remain committed to the importance of patient and public involvement and have retained the PPI statement. This paper should be read in conjunction with our companion study, which explored the views of patients as participants.(52)



### Implications for further research and practice

This study explored and characterised primary care prescribers' perceptions of safety issues and risk management strategies relevant to reduced antibiotic prescribing. The study offers insights into primary care prescribers' perceptions and as such it emphasises the safety perspective within the current debate on antibiotic prescribing and antimicrobial stewardship. The study identified dilemmas that are recognisable in the course of daily primary care practice and can form the basis for future improvement and antimicrobial stewardship programs. Our research paves the way for a cross-sectional survey of risk perceptions. It highlights the need for further development of risk stratification and risk communication tools such as decision-making checklists and evidence-based support tools. It also stresses the need for adequate training on antimicrobial resistance and reducing of antibiotics (such as GRACE-INTRO and REDUCE). (53, 54) . Safety netting had a strong presence in the interviews, however, as such is under-researched and requires further exploration. Our findings support the argument (31) that prescribers need more time to discuss the benefit-harm trade-off within shared decision making as this may help to reduce antibiotic prescribing in primary care.

### CONCLUSIONS

Attitudes towards antibiotic prescribing are changing and becoming more nuanced. There is growing confidence in the capacity to reduce the rate of prescribing and to manage patient expectations, which are themselves undergoing change. There is growing recognition that there may be safety trade-offs associated with antimicrobial stewardship and this is linked to concerns about sepsis and other serious bacterial infections. There is a need to develop better quantified estimates of risk that can inform clinical decision making and 'safety netting' advice given to patients. This will require further development of risk stratification estimates, as well as communication tools that enable these to be used in practice. Improved management of risks and benefits will help to inform future antimicrobial stewardship efforts.



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6 **Contributorship:** OB and MG designed the study; CB advised on the development of the  
7  
8 interview guide; MA and RF advised on the recruitment strategy and facilitated its  
9  
10 implementation; OB conducted the analysis with support from CB; OB drafted the paper; all  
11  
12 authors commented on and approved the paper.  
13

14  
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19

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28  
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30  
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32  
33 interpretation, or writing of the report. The authors had full access to all the data in the study  
34  
35 and all authors shared final responsibility for the decision to submit for publication.  
36

37 **Data availability statement:** The data that support the findings of this study are available  
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39 from the corresponding author upon reasonable request.  
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## REFERENCES

1. Costelloe C, Metcalfe C, Lovering A, Mant D, Hay AD. Effect of antibiotic prescribing in primary care on antimicrobial resistance in individual patients: systematic review and meta-analysis. *BMJ (Clinical research ed)*. 2010;**340**:c2096.
2. Gulliford MC, Moore MV, Little P, Hay AD, Fox R, Prevost AT, et al. Safety of reduced antibiotic prescribing for self limiting respiratory tract infections in primary care: cohort study using electronic health records. *BMJ (Clinical research ed)*. 2016;**354**:i3410.
3. Shallcross LJ, Davies SC. The World Health Assembly resolution on antimicrobial resistance. *J Antimicrobial Chemother*. 2014;**69**(11):2883-5.
4. Tonkin-Crine S, Yardley L, Little P. Antibiotic prescribing for acute respiratory tract infections in primary care: a systematic review and meta-ethnography. *J Antimicrobial Chemother*. 2011;**66**(10):2215-23.
5. Teixeira Rodrigues A, Roque F, Falcão A, Figueiras A, Herdeiro MT. Understanding physician antibiotic prescribing behaviour: a systematic review of qualitative studies. *Int J Antimicrobial Agents*. 2013;**41**(3):203-12.
6. Krockow EM, Colman AM, Chattoe-Brown E, Jenkins DR, Perera N, Mehtar S, et al. Balancing the risks to individual and society: a systematic review and synthesis of qualitative research on antibiotic prescribing behaviour in hospitals. *J Hospital Infection* 2019;**101**(4):428-39.
7. Vincent C. *Patient safety*. London: Churchill Livingstone Elsevier; 2006.
8. Sun X, Gulliford M. Reducing antibiotic prescribing in primary care in England from 2014 to 2017: Population-based cohort study. *BMJ Open*. 2019; **9**: e023989. doi: 10.1136/bmjopen-2018-023989

- 1  
2  
3 9. Public Health England. *English Surveillance Programme for Antimicrobial Utilisation*  
4 *and Resistance (ESPAUR) Report 2018 – 2019*. London: Public Health England, 2019.  
5  
6  
7
- 8 10. Department of Health. *Tackling antimicrobial resistance 2019–2024. The UK's five-*  
9 *year national action plan*. London: Department of Health, 2019.  
10  
11  
12
- 13 11. Llor C, Bjerrum L. Antimicrobial resistance: risk associated with antibiotic overuse  
14 and initiatives to reduce the problem. *Ther Adv Drug Safety*. 2014;**5**(6):229-41.  
15  
16  
17
- 18 12. World Health Organization. *Global Action Plan on Antimicrobial Resistance*. Geneva:  
19 WHO, 2015.  
20  
21  
22
- 23 13. Shehab N, Patel PR, Srinivasan A, Budnitz DS. Emergency department visits for  
24 antibiotic-associated adverse events. *Clin Inf Dis* 2008;**47**(6):735-43.  
25  
26  
27
- 28 14. Roehr B. Antibiotics account for 19% of emergency department visits in US for  
29 adverse events. *BMJ (Clinical research ed)*. 2008;**337**:a1324.  
30  
31  
32
- 33 15. Petersen I, Johnson AM, Islam A, Duckworth G, Livermore DM, Hayward AC.  
34 Protective effect of antibiotics against serious complications of common respiratory tract  
35 infections: retrospective cohort study with the UK General Practice Research Database. *BMJ*  
36 *(Clinical research ed)*. 2007;**335**(7627):982.  
37  
38  
39
- 40 16. Vazquez-Lago JM, Lopez-Vazquez P, Lopez-Duran A, Taracido-Trunk M, Figueiras  
41 A. Attitudes of primary care physicians to the prescribing of antibiotics and antimicrobial  
42 resistance: a qualitative study from Spain. *Fam Pract*. 2012;**29**(3):352-60.  
43  
44  
45
- 46 17. Horwood J, Cabral C, Hay AD, Ingram J. Primary care clinician antibiotic prescribing  
47 decisions in consultations for children with RTIs: a qualitative interview study. *Br J Gen Pract*  
48 2016;**66**(644):e207-13.  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

- 1  
2  
3 18. Broom A, Broom J, Kirby E. Cultures of resistance? A Bourdieusian analysis of  
4 doctors' antibiotic prescribing. *Soc Sci Med* 2014;**110**:81-8.  
5  
6  
7  
8 19. Livorsi D, Comer A, Matthias MS, Perencevich EN, Bair MJ. Factors Influencing  
9 Antibiotic-Prescribing Decisions Among Inpatient Physicians: A Qualitative Investigation.  
10 *Infection control and hospital epidemiology*. 2015;**36**(9):1065-72.  
11  
12  
13 20. Klein EY, Martinez EM, May L, Saheed M, Reyna V, Broniatowski DA. Categorical  
14 Risk Perception Drives Variability in Antibiotic Prescribing in the Emergency Department: A  
15 Mixed Methods Observational Study. *J Gen Int Medicine*. 2017;**32**(10):1083-9.  
16  
17  
18 21. Broniatowski DA, Klein EY, May L, Martinez EM, Ware C, Reyna VF. Patients' and  
19 Clinicians' Perceptions of Antibiotic Prescribing for Upper Respiratory Infections in the Acute  
20 Care Setting. *Medical Decision Making* 2018;**38**(5):547-61.  
21  
22  
23 22. Yates TD, Davis ME, Taylor YJ, Davidson L, Connor CD, Buehler K, et al. Not a  
24 magic pill: a qualitative exploration of provider perspectives on antibiotic prescribing in the  
25 outpatient setting. *BMC Family Practice*. 2018;**19**(1):96.  
26  
27  
28 23. Coenen S, Francis N, Kelly M, Hood K, Nuttall J, Little P, et al. Are patient views  
29 about antibiotics related to clinician perceptions, management and outcome? A multi-country  
30 study in outpatients with acute cough. *PloS One*. 2013;**8**(10):e76691.  
31  
32  
33 24. Fletcher-Lartey S, Yee M, Gaarslev C, Khan R. Why do general practitioners  
34 prescribe antibiotics for upper respiratory tract infections to meet patient expectations: a  
35 mixed methods study. *BMJ Open*. 2016;**6**(10):e012244.  
36  
37  
38 25. Lum EPM, Page K, Whitty JA, Doust J, Graves N. Antibiotic prescribing in primary  
39 healthcare: Dominant factors and trade-offs in decision-making. *Infection, Disease & Health*.  
40 2018;**23**(2):74-86.  
41  
42  
43  
44  
45  
46  
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48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
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60

- 1  
2  
3 26. Mustafa M, Wood F, Butler CC, Elwyn G. Managing expectations of antibiotics for  
4 upper respiratory tract infections: a qualitative study. *Ann Fam Med*. 2014;**12**(1):29-36.  
5  
6  
7  
8 27. Altiner A, Knauf A, Moebes J, Sielk M, Wilm S. Acute cough: a qualitative analysis of  
9 how GPs manage the consultation when patients explicitly or implicitly expect antibiotic  
10 prescriptions. *Family Practice*. 2004;**21**(5):500-6.  
11  
12  
13  
14  
15 28. Butler CC, Kinnersley P, Prout H, Rollnick S, Edwards A, Elwyn G. Antibiotics and  
16 shared decision-making in primary care. *J Antimicrobial Chemother* 2001;**48**(3):435-40.  
17  
18  
19  
20 29. Welschen I, Kuyvenhoven M, Hoes A, Verheij T. Antibiotics for acute respiratory tract  
21 symptoms: patients' expectations, GPs' management and patient satisfaction. *Family*  
22 *Practice*. 2004;**21**(3):234-7.  
23  
24  
25  
26  
27  
28 30. Legare F, Labrecque M, Cauchon M, Castel J, Turcotte S, Grimshaw J. Training  
29 family physicians in shared decision-making to reduce the overuse of antibiotics in acute  
30 respiratory infections: a cluster randomized trial. *CMAJ* 2012;**184**(13):E726-34.  
31  
32  
33  
34  
35 31. Coxeter P, Del Mar CB, McGregor L, Beller EM, Hoffmann TC. Interventions to  
36 facilitate shared decision making to address antibiotic use for acute respiratory infections in  
37 primary care. *Cochrane Database Syst Rev* 2015(11):Cd010907.  
38  
39  
40  
41  
42 32. Hart AM, Pepper GA, Gonzales R. Balancing acts: deciding for or against antibiotics  
43 in acute respiratory infections. *J Fam Pract*. 2006;**55**(4):320-5.  
44  
45  
46  
47  
48 33. Michie S, Johnston M, Abraham C, Lawton R, Parker D, Walker A. Making  
49 psychological theory useful for implementing evidence based practice: a consensus  
50 approach. *Quality and Safety in Health Care*. 2005;**14**(1):26-33.  
51  
52  
53  
54  
55 34. Lorencatto F, Charani E, Sevdalis N, Tarrant C, Davey P. Driving sustainable change  
56 in antimicrobial prescribing practice: how can social and behavioural sciences help? *J*  
57 *Antimicrobial Chemother*. 2018;**73**(10):2613-24.  
58  
59  
60

- 1  
2  
3 35. Atkins L, Francis J, Islam R, O'Connor D, Patey A, Ivers N, et al. A guide to using the  
4 Theoretical Domains Framework of behaviour change to investigate implementation  
5 problems. *Implementation Science*. 2017;**12**(1):77.  
6  
7  
8  
9  
10 36. Malterud K, Siersma VD, Guassora AD. Sample Size in Qualitative Interview  
11 Studies: Guided by Information Power. *Qualitative Health Research*. 2016;**26**(13):1753-60.  
12  
13  
14  
15 37. Braun V, Clarke V. Using thematic analysis in psychology. *Qualitative Research in*  
16 *Psychology*. 2006;**3**(2):77-101.  
17  
18  
19  
20  
21 38. Biezen R, Roberts C, Buising K, Thursky K, Boyle D, Lau P, et al. How do general  
22 practitioners access guidelines and utilise electronic medical records to make clinical  
23 decisions on antibiotic use? Results from an Australian qualitative study. *BMJ Open*.  
24 2019;**9**(8):e028329.  
25  
26  
27  
28  
29  
30 39. Broom J, Broom A, Kirby E. The drivers of antimicrobial use across institutions,  
31 stakeholders and economic settings: a paradigm shift is required for effective optimization. *J*  
32 *Antimicrobial Chemother*. 2019;**74**(9):2803-9.  
33  
34  
35  
36  
37 40. Luhmann N. *Risk: a Sociological Theory*. New York: Routledge; 2002.  
38  
39  
40  
41 41. Boiko O, Sheaff R, Child S, Gericke CA. Risks, dangers and competing clinical  
42 decisions on venous thromboembolism prophylaxis in hospital care. *Sociology of health &*  
43 *illness*. 2014;**36**(6):932-47.  
44  
45  
46  
47  
48 42. Simpson SA, Wood F, Butler CC. General practitioners' perceptions of antimicrobial  
49 resistance: a qualitative study. *J Antimicrobial Chemother*. 2006;**59**(2):292-6.  
50  
51  
52  
53 43. Wood F, Phillips C, Brookes-Howell L, Hood K, Verheij T, Coenen S, et al. Primary  
54 care clinicians' perceptions of antibiotic resistance: a multi-country qualitative interview  
55 study. *J Antimicrobial Chemother*. 2012;**68**(1):237-43.  
56  
57  
58  
59  
60

- 1  
2  
3 44. McCullough AR, Rathbone J, Parekh S, Hoffmann TC, Del Mar CB. Not in my  
4  
5 backyard: a systematic review of clinicians' knowledge and beliefs about antibiotic  
6  
7 resistance. *J Antimicrobial Chemotherapy*. 2015;**70**(9):2465-73.  
8  
9  
10 45. O'Connor R, O'Doherty J, O'Regan A, Dunne C. Antibiotic use for acute respiratory  
11  
12 tract infections (ARTI) in primary care; what factors affect prescribing and why is it  
13  
14 important? A narrative review. *Irish J Med Sci*. 2018;**187**(4):969-86.  
15  
16  
17 46. Gregory R, Peters E, Slovic P. Making decisions about prescription drugs: A study of  
18  
19 doctor-patient communication. *Health, Risk & Society*. 2011;**13**(4):347-71.  
20  
21  
22 47. Tonkin-Crine SK, Tan PS, van Hecke O, Wang K, Roberts NW, McCullough A, et al.  
23  
24 Clinician-targeted interventions to influence antibiotic prescribing behaviour for acute  
25  
26 respiratory infections in primary care: an overview of systematic reviews. *Cochrane*  
27  
28 *Database Syst Rev* 2017;**9**:Cd012252.  
29  
30  
31 48. Arroll B, Kenealy T, Kerse N. Do delayed prescriptions reduce antibiotic use in  
32  
33 respiratory tract infections? A systematic review. *Br J Gen Pract* 2003;**53**(496):871-7.  
34  
35  
36 49. Marchetti F, Ronfani L, Nibali SC, Tamburlini G. Delayed Prescription May Reduce  
37  
38 the Use of Antibiotics for Acute Otitis Media: A Prospective Observational Study in Primary  
39  
40 Care. *JAMA Pediatrics*. 2005;**159**(7):679-84.  
41  
42  
43 50. Little P, Moore M, Kelly J, Williamson I, Leydon G, McDermott L, et al. Delayed  
44  
45 antibiotic prescribing strategies for respiratory tract infections in primary care: pragmatic,  
46  
47 factorial, randomised controlled trial. *BMJ* 2014;**348**:g1606.  
48  
49  
50 51. Ryves R, Eyles C, Moore M, McDermott L, Little P, Leydon GM. Understanding the  
51  
52 delayed prescribing of antibiotics for respiratory tract infection in primary care: a qualitative  
53  
54 analysis. *BMJ Open*. 2016;**6**(11):e011882.  
55  
56  
57  
58  
59  
60

1  
2  
3 52. Boiko, O, Gulliford, MC, Burgess, C. Revisiting patient expectations and experiences of  
4 antibiotics in an era of antimicrobial resistance: Qualitative study. *Health Expect.* 2020; 00:  
5 1– 9. <https://doi.org/10.1111/hex.13102>  
6  
7  
8

9  
10 53. Gulliford MC, Prevost AT, Charlton J, Juszczuk D, Soames J, McDermott L, et al.  
11 Effectiveness and safety of electronically delivered prescribing feedback and decision  
12 support on antibiotic use for respiratory illness in primary care: REDUCE cluster randomised  
13 trial. *BMJ* 2019;**364**:l236.  
14  
15  
16  
17

18  
19 54. Yardley L, Douglas E, Anthierens S, Tonkin-Crine S, O'Reilly G, Stuart B, et al.  
20 Evaluation of a web-based intervention to reduce antibiotic prescribing for LRTI in six  
21 European countries: quantitative process analysis of the GRACE/INTRO randomised  
22 controlled trial. *Implementation Sci.* 2013;**8**(1):134.  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
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**Table 1. Interview guide.**

1	What are the indications for AB treatment?
2	
3	To what extent do NICE (or local) guidelines influence your AM prescribing?
4	
5	What are the risks of AB prescribing and non-prescribing?
6	
7	How do you differentiate between infections and patients?
8	
9	What are the common myths or stereotypes about antibiotics?
10	
11	Can you give me an example illustrating the inaccurate understanding of their purpose, mechanisms
12	of action, risks and consequences?
13	
14	In your view, is there the best way to elicit and manage patient expectations regarding antibiotics?
15	
16	How would you communicate the risks associated with both prescribing and non-prescribing
17	antibiotics?
18	
19	How confident are you in decision-making around AB prescribing?
20	
21	Would you assess your approach to AB prescribing as always adequate and if so, what makes you
22	think that?
23	
24	Could you describe consequences of inappropriate treatment for infections?
25	
26	What would be/were your actions following unresolved or repeated infections?
27	
28	What is your understanding of antimicrobial resistance?
29	
30	What are your goals and priorities in infection management?
31	
32	Are there any social norms or group pressures that affect your professional practice with regards to AB
33	prescribing and how?
34	
35	Has your prescribing practice for antibiotics changed over the recent years?
36	
37	Do you think patient expectations of AB treatment have changed over the recent years?
38	
39	Are you aware of the prescribing practice of other HCPs (your colleagues) in relation to antibiotics?
40	
41	Have you ever had to challenge their prescribing decisions?
42	
43	Has anyone challenged your own decisions?
44	
45	How hopeful are you usually that the AB treatment is the best course of action?
46	
47	Is it possible to assess both the short- and long-term impact of AB treatment on the patients?
48	
49	What is your decision-making strategy?
50	
51	How anxious do you feel about the uncertainty around prescribing?
52	
53	Which resources do you use to support your decisions on AB prescribing?
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**Table 2: Characteristics of participants. Figures are frequencies.**

<b>Characteristic</b>	<b>Variable</b>	<b>Number</b>
<b>Gender</b>	Male	8
	Female	22
<b>Location</b>	Metropolitan	21
	Shire town	9
<b>Occupation</b>	GPs	23
	Nurse prescriber	5
	Pharmacist	2
<b>Years of practice</b>	<10	16
	10-20	10
	>20	4

**Table 3: Summary of main themes and sub-themes.**

Theme	Sub-themes
<b>Theme 1. Risk assessment</b>	Identifying treatment thresholds Confidence in prescribing
<b>Theme 2. Balancing treatment risks</b>	Risks of prescribing and non-prescribing Facing antimicrobial resistance
<b>Theme 3. Negotiating decisions and risks</b>	Managing patient expectations Communicating risks

For peer review only

**Table 1** Consolidated criteria for reporting qualitative studies (COREQ): 32-item checklist

No	Item	Guide questions/description
<b>Domain 1: Research team and reflexivity</b>		
Personal Characteristics		
1.	Interviewer/facilitator	Which author/s conducted the interview or focus group? <b>P6</b>
2.	Credentials	What were the researcher's credentials? <i>E.g. PhD, MD</i> <b>P6</b>
3.	Occupation	What was their occupation at the time of the study? <b>P6</b>
4.	Gender	Was the researcher male or female? <b>P1</b>
5.	Experience and training	What experience or training did the researcher have? <b>P6</b>
Relationship with participants		
6.	Relationship established	Was a relationship established prior to study commencement? <b>P7</b>
7.	Participant knowledge of the interviewer	What did the participants know about the researcher? <i>e.g. personal goals, reasons for doing the research</i> <b>P7</b>
8.	Interviewer characteristics	What characteristics were reported about the interviewer/facilitator? <i>e.g. Bias, assumptions, reasons and interests in the research topic</i> <b>P7</b>
<b>Domain 2: study design</b>		

No	Item	Guide questions/description
	Theoretical framework	
9.	Methodological orientation and Theory	What methodological orientation was stated to underpin the study? <i>e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis</i> <b>P7</b>
	Participant selection	
10.	Sampling	How were participants selected? <i>e.g. purposive, convenience, consecutive, snowball</i> <b>P7</b>
11.	Method of approach	How were participants approached? <i>e.g. face-to-face, telephone, mail, email</i> <b>P7</b>
12.	Sample size	How many participants were in the study? <b>P7</b>
13.	Non-participation	How many people refused to participate or dropped out? Reasons? <b>P7</b>
	Setting	
14.	Setting of data collection	Where was the data collected? <i>e.g. home, clinic, workplace</i> <b>P6</b>
15.	Presence of non-participants	Was anyone else present besides the participants and researchers? <b>P6</b>
16.	Description of sample	What are the important characteristics of the sample? <i>e.g. demographic data, date</i> <b>Table 2</b>
	Data collection	

No	Item	Guide questions/description
17.	Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested? <b>Table 1 P6</b>
18.	Repeat interviews	Were repeat interviews carried out? If yes, how many? <b>N/A</b>
19.	Audio/visual recording	Did the research use audio or visual recording to collect the data? <b>P7</b>
20.	Field notes	Were field notes made during and/or after the interview or focus group? <b>P7</b>
21.	Duration	What was the duration of the interviews or focus group? <b>P8</b>
22.	Data saturation	Was data saturation discussed? <b>P7</b>
23.	Transcripts returned	Were transcripts returned to participants for comment and/or correction? <b>N/A</b>
<b>Domain 3: analysis and findingsz</b>		
Data analysis		
24.	Number of data coders	How many data coders coded the data? <b>P7</b>
25.	Description of the coding tree	Did authors provide a description of the coding tree? <b>P7</b>
26.	Derivation of themes	Were themes identified in advance or derived from the data? <b>P7</b>
27.	Software	What software, if applicable, was used to manage the data? <b>P7</b>

No	Item	Guide questions/description
28.	Participant checking	Did participants provide feedback on the findings? <b>N/A</b>
Reporting		
29.	Quotations presented	Were participant quotations presented to illustrate the themes / findings? Was each quotation identified? e.g. <i>participant number</i> <b>P8-P15</b>
30.	Data and findings consistent	Was there consistency between the data presented and the findings? <b>P8-P15</b>
31.	Clarity of major themes	Were major themes clearly presented in the findings? <b>P8-P15</b>
32.	Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes? <b>P8-P15</b>