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**Patient engagement with antibiotic messaging in secondary care: a qualitative feasibility study of the 'review & revise' experience**

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29 **Abstract** (339 words, limit 350 words)

30 *Background:* We aimed to investigate and optimise the acceptability and usefulness of a patient  
31 leaflet about antibiotic prescribing decisions made during hospitalisation, and to explore individual  
32 patient experiences and preferences regarding the process of antibiotic prescription 'review &  
33 revise' which is a key strategy to minimise antibiotic overuse in hospitals.

34 *Methods:* In this qualitative study, run within the feasibility study of a large, cluster-randomised  
35 stepped wedge trial of 36 hospital organisations, a series of semi-structured, think-aloud telephone  
36 interviews were conducted and data were analysed using thematic analysis. Fifteen adult patients  
37 who had experienced a recent acute medical hospital admission during which they had been  
38 prescribed antimicrobials and offered a patient leaflet about antibiotic prescribing were recruited to  
39 the study.

40 *Results:* Participants reacted positively to the leaflet, reporting that it was both an accessible and  
41 important source of information which struck the appropriate balance between informing and  
42 reassuring. Participants all valued open communication with clinicians, and were keen to be involved  
43 in antibiotic prescribing decisions, with individuals reporting positive experiences regarding  
44 antibiotic prescription changes or stopping. Many participants had prior experience or knowledge of  
45 antibiotics and resistance, and generally welcomed efforts to reduce antibiotic usage. Overall, there  
46 was a feeling that healthcare professionals (HCPs) are trusted experts providing the most  
47 appropriate treatment for individual patient conditions.

48 *Conclusions:* This study offers novel insights into how patients within secondary care are likely to  
49 respond to messages advocating a reduction in the use of antibiotics through the 'review & revise'  
50 approach. Due to the level of trust that patients place in their care provider, encouraging HCPs  
51 within secondary care to engage patients with greater communication and information provision  
52 could provide great advantages in the drive to reduce antibiotic use. It may also be beneficial for  
53 HCPs to view patient experiences as cumulative events that have the potential to impact future

54 behaviour around antibiotic use. Finally, pre-testing messages about antibiotic prescribing and  
55 resistance is vital to dispelling any misconceptions either around effectiveness of treatment for  
56 patients, or perceptions of how messages may be received.

57 **Trial Registration:** Current Controlled Trials ISRCTN12674243 (10 April 2017)

58 <http://www.isrctn.com/ISRCTN12674243>

59 **Keywords:** antibiotic prescribing, hospital patients, antimicrobial stewardship

60

61 **BACKGROUND**

62 Antimicrobial resistance (AMR) is an important issue affecting patients worldwide, with impacts on  
63 both healthcare costs and patient safety (1). Over prescribing of antimicrobials contributes  
64 significantly to the growing problem of AMR worldwide (2). Up to 50% of antibiotic prescribing may  
65 be inappropriate either because antibiotics are not indicated, or the agent(s) selected are too broad  
66 or continued longer than needed (3, 4, 5). In primary care, efforts to minimise antibiotic overuse are  
67 directed at only starting antibiotic treatment when there is a clear clinical reason to do so (6). In  
68 secondary care, where patients are more acutely unwell, strategies to optimise antibiotic use involve  
69 prompt empiric antibiotic therapy while there is diagnostic uncertainty, followed by regular review  
70 and revise to target and where appropriate, stop antibiotic treatment. In the NHS (National Health  
71 Service) this strategy is set out in Department of Health guidance, "Start Smart then Focus" (7). Start  
72 Smart then Focus recommends five decisions prescribers can take reviewing antibiotic therapy; stop,  
73 continue, move IV to oral, broaden or de-escalate, or move to outpatient intravenous therapy.  
74 However, controlling antibiotic overuse through review and revise is challenging (8, 9, 10).

75 Antibiotic Review Kit (ARK) Hospital is a complex behavioural intervention targeting all healthcare  
76 professionals (HCPs) involved in prescribing, dispensing or administering antibiotics for acute and  
77 general medicine adult patients. This paper reports the findings of a set of interviews with patients  
78 as part of the wider developmental and feasibility work for a full-scale RCT (randomised controlled  
79 trial) aiming to encourage appropriate and timely stopping of antibiotics that are no longer needed.  
80 The overall intervention incorporates digital, behavioural, and organisational elements, including  
81 online training, a decision aid tool to support decision making around antibiotic prescriptions, a  
82 patient information leaflet, a structure for monitoring and discussing implementation of the  
83 intervention, detailed implementation guidance, a resources website, and a peer support network  
84 (11). For the feasibility trial, all intervention elements were implemented in one medium-sized acute  
85 hospital in the UK. Full details of how ARK was used by healthcare professionals during the study are  
86 available in a separate publication (12). The qualitative study described here was an investigation of

87 the feasibility and acceptability of the patient leaflet element of the intervention among patients at  
88 the feasibility study site. This paper details the development and optimisation of the leaflet. The full  
89 protocol for the main trial is reported elsewhere (13).

90 Evidence from primary care suggests that engaging patients in antibiotic prescribing decisions can  
91 facilitate reducing antibiotic use (14). In secondary care, while there is evidence that both patients  
92 and clinicians want an increase in shared decision-making around prescribing (15, 16), it is not yet  
93 clear whether this shared decision-making could lead to similar reductions in antibiotic use (17). As a  
94 result, the ARK-Hospital information leaflet aimed to reassure, inform and empower patients about  
95 potential changes made to their antibiotic prescription. However, there is an absence of research  
96 evidence to inform the design and use of a patient information leaflet to support the antibiotic  
97 'review & revise' prescribing process within secondary care.

98 The aim of this qualitative study was to investigate and optimise the acceptability and usefulness of  
99 such a patient leaflet in secondary care, ahead of intended use in a full-scale RCT. We also aimed to  
100 explore and understand individual patient experiences of the 'review & revise' process and identify  
101 patient views and preferences regarding antimicrobial treatment in hospitals to inform both the  
102 larger trial and any future research in this field.

## 103 **METHODS**

### 104 **Developing the patient information leaflet**

105 The detail and planning of the ARK-Hospital intervention are described elsewhere (11). The patient  
106 leaflet was developed iteratively, building initially on previous research (GRACE-INTRO) which drew  
107 on theory and qualitative user feedback as detailed elsewhere (18) and was designed to be  
108 understood by readers with lower levels of health literacy. This was further refined by health  
109 psychologists and clinicians to ensure accuracy of the health messages. Feedback was sought from  
110 project stakeholders and from members of a public and patient involvement (PPI) group. This

111 feedback included suggestions for ways to improve the look and feel of the leaflet, e.g., by  
112 incorporating more engaging images, simplifying the layout, and making minor clarifications to the  
113 text. PPI input was particularly useful in ensuring that the leaflet gave relevant, but accessible  
114 information about antibiotic resistance and how to present this without causing undue concern. The  
115 leaflet provides patients with brief information about when antibiotics are used, the possible risks of  
116 taking antibiotics, the 'review & revise' process and advice about what to do when their antibiotics  
117 are stopped.

## 118 **Recruitment**

119 Ethical approval for the ARK-Hospital implementation study (ISRCTN: 12674243) was obtained from  
120 the National Research Ethics Committee (REC reference: 17/SC/0034), including feasibility, pilot and  
121 main trial phases. It is useful to note that for the feasibility, pilot and main trials, neither staff, nor  
122 patients are individually consented into the study as the overall unit of randomisation and analysis is  
123 the site or Trust and no data is identifiable. Only for qualitative data collection did we consent staff  
124 or patients. As such, participants for this qualitative component were recruited as a convenience  
125 sample from patients admitted through the Acute Medical Unit (AMU) at the feasibility study site  
126 (the Royal Sussex County Hospital, Brighton) between June 2017 and February 2018. All participants  
127 had been prescribed antibiotics during their hospital stay. For most patients, the intervention leaflet  
128 was given to patients at their time of discharge from hospital, though in a few cases patients  
129 received the leaflet when a change had been made to their antibiotic prescription. In line with ethics  
130 requirements, participants were identified and invited to take part in the study at the time of  
131 discharge by medical staff who introduced the study and provided them with a study information  
132 sheet explaining that participation was both confidential and voluntary. Medical staff also checked  
133 that the participant had been given a copy of the leaflet and asked them to keep this for the  
134 interview. Interested participants completed the consent form and provided contact details to the  
135 member of medical staff who then posted these details to researchers at the University of

136 Southampton. Researchers then contacted participants to arrange an interview and verbal consent  
137 and demographic data were collected prior to each interview. A total of 125 patients were  
138 approached about the study, with 25 providing consent to be contacted by a researcher. Of these 25  
139 patients, 10 dropped out, either because they no longer wanted to take part by the time of  
140 interview, or because they could not be contacted. This left a total of 15 study participants.

#### 141 **Interviews**

142 The study methodology involved semi-structured, think-aloud (19), telephone interviews, which  
143 lasted between 20 and 30 minutes. These were conducted by FM and KS, who are PhD qualified,  
144 research fellows with training and experience of qualitative methods in health research, including  
145 conducting cognitive interviews. The study participants were not acquainted with the researchers  
146 prior to the study, but they were informed about the purpose of the study and were made aware  
147 that the researchers were affiliated with University of Southampton. Participants were initially asked  
148 a series of open questions to explore their experience and perception of the 'review & revise'  
149 process, including any changes that were made to their antibiotic prescription and perceptions  
150 about the duration of antibiotic treatment. They were then asked to read, or listen to the  
151 interviewer read, the patient leaflet (Figure 1) that they had received while in hospital or at the time  
152 of discharge. Participants were asked to say everything that they were thinking out loud whilst they  
153 read the leaflet. Several more open-ended questions followed, which explored what participants  
154 liked or disliked about the leaflet, what they viewed as most relevant, and any suggested changes to  
155 improve the leaflet. Using a think aloud methodology enabled us to explore participant reactions to  
156 the leaflet and gain detailed feedback about each aspect of the intervention, allowing us to make  
157 changes to and optimise the content. As negative feedback is especially helpful in developing the  
158 most effective messages, we deliberately elicited this within our study. After an initial nine  
159 interviews, the leaflet was revised (Figure 2) based on participant feedback before being tested with

160 a further 6 participants, for a total of 15 unique participant interviews. Participants were  
 161 compensated with a £10 shopping voucher for taking part in the study.

162 **Data analysis**

163 Interviews were audio recorded and transcribed verbatim. No field notes were made by researchers  
 164 either during or after the interviews and transcripts were not returned to participants. Analysis  
 165 initially focused on identifying any potential barriers to use of the leaflet and interview feedback was  
 166 used to identify any areas where changes might make it more acceptable, engaging or useful. Each  
 167 transcript was reviewed line-by-line to draw out all responses that were either positive or negative  
 168 perceptions of the leaflet (20). Responses were tabulated and each negative comment was reviewed  
 169 to determine whether a change was necessary. If so, the solution was recorded in the table,  
 170 discussed with the wider team and the change was made. Changes were made if they were likely to  
 171 impact on the acceptability of the leaflet or the ‘review & revise’ process. This included exploring  
 172 aspects such as whether the information was perceived as convincing, reassuring and  
 173 comprehensible. The MoSCoW (Must have, Should have, Could have, Would have) criteria were  
 174 used to assess priority (20) and each change was made in line with the common and intervention  
 175 specific guiding principles of the Person-Based Approach (21). Although similar to content analysis,  
 176 the table of changes as illustrated below, has been created specifically for use in intervention  
 177 development. As such, it does not aim to quantify qualitative data, but instead offers a way to  
 178 analyse this intervention feedback in a systematic and efficient manner, often running in parallel  
 179 with in depth thematic analysis (21). An example of the data tabulation is shown in Table 1.

180 *Table 1. Example of table of iterative changes made to patient leaflet*

Page or aspect of the intervention	Positive comments	Negative comments	Possible change	Reason for change	Agreed change	MoSCoW
Section titled: “What are the risks of taking antibiotics?”		Confusion over how antibiotic resistant bacteria can be spread to others, e.g.	<b>Explanation of spreading antibiotic resistant bacteria to</b>	<b>Important to behaviour change</b> as we do not want to confuse or	Changed bolded text to reduce any concerns	<b>Must have</b> – crucial to ensure patients accurately understand

		"I didn't realise that antibiotic resistance can spread to other members of the family. I'm not quite sure what it means."	<b>others made clearer.</b>	concern patients. <b>Expert</b> clinicians and health psychologists agreed the change was suitable. <b>Repeatedly</b> mentioned by participants.	and clarified text about passing on resistance to others.	the risks of antibiotics.
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182 Each transcript also underwent inductive thematic analysis (22), supported by use of QSR NVivo 11  
 183 software, and was coded into emerging themes, which represented frequent patterns of meaning  
 184 within the dataset. Coding followed the aims of the research, focusing on patients' experiences and  
 185 perceptions of the 'review & revise' process and the acceptability of a patient leaflet. Coding was  
 186 done by FM, an experienced qualitative researcher, with KS reviewing transcripts and codes  
 187 frequently and advising on the development of themes. The final themes were agreed upon by the  
 188 research team through discussion and consensus that saturation had been reached based on the  
 189 completion of 15 interviews. Data collection stopped when no new concerns or themes emerged.

190 **RESULTS**

191 Ten (67%) women and five (33%) men participated, with an age range of 50-91 and mean age of 72  
 192 (SD=13.2). All participants spoke English as their first language and reported their cultural  
 193 background as British. Participants had all been discharged from hospital and eight (53%) were still  
 194 taking antibiotics at the time of discharge. Full demographic details are available in Table 2.

195 *Table 2. Demographic characteristics of the sample (n=15)*

Demographic characteristics	Number / Proportion of the sample <i>n</i> (%)
<b>Gender</b>	
Female	10 (67%)
Male	5 (33%)
<b>Age</b>	
18-34 years	0 (0%)
35-54 years	3 (20%)
55-74 years	3 (20%)
>75 years	9 (60%)

<b>Cultural background</b>	
White British/English	15 (100%)
Other	0 (0%)
<b>Education</b>	
GCSEs/GNVQs or equivalent	6 (40%)
A-levels	2 (13%)
University degree (e.g. BSc, BA, MSc, PhD)	1 (7%)
No exams taken	6 (40%)
Other	0 (0%)
<b>Languages spoken</b>	
English	15 (100%)
Other	0 (0%)
<b>Taking antibiotics when discharged</b>	
Yes	8 (53%)
No	5 (33%)
Can't remember/not sure	2 (13%)

196

197 Following detailed thematic analysis, 34 subcategories that fell into 12 categories were extracted  
198 from the transcripts. From these, 4 interlinking themes were identified (Table 3). The participants  
199 described their perceptions of the leaflet and the impact that it had on their views of treatment. This  
200 led to discussions about their largely positive experiences of the 'review & revise' process, while also  
201 linking to any existing knowledge of antibiotics and antibiotic resistance. Finally, participants all  
202 described the trust that they place in HCPs to make treatment decisions, which appeared to mitigate  
203 any potential concerns around prescriptions being changed or stopped.

204 *Table 3. Analytical framework for developing categories and themes for patients' experiences*

<b>Theme 1: Leaflet acceptability and impact on perceptions of treatment</b>		
<b>Category</b>	<b>Definition</b>	<b>Example Quote</b>
<i>Positive perceptions of review and revise</i>	Positive feedback given about the leaflet as an introduction to the 'review & revise' process. Also includes discussion about recommending the leaflet to others and the overall relevance of the leaflet.	"I think it makes you feel better knowing that you're being checked on and deciding whether we're going to need all these antibiotics all the time." (P9, Female, 81)
<i>New concerns raised about resistance</i>	Any concerns or questions that patients discussed regarding antibiotic resistance as well as how this may impact friends and family.	"The one thing that would probably worry me more than anything is that the more antibiotics you take the more likely you are to spread them to other people, such as your family and friends." (P3, Male, 78)
<i>Timing of when leaflet received</i>	Discussion about perceptions of the impact that timing of the leaflet had on their input into treatment as well	"I found that where I had the leaflet it was very helpful in actually talking to them [HCPs]

	as perceived relevance of the leaflet.	about what I was being specifically treated for.” (P3, Male, 78)
<b>Theme 2: Experience of review and revise process</b>		
<b>Category</b>	<b>Definition</b>	<b>Example Quote</b>
<i>Positive perceptions of initial antibiotic prescribing</i>	Positive perceptions about how antibiotics were initially prescribed, including reasons for hospitalisation, drug mode of delivery, awareness (or not) of initial prescription and any information given about prescription and/or treatment.	“...when they put me on the antibiotics they were telling me exactly what they for, how long I was going to be on for, and what they was doing, and if I’ve got any problems with them at all let them know and they’d stop them.” (P5, Male, 77)
<i>Experience of prescription changes</i>	Feedback about any changes to antibiotic prescription. Includes discussion about any diagnostic testing and results, changes to drug mode of delivery and the efficacy of treatment.	“They started me on antibiotics and I had about 2 or 3 that day and then 2 in the morning, and then when they gave me an x-ray they realised it wasn’t a chest infection, they think it was a viral infection. So they cancelled the antibiotics.” (P4, Female, 51)
<i>Patient perceptions of input into treatment</i>	Amount of input patients felt they had regarding antibiotic treatment. Reflections on whether they had the opportunity to ask questions or discuss treatment at the time of prescribing, or as any changes to treatment were made, up until the time of discharge.	“Anything I did want to know, people automatically told me if I had anything [medications], which was really good.” (P14, Female, 83)
<b>Theme 3: Existing knowledge of antibiotics</b>		
<b>Category</b>	<b>Definition</b>	<b>Example Quote</b>
<i>Positive past experience(s) of antibiotic treatment</i>	Any positive past treatment experiences reported by patients. It includes aspects of how treatment was received, but also treatment efficacy.	“Well obviously, the only thing I use them for is if you’ve got an infection because then it kills the infection; it makes you well again. That’s the only thing I know about antibiotics.” (P4, Female, 51)
<i>Negative past experience(s) of antibiotic treatment</i>	Any negative past experiences of antibiotic treatment, with discussion including problems with treatment, particularly the experience of side effects.	“I agree that some antibiotics aren’t great, and I know in the past I’ve had antibiotics that upset your stomach and had to stop them or change them. So I’ve said in the past, don’t give me that one because I don’t like it.” (P1, Female, 50)
<i>Existing concerns about antibiotic resistance</i>	Patients’ existing knowledge of antibiotic resistance and the concerns that they had about this.	“You can get immune to them if you take too many. I mean it’s pretty obvious, it’s like anything else, that they will stop working, that’s why I don’t like to take so many.” (P2, Female, 65)
<b>Theme 4: Trust in healthcare professionals</b>		
<b>Category</b>	<b>Definition</b>	<b>Example Quote</b>
<i>Positive existing relationship with HCPs</i>	Positive perceptions that patients have about their relationship with	“The doctors and the hospital have been very good, because I have

	HCPs, including previous experience of care by GPs and pharmacists, as well as positive experiences of care during their recent hospital stay.	been admitted quite a few times. They don't turn around and say oh no, not you again, they do treat me as a new patient every time." (P2, Female, 65)
<i>Willingness to take antibiotics</i>	Specific discussions about being happy to take antibiotic medications in hospital, particularly as this is often life-saving and not always viewed as a 'choice' if patients want to recover.	"I understand the risk you have to take, but if you're in a situation like I was, where it was life and death, you're going to take a chance of taking antibiotics, because if I hadn't taken them I would have died." (P7, Male, 62)
<i>Positive perceptions of HCPs as experts</i>	Perception of HCPs as experts giving each patient the best possible treatment. Patients discussed being happy to follow expert HCP advice about antibiotic treatment, including treatment duration, changes to treatment, and not always needing to feel involved in initial antibiotic treatment decisions.	"I'd be quite happy to accept whatever a doctor prescribed for me, because they're the experts and I am not." (P6, Female, 91)

205 This data is an extract of quotes derived from thematic analysis of interviews exploring participants'  
206 experiences of the 'review & revise' process and provision of an information leaflet in secondary care.

207

## 208 **Leaflet acceptability and impact on perceptions of treatment**

209 During initial interviews, several participants had questions or concerns regarding antibiotic  
210 resistance, particularly how this can be spread to others. For most, this stemmed from a lack of  
211 awareness that resistance can be passed on and a lack of clarity about how this happens:

212 *"I didn't realise that resistance could spread to others...I'm not quite sure what that means,*  
213 *how can it spread...I don't understand that."* (Patient 2, Female, 65)

214 We felt that it was important to address these concerns by making minor revisions to the leaflet in  
215 consultation with the PPI group. These revisions aimed to reassure readers that when their doctor  
216 prescribes antibiotics only when really needed, this helps to reduce the likelihood of developing (and  
217 hence passing on), resistance. Following these revisions, further patient interviews indicated that  
218 although there was still a lack of awareness around the spread of resistance, concern appeared to  
219 have been mitigated:

220 *"I didn't realise that antibiotic resistance, you know by me taking it, it could affect somebody*  
221 *else...it doesn't concern me, I just didn't realise that, but it's very easy to understand."*  
222 *(Patient 13, Female, 74)*

223 Overall, the majority of participants reacted positively to the leaflet, explaining that they found it  
224 "informative" and "easy to read". Several participants also discussed the importance of being given  
225 the information that was included in the leaflet:

226 *"I think it's a good move to actually inform the public, not just patients, but the general*  
227 *public. To inform them about the dangers in the future of antibiotics not working."* (Patient  
228 *11, Male, 77)*

229 The leaflet was given to some participants when antibiotics were initially prescribed, and to others  
230 only at the time of discharge from hospital. A couple of participants who received the leaflet during  
231 discharge mentioned that they may have found it more useful at the time of treatment, but the  
232 majority felt that it was still of interest and relevance at the time of discharge. In fact, all participants  
233 reported that they would recommend the leaflet to others and several explained that they had kept  
234 it to show to family and friends, or as a document that they could refer back to for further  
235 information.

### 236 **Positive experience of 'review & revise' process**

237 Participants all discussed details of their recent stay in hospital, and reflected on their experience of  
238 the antibiotic 'review & revise' process. Many participants had been admitted for very serious  
239 conditions and spoke about being unaware of their initial antibiotic prescription. Others explained  
240 that they were started on antibiotics while diagnostic tests were conducted to confirm their  
241 diagnosis. Regardless of awareness of treatment or a confirmed diagnosis, all participants reported  
242 positive perceptions of the antibiotic prescribing process, often recognising the importance of  
243 receiving fast, initial treatment:

244 *"I was just told it was a precaution because it was suspected meningitis and obviously I think*  
245 *in that case they did the right thing, because meningitis is pretty nasty and can kill."* (Patient  
246 *1, Female, 50)*

247 Several participants had experienced changes to their antibiotic prescription. For some this meant  
248 changing to a different mode of delivery, dosage or drug, while for others it meant stopping  
249 antibiotics altogether. Again, all participants spoke positively about revisions to their prescriptions,  
250 often mentioning that HCPs had taken time to clearly explain and inform them about these  
251 decisions:

252 *"They upped the dosage frequency, and I think they needed to wait to check because they*  
253 *said we're giving you a wide-ranging one, but they may need to adapt it...and the dose had*  
254 *changed and it had been explained to me why."* (Patient 15, Female, 50)

255 Overall, participants reported perceiving the 'review & revise' process to be sensible and felt that  
256 their experiences matched the description provided by the leaflet. In some cases, participants even  
257 felt that the leaflet had helped them to make sense of their experiences.

#### 258 **Existing knowledge of antibiotics and resistance**

259 All participants had some knowledge of antibiotics and antibiotic resistance and many had past  
260 experience of antibiotic treatment. Often this had been a positive experience, both in terms of the  
261 prescribing process and the efficacy of treatment, but several participants had previously  
262 experienced problems, reporting that certain drugs were less effective or produced side-effects.  
263 Among those who had more negative experiences, there was still a general feeling of acceptance  
264 that they were being prescribed antibiotics because they were the most suitable treatment:

265 *"I agree that some antibiotics aren't great and I know in the past I've had some that upset*  
266 *my stomach and had to stop or change them...but I still think you need to take them if you're*  
267 *that ill and sometimes that outweighs the side effects, and sometimes they can give you*  
268 *something to counteract a side effect."* (Patient 1, Female, 50)

269 Based both on past experience and references to the media, most participants displayed some  
270 knowledge of antibiotic resistance. Although they were not necessarily aware of the mechanisms of  
271 how resistance works, there was a general awareness that resistance is a cause for concern and may  
272 result in less effective future treatment:

273 *“If you use it too much it won’t necessarily work when you do need it, you know?” (Patient*  
274 *14, Female, 83)*

275 While participants voiced concerns about growing resistance to antibiotic treatments, these  
276 appeared to be mitigated by understanding that their current treatment was a necessity. Although  
277 they were keen to avoid future resistance and reported that they would be happy to reduce their  
278 use of antibiotics if possible, they perceived antibiotics as having been prescribed to combat a  
279 serious, often life-threatening, health condition.

#### 280 **Trust in healthcare professionals**

281 All participants spoke positively about their relationship with HCPs, both in relation to routine care  
282 provided by their general practitioner (GP), or their recent care while in hospital. The majority of  
283 participants reported being given information about their treatment and condition and being  
284 offered the opportunity to ask any questions. Even among participants who had been unaware of  
285 the initial prescription, there was a feeling that they had been provided with details about their care  
286 as soon as they were in a state to respond to the information. Despite the chance to ask questions,  
287 most participants reported that they did not do this as they had either already been given the  
288 information they needed, or their condition was improving and they did not have any concerns.  
289 Overall, participants appeared to place a large amount of trust in HCPs. There was a sense that HCPs  
290 were seen as experts who had patient care as their main priority. This trust in HCPs appeared to  
291 mitigate any concerns that participants might have about their treatment, as they were willing to  
292 follow expert advice even if it meant changing or stopping an antibiotic prescription:

293           *"I put my faith in them, that's fine. If they stop they stop, I'm quite happy. They said 'do you*  
294           *mind if we stop them', so I thought no, you want them stopped, stop them."* (Patient 5, Male,  
295           77)

296 Several participants explained that although they were happy to be given information about their  
297 treatment, they understood that often they did not have a real 'choice' about taking antibiotics if  
298 they wanted to recover. Overall, there was a pervasive sense among participants that antibiotics had  
299 only been prescribed for them because they were really needed.

## 300 **DISCUSSION**

301 This study offers novel insights into how patients in secondary care are likely to respond positively to  
302 messages advocating a reduction in the use of antibiotics through the 'review & revise' approach.  
303 Within our participant group, the information leaflet was viewed as both acceptable and useful  
304 without causing undue concern. Individuals reported positive experiences regarding antibiotic  
305 prescription being changed and stopped. Many participants had prior experience or knowledge of  
306 antibiotics and resistance, and generally welcomed efforts to reduce antibiotic usage. There was an  
307 overall feeling among participants that HCPs were trusted experts who were providing the most  
308 appropriate treatment for their condition.

### 309 **Opportunities for improving patient communication and engagement with 'review & revise'**

310 Our findings suggest that informative and balanced messages are useful in helping patients  
311 understand and accept the 'review & revise' antibiotic prescribing process. Communicators can  
312 ensure that antibiotic messaging is effective in a number of ways. First, messages should incorporate  
313 evidence-based information, particularly in relation to antibiotic resistance and the safety and  
314 effectiveness of shorter courses of antibiotic treatment (23). Additionally, they should address  
315 common patient misperceptions about the mechanisms of resistance. Previous research has shown  
316 that patients appear to view antibiotic resistance as a wider public health threat, rather than a  
317 personal one, particularly if they have not taken antibiotics regularly themselves, because they do

318 not see it as something that is transferrable to others (24, 25). The current study builds on these  
319 findings by including a message about how antibiotic resistance can be passed on to family, friends  
320 and even pets. Although some patients had questions or concerns about this process and expressed  
321 a desire to avoid antibiotic treatment if possible, none reported that they would refuse antibiotic  
322 treatment if it had been deemed necessary by an HCP. This suggests that clear and open messages  
323 about the spread of resistance may act as welcome and important motivators for the acceptance of  
324 the 'review & revise' prescribing process among patients.

325 The long standing and widely held belief that it is important to complete a course of antibiotics to  
326 prevent AMR was clearly evident in the current study (24, 26). This has been challenged by evidence  
327 showing that antibiotic treatment courses are often excessive for individual patients (23) and  
328 analyses suggesting the belief contributes to overuse of antibiotics and increases selection for AMR  
329 (27). Our study explored reactions to messaging that implicitly suggested that a course of antibiotic  
330 treatment may not always need to be completed and found that patients accepted this idea. It may  
331 be that these findings are specific to our patient population who had been recently and acutely ill  
332 and not always fully aware of all aspects of their treatment. For instance, unlike primary care, a  
333 patient in secondary care may be aware that they are receiving antibiotics, but not necessarily the  
334 dosage or the length of their initial prescription. While in hospital, patients are closely monitored by  
335 HCPs and changes to treatments may be expected during this time. As a result, patients within  
336 secondary care may be more open to discussing and accepting changes to their antibiotic treatment.  
337 Primary care research in this area has developed strategies to reduce initial prescribing of  
338 unnecessary antibiotic courses (28, 29), having shown that antibiotic prescribing increases patient  
339 intentions to seek medical care for future illness, compared to either not prescribing, or delayed  
340 prescribing (30, 31). This indicates that antibiotic prescribing decisions can have longer term effects  
341 on health seeking behaviour, although the potential and feasibility of 'review and revise' strategies  
342 to reduce overuse of antibiotic in secondary care, and how to most effectively communicate this to  
343 patients, has not been investigated. Given the positive patient reactions to the concept of 'review

344 and revise' within the current study, it may be beneficial to explore how this could potentially  
345 facilitate shared clinician-patient decision making.

346 Our study also highlights the importance of testing messages with the target audience. During the  
347 development of our information leaflet, we addressed a number of questions from HCPs and the  
348 ethics committee as to the usefulness and responsibility of providing such information to patients.  
349 There was some uncertainty about whether patients would actually want an information leaflet and  
350 whether it might cause or increase any concerns about antibiotic treatment or resistance. Our  
351 findings build on existing research, which has shown that patients within secondary care are keen to  
352 receive proactive rather than reactive information about antimicrobials, allowing them to feel more  
353 confident and invested in their care (17). While HCPs may worry about patient reactions, there is a  
354 growing body of evidence to suggest that shared decision making between patient and HCP could  
355 have a role to play in educating patients about antimicrobial stewardship and reducing the  
356 inappropriate use of antibiotics (32, 25). There is also an extensive body of literature examining the  
357 relationship of trust between patient and HCP and the impact this has on elements such as patient  
358 satisfaction and treatment adherence (33, 34). Our findings are in line with earlier research which  
359 shows that secondary care patients place a high level of trust in HCPs and are confident in their  
360 ability to prescribe antibiotics accurately and only when necessary (25, 35). This trust in HCPs  
361 combined with the documented want for information and greater patient engagement (17, 35)  
362 suggests that patients are open and receptive to messages about the 'review & revise' process.  
363 Additionally, our findings are consistent with recent research indicating that patients may find it  
364 reassuring to be able to share antibiotic treatment information with family (35). Further research  
365 into the timing of messages may also be useful as preferences may vary by clinical population or  
366 setting and could alter acceptability. By testing the key components of messaging with target  
367 populations, we have the best chance of ensuring maximum effectiveness, while reducing any  
368 unintentional, negative impacts (36).

369 Finally, this study has helped to provide some recommendations for how the leaflet can be best used  
370 in the main trial. First, the main trial should make use of the final, updated version of the leaflet, as  
371 this was developed based on patient feedback as detailed in this paper. Second, study sites in the  
372 main trial should aim to have a clear plan in place detailing both who will be distributing the leaflet  
373 and when it should be provided to the patient. The current study indicated that a lack of time and  
374 resources can make it challenging to find a member of staff to distribute the leaflet. As a result, the  
375 main study sites may find it useful to address this in their planning to determine the timing and  
376 staffing that would be most feasible for their site. Finally, where it is not possible to find the  
377 resources or staffing to distribute a leaflet, main trial sites could consider providing the leaflet in  
378 another format, such as a poster that is displayed on the wards. Although this may be a less optimal  
379 format, it may still help to provide patients access to information that they are keen to receive.

#### 380 **Strengths and limitations**

381 This in-depth, qualitative study of antibiotic prescribing within secondary care has helped to  
382 highlight key themes that should be considered when designing future studies, but it does have  
383 some limitations. Recruitment proved challenging due to many participants having been hospitalised  
384 for serious health conditions. Although these conditions had improved by the time of discharge and  
385 recruitment to the study, often participants were still feeling unwell and in some cases were  
386 readmitted to hospital before an interview could take place. As a result, we may have missed a  
387 unique set of experiences related to the 'review & revise' process among those participants who  
388 perhaps went on to receive further antibiotic treatment, which could have altered their perceptions  
389 of the process. It would have been preferable to conduct interviews face to face with participants as  
390 this could potentially have yielded more in-depth responses, however this was not practical for this  
391 study because of the necessary restrictions around the recruitment process. In addition, due to the  
392 unavoidable delay between participant recruitment and interview, not all participants still had a  
393 copy of the leaflet by the time of interview. Although every effort was made to ensure that they had

394 the leaflet by sending a replacement copy by post or email, in 1 case this was not possible, and the  
395 researcher decided to read the text over the phone rather than potentially lose the study  
396 participant. As a result, it is important to consider that this could have had an impact on the  
397 responses of that participant, however they still provided valuable feedback about the leaflet and  
398 their overall experiences. It is also important to note that results of the current study are specific to  
399 patients within an acute medical unit in a UK secondary care setting and therefore, may not be  
400 generalisable to other populations outside the UK or in primary care, where there may be a very  
401 different set of clinical issues. While this feasibility study had only one hospital site, the main trial  
402 includes 36 sites from healthcare trusts across England, Wales, Scotland and Northern Ireland. Due  
403 to the differing characteristics of these varied regions, it is likely that other issues may arise that  
404 were not evident within this feasibility study. These may include elements such as the practicalities  
405 of who should give the leaflet to patients, when the leaflet should be provided and whether there is  
406 sufficient budget to print the leaflet. We would suggest that it would be useful for the main trial to  
407 further understand how and if a patient information leaflet advocating the 'review & revise' process  
408 might be perceived among other hospital populations, e.g. non-acute medical ward. It would also be  
409 beneficial to consider how a more diverse patient population across different ages and ethnicities  
410 may react to the leaflet as part of the main trial. Finally, it is possible that there may be some  
411 response bias among participants who may have felt obliged to provide positive responses regarding  
412 their perceptions and experiences.

## 413 **CONCLUSIONS**

414 Secondary care patients responded positively to clear, factual information about antimicrobials and  
415 were keen to receive an information leaflet about antibiotic prescribing and the 'review & revise'  
416 process. Messages and information about antibiotic treatment coming from HCPs were seen as  
417 welcome and trustworthy, as well as being in the best interest of the patient. As such, encouraging  
418 HCPs within secondary care to engage patients in greater communication and information provision

419 could provide great advantages in the drive to reduce antibiotic use. Pre-testing messages about  
420 antibiotic prescribing and resistance is vital to dispelling any misconceptions either around  
421 effectiveness of treatment for patients, or perceptions of how messages may be received. Although  
422 it is not feasible to pre-test all messages, for all populations, it remains important to test key  
423 components of messaging in order to ensure maximum optimisation and intervention effectiveness.

424

425 **List of abbreviations:** HCP, Healthcare professional; AMR, antimicrobial resistance; NHS, National  
426 Health Service; ARK, Antibiotic Review Kit; RCT, randomised controlled trial; PPI, public patient  
427 involvement; AMU, acute medical unit; GP, general practitioner

#### 428 **DECLARATIONS**

##### 429 **Ethics approval and consent to participate**

430 Ethical approval was obtained from the South Central Oxford C Research Ethics Committee (REC  
431 reference: 17/SC/0034), including feasibility, pilot and main trial phases. Written consent was  
432 obtained by a HCP for each individual participant following their expression of interest in the study.

##### 433 **Consent for publication**

434 The study consent form included an item stating that the participant agreed to the use of  
435 anonymised quotes in any research reports or publications. Each participant signed this form.

##### 436 **Availability of data and material**

437 The data that support the findings of this study are available on request from the corresponding  
438 author (FM). The data are not publicly available due to them containing information that could  
439 compromise research participant privacy/consent.

##### 440 **Competing interests**

441 All the authors declare no conflict of interest.

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449 **Author's contributions**

450 FM wrote the first draft of the paper, while all authors contributed to and approved the final  
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