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Perception and views about individualising antibiotic duration for respiratory tract infections when patients feel better: a qualitative study with primary care professionals

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ABSTRACT

Background Evidence shows a high rate of unnecessary antibiotic prescriptions for respiratory tract infections (RTIs) in primary care. There is increasing evidence showing that shorter courses for RTIs are safe and help in reducing antimicrobial resistance (AMR). Stopping antibiotics earlier, as soon as patients feel better, rather than completing antibiotic courses, may help reduce unnecessary exposure to antibiotics and AMR.

Objectives The aim of this study was to explore the perceptions and views of primary care healthcare professionals about customising antibiotic duration for RTIs by asking patients to stop the antibiotic course when they feel better.

Design Qualitative research.

Setting and participants A total of 21 qualitative interviews with primary care professionals (experts and non-experts in AMR) were conducted from June to September 2023. Data were audiorecorded, transcribed and analysed thematically.

Results Overall, experts seemed more amenable to tailoring the antibiotic duration for RTIs when patients feel better. They also found the dogma of 'completing the course' to be obsolete, as evidence is changing and reducing the duration might lead to less AMR, but claimed that evidence that this strategy is as beneficial and safe as fixed courses was unambiguous. Non-experts, however, believed the dogma of completing the course. Clinicians expressed mixed views on what feeling better might mean, supporting a shared decision-making approach when appropriate. Participants claimed good communication to professionals and patients, but were sceptical about the risk of medicalisation when asking patients to contact clinicians again for a check-up visit.

Conclusions Clinicians reported positive and negative views about individualising antibiotic courses for RTIs, but, in general, experts supported a customised antibiotic duration as soon as patients feel better. The information provided by this qualitative study will allow improving the performance of a large randomised clinical trial aimed at evaluating if this strategy is safe and beneficial.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ Interviews were conducted until sufficient data were collected to develop well-supported themes. Two experienced qualitative researchers collected, analysed and interpreted the data, ensuring that different approaches and interpretations were considered.
⇒ We mainly considered experienced primary care physicians working in primary care but also included other types of professionals, such as nurses, doctors working in out-of-hour services, family medicine trainees and policymakers, in an attempt to broaden the scope of our interviewees.
⇒ Despite including doctors with high and low interest in rational use of antibiotics and antimicrobial resistance, the latter were under-represented in our sample as we explored the views of clinicians aimed at starting a clinical trial evaluating the benefits and safety of customising the length of antibiotic treatment for respiratory tract infections (RTIs).
⇒ The possibility of bias cannot be ruled out as the data collection used two methods: conducting focus groups with experts and conducting individual interviews with other participants.
⇒ The strategy of shortening and tailoring antibiotic duration for infections other than RTIs was not evaluated in this qualitative study as RTIs account for at least 60% of the antibiotics prescribed in primary care and the use of shorter durations in other infections is more common.

INTRODUCTION

The optimisation of antimicrobial therapy remains an ongoing challenge that requires an intelligent utilisation of all tools and resources at our disposal. Unnecessary antibiotic use significantly contributes to increasing antimicrobial resistance (AMR), medical costs and the risk of drug-related adverse events.[1] Studies have showed strong evidence of correlation between prescription of

antibiotics and selection of resistant bacteria.[2] Ensuring prudent antimicrobial utilisation is key to an effective response to this huge problem, mainly in primary care, in which nearly 80% of all antibiotics are issued.[3] The most frequent conditions for which antibiotics are given are for respiratory tract infections (RTIs), which account for more than approximately 60% of the prescriptions in this setting.[4 5] One strategy to reduce the selection of AMR is by decreasing the use of antibiotics, as these conditions are usually self-limiting and antibiotics have little or no clinical benefit in most cases, unless there is a serious underlying comorbidity. Another strategy is to shorten the length of the antibiotic courses. There is currently great debate as to whether short-term is better than long-term antibiotic therapy.[6] Some systematic reviews comparing short course versus standard course antibiotic therapies for RTIs have been published, with shorter antimicrobial therapy durations (of 5 days) being as effective as longer durations for some of RTIs. Despite this evidence, most clinicians still use standard or longer courses.[7]

In light of the association between antibiotic prescribing and AMR, many interventions have been studied in order to promote more prudent antibiotic prescribing. Effective uptake of new evidence in routine clinical care is challenging, and many barriers and enablers have been identified.[8] The act of completing the antibiotic course is a well-known long-standing dogma regarding antibiotic use, although inadequately supported by clinical evidence in primary care. Individualising antibiotic duration and asking the patient to cease the course as soon as symptoms improve may help reduce unnecessary antibiotic exposure.[9] Our group is planning to carry out a randomised clinical trial aimed at evaluating the benefits and safety of customising antibiotic course duration in each patient asking them to discontinue the antibiotic course as soon as they feel better with or without a check-up visit for clinical assessment. Before the inception of this study, we planned the present qualitative study, as this methodology can contribute to the optimisation of the content, quality, delivery and acceptability of the trial intervention.[10] The aim of this study was to explore primary care healthcare professionals' perceptions and views about tailoring antibiotic duration for RTIs as soon as patients feel better.

METHOD

Study design

We chose a qualitative study design applying semistructured interviews with primary care healthcare professionals who had experience with the management of RTIs. The qualitative design allows openly exploring the tailoring of antibiotic duration for RTIs, given that this is an emerging strategy aimed at reducing the exposure to antibiotics in primary care.

Recruitment and sampling

Professionals were recruited in Catalonia. Different types of healthcare personnel, such as general practitioners, nurses, general practitioners working in primary care out-of-hours (OOH) services, family medicine trainees and policymakers, were included if they had managed or were currently managing RTIs in general practice. We chose members of the study group on infectious diseases of the Catalan Society of Family Medicine, who are considered experts in the rational use of antibiotics and are more sensitive to the problem of AMR, and some doctors who are not members of this group, who were recruited through research team contacts. Potential participants were provided with study information. All participants gave verbal consent, with written records retained. Participants were given free snacks and beverages for their time.

Data collection

All the expert professionals, residing in the same city and familiar with each other, participated in one focus group, while the rest of the participants underwent face-to-face interviews (table 1). Two researchers collected data using semistructured topic guides (see online supplemental appendix S1). Clinicians were asked about their experiences of managing RTIs with short courses and views on tailoring antibiotic duration for RTIs. Data were collected from June to September 2023 and subsequently analysed.

Analysis

Transcripts were checked for accuracy against the interview recording and were then anonymised and analysed using thematic analysis. We followed the six iterative steps of thematic analysis: (1) familiarisation with the data (2) generating initial codes relevant to the research question, (3) searching for themes by grouping the codes identified, (4) reviewing themes in relation to coded data, (5) defining and naming themes and (6) producing the report.[11] Two researchers (AM and CL) carried out the analysis as primary coders mainly using inductive and semantic coding aided by NVivo V.12 software. Constant comparison was used to compare data across interviews, to identify similarities and differences between participants and contexts, and to identify deviant cases. We systematically coded meaningful units of text which were related to the research questions from the data using a line-by-line approach. Codes were categorised, grouping similar codes together.

Patient and public involvement

No patients were involved in this study. We plan to carry out another qualitative study on the same topic with patients.

RESULTS

Twenty-one primary care professionals were interviewed from June to September 2023. Most participants were female (n=13), with a median age of 41 years (table 1).

All participants expressed both positive and negative views about tailoring antibiotic duration in patients with a

Table 1 Sample characteristics (n=21)

Characteristics	Observations
Interview length, min, range (median)	35–90 (76)
Professional role	
GP working in primary care (age)	11, 5 experts (1–5), non-experts (6–11)
GP1: male (50)	
GP2: male (64)	
GP3: female (42)	
GP4: male (51)	
GP5: female (50)	
GP6: female (43)	
GP7: female (40)	
GP8: male (39)	
GP9: female (31)	
GP10: female (29)	
GP11: female (33)	
GP working in OOH services	3 (all experts)
OOH1: male (45)	
OOH2: female (41)	
OOH3: male (57)	
Nurses	3, expert (1), non-experts (2–3)
Nurse1: female (35)	
Nurse2: female (32)	
Nurse3: female (29)	
Family medicine trainee	2, non-experts
Trainee 1: male (24)	
Trainee 2: female (26)	
Policymaker	2, experts (both previous GPs)
Policymaker 1: male (44)	
Policymaker 2: female (51)	
Age, range (median)	24–64 (41)
Years in the current role, range (median)	1–41 (13)
Years of clinical experience, range (median)	1–42 (22)
Sex	
Female	13
Male	8

GP, general practitioner; OOH, out-of-hours.

RTI when they feel better. A total of five themes emerged (table 2).

Theme 1: shorter courses for RTIs

Most experts interviewed, including the expert doctors, nurses and doctors working in OOH services considered that the longer the antibiotic regimen, the greater the resistance created, as this facilitates greater contact between the microorganism and the antibiotic, thereby producing more potential for the generation of AMR, as well as more side effects. Most participants agreed that the new clinical guidelines recommending these shorter regimens (5 days in most RTIs) help doctors to foster more rational antibiotic use. They also claimed that these shorter courses help patients adhere to the medication plan compared with the standard courses.

> Shorter courses cause fewer side effects than standard courses. In the light of new evidence, it is good that shorter antibiotic courses of five days have been endorsed by clinical guidelines, as this promotes their use. I imagine as well that these shorter courses might cause less AMR than longer courses and enhance drug adherence. So, I think we should always prescribe five-day antibiotic courses (policymaker, 1).

> We are concerned about resistance as a global threat. If the ecological studies show that there must be shorter courses, then we must give shorter courses. The dogma of completing an antibiotic course should be debunked (trainee, 1).

Several antituberculous drugs are taken simultaneously in tuberculosis and it is non-standard to use shorter courses. It should be clear that this new paradigm might only be applied in non-tuberculous RTIs. Similarly, some clinicians claimed that not all RTIs can be treated with shorter courses. The role of the guidelines has improved the progressive utilisation of these shorter courses.

> We can recommend short courses as stated in the updated clinical guidelines but there is still the need for further research. Some infections can be treated with only five days, but we know that streptococcal pharyngitis requires a longer therapy, so we cannot use five days of antibiotic treatment for a streptococcal pharyngitis (GP, 8).

Most non-experts, as well as some expert GPs, posed some doubts about using a 5-day antibiotic regimen for serious RTIs and claimed that standard courses should still prevail as there is not much evidence about shorter courses. Some non-experts also preferred the use of broad-spectrum antibiotics for these patients.

> I don't know, maybe I am more reluctant to use a shorter course for pneumonia. The updated guidelines recommend five days but there is an asterisk; if the patient is not clinically or hemodynamically stable, consider lengthening the duration of antibiotics or revisit the patient. So, I continue recommending seven days and if possible, I continue relying upon broad-spectrum antibiotics for these infections (GP, 11).

Theme 2: changing evidence by tailoring antibiotic duration in RTIs

There were divided thoughts about the dogma of completing the antibiotic course. Experts, in general,

Table 2 Positive and negative views about shortening and tailoring antibiotic duration in patients with respiratory tract infections

Themes	Positive views	Negative views
Shorter courses for RTIs	► Agreement about using shorter antibiotic courses, as this might result in less AMR (GP1, OOH3, PM1). ► Preference of shorter courses as this is associated with fewer side effects (GP1, GP4, OOH3, PM1). ► Shorter therapies enhance patient adherence (PM2, trainee1). ► Most guidelines recommend shorter courses, and this helps clinicians to use them (PM2, OOH3).	► This approach is applicable only for non-tuberculous RTIs (OOH3). ► There is still some controversy regarding shorter therapies in some RTIs (GP4, GP8, OOH3). ► Many clinicians are reluctant to use 5-day courses in pneumonia (GP11, PM1, trainee2). ► Broad-spectrum antibiotics should be chosen if shorter courses are given (trainee2).
Changing evidence by tailoring antibiotic duration in RTIs	► The dogma of completing courses should be revised (GP2, GP3). ► Strategy already used by some patients who stop antibiotic courses when feeling better (GP1, GP4, GP5). ► The increasing use of short courses in RTIs paves the way to tailor antibiotic duration to the patient's needs (OOH1). ► Agreement about tailoring antibiotic duration if evidence-based, as this would even result in less AMR than fixed short courses (OOH3). ► Guidelines must play a crucial role in promoting evidence-based adoption of this strategy (GP1, trainee1).	► Belief in the dogma of completing the course (trainee2, nurse2). ► Most HCPs are unfamiliar with this strategy (trainee2, nurse3). ► Unambiguous evidence is necessary to ensure the safety of this strategy, not leading to a greater number of complications and hospitalisations (OOH3, trainee2). ► Education for HCPs and the general population is needed in order to reverse the widespread long-standing dogma that antibiotic course shortening leads to more AMR (GP5, nurse2).
Defining the concept of 'feeling better' and shared decision making	► Since there is subjectivity in this definition, most professionals consider that patients must decide when they are better (PM2, OOH2, nurse2). ► Most HCP prefer asking patients to stop a course rather than asking them to start a course if they do not feel better (delayed antibiotic prescribing) (GP1). ► When in doubt, a short course would generally be preferred to not administering antibiotics (GP5) ► A shared decision-making approach with patients is necessary (GP1).	► Not all patients may be comfortable making the decision to stop antibiotic treatment when they feel better (GP5). ► Certain criteria, such as normal temperature, pulse oximetry and respiratory rate, must be met, although a clear definition is lacking (PM1).
Balancing pros and cons of tailoring treatment duration .	► Both GPs and nurses are best positioned to personalise antibiotic duration during consultations due to their familiarity with patients (GP1, GP3). ► HCPs face no risk that this practice will lead to an increase in the number of episodes of unnecessary antibiotic therapies (PM1, GP1, GP2).	► Sceptical to reduce antibiotic duration in pneumonia and many COPD exacerbations without reevaluation (GP4, trainee2). ► Doubts arise when bacteriological eradication is not achieved in specific RTIs (PM1, GP1, GP9). ► Sceptical about shortening antibiotic duration in elderly patients, those with weakened immune system, comorbidities, or underlying lung diseases (OOH3, OOH2, GP4, trainee2). ► Fear that this strategy could lead to medicalisation and increased workload in the future (GP4, PM2, trainee2).

Continued

Table 2 Continued

Themes	Positive views	Negative views
Determining the necessity of additional visits and testing while customising the duration of antibiotic treatment	► In potentially non-serious RTIs, patients should be informed to discontinue antibiotic treatment once they feel better, without the need for a follow-up consultation (PM1, GP1). ► Nurses can play an important role in follow-up visits for potentially serious RTIs and persuading patients to stop antibiotics if all parameters are normal (PM2, nurse1).	► In potentially serious infections, it is necessary to schedule an additional appointment for clinical assessment, CRP or lung ultrasound when patients feel better (PM1, PM2, GP3, GP4, GP6). ► Training is essential to determine when to order and how to interpret CRP values (GP1, trainee1). ► Sub-therapeutic doses must be avoided if widespread implementation of this practice occurs (GP1). ► Antibiotic boxes should contain fewer tablets (GP5, trainee2).

AMR, antimicrobial resistance; COPD, chronic obstructive pulmonary disease; CRP, C reactive protein; GP, general practitioner working in primary care; HCPs, healthcare professionals; OOH, general practitioner working in out-of-hours services; PM, policymaker; RTI, respiratory tract infection.

considered that this dogma should no longer be promoted. Non-experts considered the dogma to still prevail.

> Two years ago, in university, we were all told to complete all antibiotic courses to reduce AMR. So, I do not understand the assertion of the other way round. When I give an antibiotic, I tell patients to complete the whole antibiotic course even if they feel better and I advise them not to skip any dose as this might spur AMR (trainee, 2).

Most professionals were unfamiliar with shortening and individualising antibiotic duration when patients feel better. However, the experience gained from shorter courses in other non-RTIs has helped to revise the dogma of using fixed durations among clinicians. Clinicians expressed that evidence is continuously changing in medicine and they also highlighted that not all RTIs behave in the same way. Many interviewees acknowledge that both clinicians and patients will need to be educated as they have always heard that they must finalise an antibiotic regimen for an RTI and changing a dogma takes time.

> As Harrison's Internal Medicine textbook mentions in the preface, 'medicine is an everchanging science' and evidence is always changing. If stopping the antibiotic course when patients feel better is as safe and effective as fixed standard durations, I will be delighted to endorse this policy in my consultation (GP, 5).
>
> I absolutely agree with shortening the antibiotic courses to the reality of each patient, but it is also true that culture needs to be created. Education is needed for us and the general population in order to reverse the widespread long-standing belief that shortening an antibiotic course leads to more AMR (nurse, 2).

Most professionals noted that a significant percentage of patients tend to discontinue antibiotic treatment once they feel better. In such cases, if the patients are indeed in good health, doctors consider it illogical to reintroduce the antibiotics. Participants also claimed that if this strategy were promoted, reintroducing an antibiotic course when patients feel better makes no sense.

> Many patients no longer take long antibiotic courses; for example, in pharyngotonsillitis, how many patients follow the 10-day regimens that we recommend? In two or three days the patients are perfect and stop taking the medication (GP, 3).

All the experts interviewed agreed to stop antibiotic treatment in adult patients without significant comorbidity and without underlying respiratory conditions. However, if patients discontinue the antibiotic regimens given prescribed, it is necessary to ask why they do so.

> Patients should be asked why they stopped taking the treatment. Due to a side effect of the antibiotic, interactions of the antibiotic with other drugs, or has it been stopped because the treatment was not working? Then you must consider the age of the patient. Is the patient immunocompetent or not? Is this a new RTI in an otherwise healthy individual or an infection in a patient with an underlying respiratory problem? Why they stopped treatment is not an irrelevant issue, it is of extreme relevance. Personally, I am in favour of shorter courses, but patient treatment needs to be individualized (GP, 2).

All the participants advocated studies demonstrating that curtailing the duration of the antibiotic course as soon as patients feel better is safe. Doctors claimed for clear evidence to be sure that this will not lead to clinical worsening, a greater number of complications, an

increase in hospital admissions or more contacts with the health system in general.

> Guidelines might endorse this strategy, provided studies show that it is effective and safe. There are two steps here; one is the study that shows that pneumonia can be treated in three days, for example, and the other is to convince yourself, as a clinician, that I can tell the patient that when they feel better, they can stop treatment (OOH doctor, 3).

This evidence should determine the minimum duration of antibiotic treatment for different RTIs if patients adhere to this strategy of tailoring antibiotic treatment.

> At present, we do not know the minimum duration of an antibiotic course. We do not know whether it is one, two, three, or more days, although there is some evidence for two or three days, but further studies are needed (OOH doctor, 1).

As soon as this evidence is available, it should be mentioned in the guidelines. Some participants admitted, however, that not all professionals read the protocols, and imaginative strategies are necessary so that once we have this evidence, we can individualise treatment.

> We can recommend short courses, but it takes a long time to apply the protocols. Guidelines must be the basis for you to disseminate the best evidence. You must be imaginative so that they are read by healthcare professionals. A good way is to involve them in training courses, which are based on the explanation of the guidelines; the professional learns the guideline and also gets recognised, improving their curricula. It's a formula that I really like (GP, 1).

There were comments on the need to carry out an ample study, involving many primary care professionals, aimed at evaluating the effectiveness and safety of the strategy of tailoring antibiotic treatment in RTIs.

> It is much more effective when you do a study and see for yourself that shortening the antibiotic treatment is safe. It is much better for further implementation (OOH doctor, 1).

Theme 3: defining the concept of 'feeling better' in RTIs and shared decision making

The interpretation of 'feeling better' varies among individuals. For some participants, it was important to establish a clear understanding of what 'feel better' means. For some, it implies returning to their pre-infection state of well-being, while for others, it simply entails the alleviation of specific worrisome symptoms. Professionals need to communicate this information effectively to patients to determine when they can discontinue treatment. The definition of 'feeling better' encompasses both objective and subjective aspects. Clinical indicators such as the absence of fever, rapid breathing and shortness of breath (normal pulse oximetry) are important, but there is a considerable degree of subjectivity when it comes to assessing other symptoms.

> If patients are free from significant discomfort, have no fever, and feel well, it is evident that they have improved. When some patients come to the consultation and tell you that they have already stopped treatment, they often have not been taking treatment for a day or two. If the patient has no fever and the primary symptoms that prompted the visit (such as dyspnoea, cough, tachypnoea, or mucopurulent sputum) have subsided, re-introducing the treatment makes no sense (nurse, 2).

Other participants considered, however, that it is not so important to ask patients when they are better. They advocated empowering the patient to make decisions about discontinuing antibiotic treatment, in the same way as when we propose delayed antibiotic prescribing. However, these professionals prefer conveying a positive message, such as 'when you feel better, stop the treatment' rather than a negative one like 'if you don't feel better in a few days, start taking the antibiotic'. In cases of doubt, clinicans would prefer a short course rather than abstaining from prescribing antibiotics.

> Patients are aware of their improvement, without exception. Personally, I favour this approach over the practice of delayed antibiotic prescribing. It conveys a positive message: when you feel better, discontinue. In contrast, delayed antibiotic prescribing conveys a negative message: if there is no improvement, start taking it. So, I prefer this strategy (GP, 1).

This approach entails a shared decision-making model, providing a framework for information exchange that informs a joint decision between the clinician and the patient. Patients are delegated the responsibility to discontinue antibiotic treatment once they feel better. However, not all patients are willing to engage in such discussions, such as older individuals, who often prefer a more passive role in deciding their treatment.

> I think there is no need to define it. Patients are generally smart. If patients are unwell, they will not stop a treatment. I believe that feeling better must be defined by each patient, and we must respect patients when they tell us that they feel better (OOH doctor, 2).

Theme 4: balancing the pros and cons of tailoring the duration of antibiotic treatment in RTIs when feeling better

Experts and some non-experts agreed to reduce the duration of the antibiotic regimen and tailoring them in most RTIs, such as acute otitis media or acute rhinosinusitis. However, most felt sceptical about reducing antibiotic duration in pneumonia, especially in patients who present a greater risk of complications, such as older individuals, persons with immunosuppression and patients

with significant comorbidities. In these cases, caution was claimed before discontinuing antibiotic treatment.

> I distinguish two types of patients. In young or healthy patients with pneumonia I agree to shorten the treatment to three days, but not in patients with unhealthy lungs (GP, 4).

Participants emphasised the significance of bacterial eradication when deciding to tailor the duration of antibiotic therapy. Nearly all the experts agreed to stop an antibiotic treatment if the patient feels better and if there is no risk of not eradicating the microorganism. On the other hand, they did not agree to stop the treatment because the patient is better, but the microorganism is not eradicated, as this can be associated with a greater risk of relapse. In addition, participants asserted that subtherapeutic doses should not be administered when eradication of the microorganism is necessary.

> As a clinician, I am more interested in clinical effectiveness than bacteriological eradication, as long as this does not result in more relapses. I distinguish between infections and infections. For example, when it comes to a pneumonia I am interested in clinical effectiveness, while in pharyngotonsillitis I am more interested in bacteriological eradication. Why? I think it's crystal clear; I don't want the patient to come back again after a few weeks with another episode of pharyngotonsillitis because the germ causing the infection has not been eradicated. What about pharyngotonsillitis carriers? How important are carriers? (GP, 1).

It was made clear that this strategy of tailoring the duration of the antibiotic regimen can only be done in primary care when the doctor has a good understanding of the patient's medical history.

> I believe that we can recommend the three-day courses to patients because we have an intuition of what will go well. This intuition cannot be applied by the pulmonologist, but we are family doctors, we are the doctor of these patients, and we know them (GP, 3).

All professionals agreed that this strategy will not increase the number of antibiotic prescriptions for RTIs. When doctors prescribe antibiotics, they do so because they really think patients need them. The overuse of antibiotics in treating mainly viral infections should be attributed to poor training.

> The problem that so many episodes of acute bronchitis, for example, are still treated with antibiotics is due to a lack of training. If you go to any hospital with a fever and wheezing, they give you an antibiotic. There is a clear training problem. Changing this practice is challenging, but it is believed that individualized and shortened antibiotic courses will not result in increased prescription rates (GP, 1).

However, some professionals—both experts and non-experts—considered that customising the antibiotic duration can become a problem since some expressed concern about a possible medicalisation of this strategy.

> It should be noted that the use of rapid tests or lung ultrasound tests must be balanced to avoid excessive medicalization of the strategy. Ensuring that unnecessary repeated testing is avoided is essential (GP, 4).

Theme 5: determining the necessity of additional visits and testing while customising the duration of antibiotic treatment

In general, expert participants were comfortable instructing patients to stop antibiotic treatment once they have recovered from RTIs that are not initially severe. They were sceptical about asking everyone with RTIs to return to the practice once they are better and thought that in most cases, they only need clear information on when to stop antibiotic treatment.

> It depends on the infection; for pneumonia you will ask the patient to come back, for an otitis or a rhinosinusitis you will not tell the patient to come back, or at most, you can make a phone consultation to find out how they are; in most cases you tell them to simply stop the treatment when they feel better (GP, 3).

However, in lower RTIs that might potentially become complicated, such as pneumonia or exacerbations of chronic obstructive pulmonary disease (COPD), professionals recommended asking patients to return for a follow-up consultation to monitor clinical signs once they have improved. Some professionals also suggested considering other objective measures of inflammation, such as the measurement of C reactive protein (CRP) levels, in addition to clinical variables for these potentially serious infections.

> If we want to tailor antibiotic duration for an uncertain lower RTI, such as pneumonia or a COPD exacerbation, it would be better to have a CRP determination the day of the consultation and another one when the patient feels better. If on the first day, they have a CRP of 120 mg/L, we must suspect pneumonia, and after four days, when the patient is better, the clinical variables are normal, and you perform a CRP test and it is below 20 mg/L for example, I would be very confident and advise the patient to stop the antibiotic regimen, since the inflammation has normalized (GP, 1).

Nurses might play an essential role in this strategy. In many healthcare centres, nurses often handle RTIs, and they could be responsible for monitoring clinical variables and performing CRP tests when patients feel better. If abnormalities are detected during lung auscultation or if some specific criteria are not met (such as fever, low oxygen saturation, dyspnoea or underlying bronchopathy), the patient is referred to a doctor for further evaluation. Although there is a lot of variability among centres

and depending on the expertise of the nurse, nurses generally solve most RTIs and doctors do not see these patients, and, thus, they could also be responsible for tailoring antibiotic durations.

> If we see that the auscultation is abnormal, we refer it to the doctor for evaluation. It also depends on the clinical symptoms and signs, if there is fever or not, pulse oximetry, if there is dyspnoea or not, or if the patient has an underlying bronchopathy. The COVID-19 pandemic has given us more confidence in general as to how to manage infectious diseases. Before the pandemic, our resolution capacity for RTIs was low and now it is much higher. Therefore, most nurses will agree to carry out these control measurements when patients feel better (nurse, 1).

They all agreed that CRP rapid testing should be recommended when a professional has doubts about when a lower RTI might be serious. With the knowledge that CRP values are lower than 20 mg/L in three quarters of the cases, antibiotic treatment can be saved in these cases. However, many professionals showed reluctance to incorporate this rapid test unless it is accompanied by good training, and when to indicate and how to interpret it.

> It is necessary to avoid what is happening in the Nordic countries where the test is overused, and outside the recommended indications. You should be very careful and use it in cases of doubt and in potentially serious infections (GP, 4).

Some professionals mentioned the potential role of lung ultrasound as an alternative or complementary method to CRP rapid testing. However, further research is needed to assess the usefulness of lung ultrasound and determine if it can be used alongside clinical variables to guide the decision of when a patient can stop antibiotic treatment. Serial monitoring of CRP values and ultrasound findings at 24, 48 and 72 hours are needed to help better understand how CRP values and ultrasound findings change in RTIs.

> I think that lung ultrasound could be a good substitute for CRP or even a complementary test to CRP, since for the time being and thanks to COVID-19 there are now more professionals trained in ultrasound than CRP and shortening the duration of antibiotic treatment can be guided by performing an ultrasound test (policymaker, 2).

It was suggested that it would be beneficial to start marketing antibiotic packs with fewer pills, such as nine pills of amoxicillin or amoxicillin with clavulanic acid, or to provide the exact number of pills as is done in some other countries. This type of strategy should coexist with the implementation of short regimens, such as the established 5-day regimens for most RTIs. In any case, professionals agreed that it is important to inform patients accurately about the required dosage, but this will depend on the available evidence, and what to do with the doses that have not been used.

> It is necessary to adapt the number of tablets according to the exact duration, but this is not of interest to promoters. There is a lot of competition behind this, and it also depends on the regulatory bodies. But it is also true that we should recommend more and more that patients return the leftover doses of antibiotics or take them to the pharmacy offices; here the role of pharmacists is fundamental (GP, 5).

DISCUSSION

Summary of main fundings

Despite being inadequately supported by evidence, the act of completing the antibiotic course is a dogma that has widely prevailed so far, whereas customising the antibiotic duration and asking the patient to cease the course as soon as symptoms improve may help reduce unnecessary antibiotic exposure. The present study found that, in general, experts were amenable to this strategy, mostly because they acknowledged that evidence is continuously changing and reducing antibiotic courses would lead to less AMR than fixed antibiotic courses. However, they demanded clear and unambiguous evidence that this strategy is beneficial and safe along with a good communication to both professionals and patients. They asked for a nurse check-up control visit with clinical assessment and/or performance of point-of-care CRP rapid testing or lung ultrasound in potentially serious situations, older patients, presence of comorbidities, weakened immune status or underlying lung diseases. Professionals considered that this strategy could facilitate shared decision making when appropriate and found it more suitable than delayed antibiotic prescribing. Experts thought that customising antibiotic duration for the different RTIs as soon as patients feel better contradicts the advice to complete the course whereas non-experts were against this strategy as it refutes a long-standing dogma that is still taught at the universities and is recommended by specialists. Participants believed that the recent endorsement of shorter courses for RTIs will facilitate individualising and further shortening the duration for some RTIs, but they were concerned about the risk of medicalisation when asking patients to contact clinicians again for a check-up visit.

Comparison with existing research findings

This is the first study aimed at exploring the views of primary care clinicians regarding shortening and individualising antibiotic duration for RTIs when patients feel better. Consequently, no comparable articles are available for reference. However, during the writing of this article, we encountered a new publication by UK researchers addressing the reduction of antibiotic courses for urinary tract infections, based on an improved condition of patients, with a similar approach to our

study.[12] Similarly, most experts were against the perception that not completing or shortening antibiotic courses contributes to AMR. However, non-experts still consider that this statement is still true, a belief stemming from the notion, reinforced by public health messages, that incomplete eradication of pathogens leads to the resurgence of resistant infections. Nonetheless, the concept of 'target selection' as a threat has been questioned, mainly in the primary care setting. There is no evidence that taking antibiotics beyond the point at which a patient's symptoms are resolved reduces AMR. To the contrary, the focus has shifted to the risks of 'collateral selection' occurring during antibiotic treatment, which can be mitigated through shorter antibiotic exposure.[13 14] Specifically for pneumonia, studies have shown that longer courses of therapy result in more emergence of AMR,[15 16] which is consistent with everything we know about natural selection, the driver of antibiotic resistance, and thus, the longer patients and the environment are exposed to antibiotics, the greater the selective pressure driving resistance.[17] Since 2017, the WHO has abandoned this unproved dogma of completing courses.[18] The findings of the current study align with the shift away from this instruction and advocate personalised guidance.

Many experts, including some general practitioners, OOH service doctors, policymakers and nurses emphasised the significance of prescribing or taking antibiotics for the minimal optimal duration. However, as mentioned by some participants, a more comprehensive understanding of how AMR evolves in different RTIs and its correlation with antibiotic course lengths require further research. Evidence demonstrates that stopping the antibiotic course for some lower RTIs at days 2–3 is effective and safe. A clinical trial in the early 2000s demonstrated that 3 days of protocol-specified antibiotics were as efficacious as longer courses of therapy for hospitalised patients with mild to moderate community-acquired pneumonia who already presented clinical improvement, which accounted for 70% of the sample.[19] Another randomised controlled trial of levofloxacin once daily for 2 days versus 7 days for COPD exacerbations concluded that the shorter course was non-inferior to 7 days with respect to cure rate, need for additional antibiotics, exacerbation-free intervals, recurrent exacerbations and hospital readmission.[20] More research on this topic is obviously needed.

Mitigating the spread of AMR by more prudent antibiotic use is a public health priority since the utilisation of unnecessary antibiotics continues to be very high.[21] Prioritising judicious antibiotic use to curtail the spread of AMR is of paramount importance in public health. The aim of the present qualitative study is based on the principle of 'shorter is better', initially conceived one decade ago[9]: standard antimicrobial therapy durations in medicine are not based on controlled studies. Hence, randomised clinical trials are adequate to challenge this long-standing dogma of 'completing the antibiotic course', establishing a new treatment duration standard. The evidence shows that persuading doctors, mainly general practitioners, to refrain from prescribing antibiotics for RTIs is arduous. However, encouraging them to prescribe a minimum duration of therapy supported by randomised clinical trials might be more feasible as shown in this study. An important point is that conventional stewardship strategies aimed at patients not requiring antibiotics do not aid those who truly need them but receive treatment for an excessive duration. Conversely, as Spellberg puts it, administering antibiotics for shorter periods benefits both groups.[9]

Strengths and limitations

We accept that our study has several limitations. This qualitative study aimed at exploring the views of primary care professionals about customising antibiotic duration for common RTIs and the potential benefits and barriers of this novel strategy was specifically carried out in only one region, in Southern Europe, in which the rate of antibiotic consumption is high. We do not know if other views could have been observed in areas with a low rate of antibiotic prescribing for RTIs, but we included experts who prescribe rational use of antibiotics and professionals sensitive to the problem of AMR. We specifically focused on primary care clinicians working in publicly funded clinics as this is where most antibiotic prescribing occurs. We included doctors experienced in managing RTIs, such as doctors working in primary care practices but also clinicians in primary care OOH services, policymakers formerly working as general practitioners and young trainees in family medicine. We did not limit our scope to only clinicians from a range of clinics to reflect the breadth of antibiotic prescribing practice in this region, and we also recruited nurses as these professionals are now mainly responsible for managing RTIs in many European countries. Potential bias cannot be ruled out since data collection involved two methods: focus groups with experts and individual interviews with the other participants. However, this approach was adopted for practical feasibility.

Our convenience sampling may have introduced selection bias in favour of prescribers who were interested in the rational use of antibiotics. Despite including doctors who were more and less aware of the problem of AMR, the latter were under-represented in our sample as we aimed to explore the views of clinicians aimed at starting a clinical trial to evaluate the benefits and safety of customising the length of antibiotic treatment for RTIs. However, our findings also suggest that many professionals were not familiar with this innovative strategy aimed at reducing antibiotic exposure. Another limitation is that we only explored the strategy of customising antibiotic duration for only RTIs, not for other types of infections. RTIs account for at least 60% of the antibiotics prescribed and there is more uncertainty about the use of shorter antibiotic durations in these infections.

The study also has some strengths that should be emphasised. Interviews were conducted until sufficient data were collected to develop well-supported themes.

Two experienced qualitative researchers collected, analysed and interpreted the data, ensuring that different approaches and interpretations were considered.

Implications for clinical practice, policy and future research

The use of customised antibiotic durations for RTIs may affect a great proportion of unnecessary antibiotic prescribing because there are important social determinants of prescribing that seem to override updated guideline-driven prescribing, which recommends shorter therapies for most of these infections. Multifaceted interventions which target multiple influences on clinician prescribing behaviour are therefore likely to be needed to improve patient outcomes while minimising risk from different patterns of antibiotic prescribing. One of these strategies is aimed at tailoring the prescribing duration for RTIs to the real needs of each individual.

Further studies aimed at evaluation of the benefits and safety of this strategy are needed in primary care settings to test the clinical and cost-effectiveness of individualising the duration of the antibiotic course to each patient with an RTI. These interventions will also need to take the perspectives of patients into account for them to achieve maximum benefit.

In conclusion, primary care healthcare professionals expressed both favourable and unfavourable opinions regarding individualising antibiotic duration for RTIs based on patient improvement. However, the overall stance of experts supported endorsing a personalised antibiotic duration as soon as patients improve. This recommendation might also include a follow-up appointment, depending on the severity of the infection. The insights gained from this qualitative study will enable improvement of the setup of a randomised clinical trial aimed at determining the safety and advantages of this innovative and particular strategy.

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