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The role of locum GPs in antibiotic prescribing and stewardship: a mixed-methods study

Running title: Locum GPs and antibiotic prescribing

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Abstract

Background: Most antibiotics are prescribed in primary care. Locum or sessional general practitioners (locums) are perceived as contributing to higher prescribing and may face barriers to engaging with antimicrobial stewardship (AMS).

Aim: To identify how locums' antibiotic prescribing compares to other general practice prescribers, and how they perceive their role in antibiotic prescribing and AMS.

Design and Setting: A mixed-methods study in primary care.

Methods: Data on antibiotic prescribing, diagnoses, and patient and prescriber characteristics were extracted from The Health Improvement Network database. A mixed-effects logistic model was used to compare locums' and other prescribers' antibiotic prescribing for conditions which do not usually benefit from antibiotics. Nineteen semi-structured telephone interviews were conducted with locums in England and analysed thematically.

Results: Locums accounted for 11% of consultations analysed. They prescribed antibiotics more often than other GPs and nurse prescribers for cough, sore throat, asthma exacerbations and acute bronchitis. The percentage of patients receiving antibiotics for these conditions was 4% higher (on absolute scale) when consulting with locums compared to other GPs. Four themes capture the perceived influences on prescribing antibiotics and AMS: (1) Antibiotic prescribing as a complex but individual issue; (2) Nature and patterns of locum work; (3) Relationships between practices and locums; (4) Professional isolation.

Conclusions: Locums contribute to higher antibiotic prescribing compared to their peers. They experience challenges but also opportunities for contributing to AMS, which should be better addressed. With an increasing proportion of locums, they have an important role in antibiotic optimisation and AMS.

Key words: Primary health care, general practice, antimicrobial stewardship, antibiotic prescribing, mixed-methods, qualitative

How this fits in

Locum or sessional general practitioners (locums) constitute over a third of GPs in the UK (36% in 2017) but the patterns of and influences on locums' antibiotic prescribing have been unclear. This study showed that locums were more likely than regular GPs and nurse prescribers to prescribe antibiotics for cough, sore throat, bronchitis, asthma and COPD exacerbations. It also identified factors related to locum work that pose challenges to locums' prudent antibiotic prescribing and engagement with antimicrobial stewardship efforts. More focus is needed to engage locums in antimicrobial stewardship, and practices that employ locums to better communicate with and support locums.

Introduction

Overuse of antibiotics contributes to antimicrobial resistance, one of the most important and urgent public health threats.(1,2) In the UK, most antibiotics are prescribed in general practice,(3) often for self-limiting infections.(4–7) In 2013, the UK published its first 5-year national action plan for tackling antimicrobial resistance, which included antimicrobial stewardship (AMS) programmes.(8,9) Despite these initiatives, antibiotic prescribing patterns still vary considerably across areas and practices, and some remain high-prescribers.(5,10–12) In our previous research, Clinical Commissioning Group and general practice professionals perceived a high turnover of locum general practitioners (GPs) as contributing to higher antibiotic prescribing and locums as more likely to be higher prescribers; this was because practices with transient staff were perceived as having less ownership of prescribing and locum GPs were perceived as less accountable for prescribing, less engaged in AMS, less aware of local guidelines and lacking continuity of care.(13,14)

Locum or sessional GPs are registered, licensed GPs who work in temporary positions, often for multiple organisations, covering short-term absences and vacancies.(15) A growing proportion of GPs (36%, over 21,300 in 2017) work as locums in the UK.(15) The National Association of Sessional GPs (NASGP) estimated that locum GPs (henceforth 'locums') consult with around 36 million patients every year.(16) Unlike 'regular', practice-based (salaried, partner) GPs, locums face unique challenges of working across organisations with different systems, contexts and teams, and with unfamiliar patients that they may not see again. The NASGP highlights the many challenges faced, and skills required, by locums, noting that locums are generally undervalued, lack support and may be scapegoated.(16) Studies support the widespread negative perceptions and experiences of employing and working as locums, which can have adverse implications for the professional identity, organisations and patients.(17–19) A recent narrative review on the quality and safety of locums across settings and countries suggested that the context of locums' work may increase risks, but only eight empirical, methodologically-poor studies were identified.(20)

Although locums form a substantial proportion of the GP workforce, there is little research on locums and, to our knowledge, none focused specifically on the role of locums in AMS. This study aimed to assess the locums' role in prudent antibiotic prescribing, and explore their perceptions of AMS, which could help identify opportunities for further optimisation of antibiotic prescribing. We addressed two research questions:

1. How does locums' antibiotic prescribing compare to other general practice prescribers?
2. How do locums experience and view antibiotic prescribing and AMS?

Methods

A sequential explanatory mixed-methods study design was used to address the two research questions.⁽²¹⁾ The quantitative and qualitative data were analysed separately and sequentially: quantitative analysis addressed research question 1 and then qualitative analysis addressed question 2. Stakeholders, including professionals (e.g., GPs, health psychologists) and Patient and Public Involvement representatives, provided advice and feedback on the study (e.g., design, interpretation).

Quantitative methods

Data on oral antibiotic prescribing, diagnoses and patient, practice and prescriber characteristics were extracted from The Health Improvement Network (THIN), a primary care electronic database that is representative (~7% coverage) of the UK population.^(22,23) The THIN database distinguishes antibiotic prescribing between different roles, including locums, salaried GPs, partners and registrars. We included data from English general practices that provided data for at least one full calendar year between 1 January 2013 and 31 December 2015.

We previously evaluated variation between practices in the percentage of patients being prescribed an antibiotic for common conditions that generally do not need antibiotics,⁽²⁴⁾ and the extent of variation in practice-level antibiotic prescribing rates that can be explained by patient and

practice characteristics.(10) Using a similar approach, in this study we evaluated whether there are differences between proportions of patients prescribed an antibiotic for common conditions when consulting with locums compared to other GPs and nurse prescribers. Prescribing patterns were not assessed for GP retainers, assistants or other healthcare providers given the low number of consultations associated with these groups.

We included the following conditions for which antibiotics do not usually provide additional benefit: acute bronchitis, acute cough, acute otitis media, acute rhinosinusitis, acute sore throat, asthma exacerbations and mild acute exacerbations of COPD. In line with previous work,(24) patients with relevant comorbidities or complications and recurrent and chronic presentations were excluded to reduce potential confounding by patient frailty or severity of disease. Confidence intervals for the prescribing proportions were calculated using robust standard errors to take into account dependence between multiple episodes from the same patient/practice.

Qualitative methods

Locums were recruited through newsletters of the Royal College of General Practitioners and NASGP. Those interested were emailed study information and asked questions to enable sampling. Participants were included if they primarily worked as locums in National Health Service general practices in England. They were purposefully sampled to ensure diverse characteristics (e.g., time since qualification, patterns of working as a locum, geographical area; see Table 1) and until saturation (considered when no new major findings related to the research question were identified in multiple sequential interviews).

Participants gave verbal consent to participate which was recorded. Telephone interviews were conducted by AJB (a qualitative researcher and social scientist) between November 2019 and February 2020 using a semi-structured topic guide (Supplementary Document 1) exploring: experiences of working as locums, perceived influences on locums' antibiotic prescribing and optimisation, awareness of and engagement with AMS initiatives, and suggestions for

improvements. Participants were reimbursed for participation. Interviews were audio-recorded, transcribed verbatim, checked for accuracy and anonymised.

Interviews were analysed thematically (taking an essentialist/realist epistemological stance),(25) using NVivo (v.12) software. The first five transcripts were inductively and independently coded by three experienced qualitative researchers (AJB, STC, OvH). The multiple coding (26) was compared and discussed to develop a coding framework, which was then used to analyse the remaining transcripts, adding any new codes as needed. Codes and categories were combined into themes to address the research question.

Results

Quantitative results

In total, locums accounted for 11% of 1,511,787 consultations analysed. Acute sore throat (26% of all identified antibiotic prescriptions) and acute cough (38%) were the two main conditions for which antibiotics were prescribed. The percentage of patients receiving antibiotics for these conditions were 4% higher (on an absolute scale) when consulting with locums compared to other GPs (Figure 1). A similar difference was observed for asthma exacerbations and acute bronchitis, while prescribing percentages were more similar for other conditions (Figures 1-2). An exception was impetigo, where other GPs prescribed antibiotics more often than locums (54%, 95% CI 53% – 55% versus 47%, 95% CI 45% - 48%, Figure 2).

For several conditions, nurses prescribed antibiotics in a smaller proportion of consultations (Figures 1-2) than locums and other GPs. However, this pattern was not consistent across all conditions: a higher percentage of children (2-18 years old) consulting with acute otitis media received antibiotics in consultations with nurse prescribers compared to locums or other GPs.

<Figures 1 and 2>

Qualitative results

Nineteen locums were interviewed (Table 1). Interviews lasted 38-64 (mean 49) minutes. Four themes were identified to capture locums' experiences and perceptions of influences on antibiotic prescribing and AMS. Findings are supported by quotes (Table 2).

<Tables 1, 2>

1. Antibiotic prescribing as a complex but individual issue

Interviewees described antibiotic prescribing as complex clinical decisions influenced by individual-level factors, such as GP's experience, skills and confidence, and patient's clinical presentation (e.g., symptoms) and expectations/behaviour. Some described an increasing awareness of AMS among GPs and patients; others argued that more change is still needed. They perceived locums to have an important role in AMS because they constitute many prescribers, but that role was seen as similar to all GPs' responsibility for appropriate prescribing.

It's very much an individual GP responsibility really. If a practice stressed to me the importance of avoiding inappropriate antibiotics, I'd almost feel like they were stating the obvious (...) all GPs should understand what appropriate antibiotic prescribing is, that's real basic bread and butter general practice. [L1]

Participants also reported varied experiences and views of using AMS strategies (e.g., guidelines, leaflets, delayed prescriptions, clinical scores). Most did not know their individual antibiotic prescribing rates nor received feedback on it, but they believed that they were low/prudent prescribers. They were interested in feedback on their prescribing and thought that it would be useful to locums and all GPs, and could be incorporated into GP appraisals. While most participants did not know the prescribing rates in practices they worked in, they had little or no interest in this because as locums they described no 'vested interest' in the practices.

I'd be more interested in my own prescribing in comparison to the other doctors within the practice... I don't have a vested interest in any of the practices that I'm working in, it wouldn't be that useful to me to know whether they're high or low prescribers... [L9]

However, they were also unsure how locums' prescribing could be identified as partner GPs' names were often on prescriptions issued by locums.

2. Nature and patterns of locum work

The overall nature and patterns of locum work seemed to influence locums' antibiotic prescribing. Participants worked across different practices and areas, which varied considerably. This variation in IT systems, workflows and prescribing guidelines was challenging for locums who, as a result, might not always follow the local guidelines or workflows. For example, some participants reported following familiar prescribing guidelines from a different area to where they currently worked, and relying on IT prompts to indicate non-concordance with local guidelines. Participants suggested that working in one local area and regular, longer-term practices helped minimise this challenge, and that adopting similar guidelines and approaches would make appropriate prescribing easier for locums.

Participants described how locums have more control and flexibility over their work. Thus, some requested longer appointments or catch-up slots to ensure sufficient time to provide good quality care (e.g., discussing antibiotics, safety-netting). Others perceived locums as being under more pressure from patients and time due to hourly payment, which could lead to quickly 'closing' consultations with antibiotic prescriptions (rather than taking time to discuss patients' perceptions about antibiotic treatment) to avoid running over.

...the pressure that patients put on locums to prescribe, and the pressure of time on the locum (...) it is to do with the time that we have, so you're paid by the hour. You don't necessarily want to run over... I think that makes a lot of locums more likely to not want to have that discussion to change patient perceptions about their use of antibiotics, and that it's just easier to give antibiotics. [L16]

Participants also described another aspect of control and flexibility over their work in being able to select practices where they work. For example, they reported avoiding practices perceived as unorganised and struggling with demand and insufficient staff, and therefore with more staff turnover and less control over prescribing quality; they perceived appropriate prescribing and good quality care as more difficult in such practices.

Locums reported consulting with more acute cases (while those with chronic illnesses were seen by a regular doctor) who were more likely to require antibiotics. They also reported that seeing unfamiliar patients and not being able to follow patients up can make locums more likely to prescribe antibiotics to avoid risks of not prescribing, complaints and additional work for other GPs if patients re-consulted. However, participants also described how seeing unfamiliar patients may put locums in a better position to suggest a 'new' no-antibiotic approach, and that locums might be less concerned about potential negative impact of not prescribing on doctor-patient relationship.

...because I'm not their normal GP... I have the time and I have the fresh pair of eyes to go, "Actually, you know, things are changing a bit and I read something recently or I've been to an education session and how about trying without antibiotics this time?" [L3]

3. Relationships between practices and locums

Participants' relationships and communication with practices varied considerably. They reported no communication about practices' initiatives or approaches related to prescribing and AMS (e.g., antibiotic-related targets, priorities), and that they could participate or contribute if they were told about them (e.g., during inductions). There was generally no or little feedback between practices and locums (unless concerning safety issues) and even less scrutiny over, and accountability for, locums' prescribing than regular clinicians. Participants reported that receiving feedback from practices would be helpful for them to improve and/or feel appreciated.

Participants described how locums were generally perceived, and felt, as '*just to see patients*' (L10) and not a part of practice teams. Thus, some reported that locums have neither influence on, nor role in influencing, practices' antibiotic prescribing or AMS initiatives.

...you're not part of the team and they don't make you feel part of a team, you're just there to come in and cover the session and that's all you're there to do. You're not involved in discussions about prescribing or the processes in the practice... it's not really my role as a locum to get involved in trying to change processes that don't seem to be working. [L3]

Others noted that locums working across many different practices have opportunities to observe and compare what works well, and identify potential improvements. Although locums' feedback to practices was rare, some reported contributing to improvements in practices where they had good relationships.

Although participants reported that they practise similarly regardless of their role or where they work, the influence of different organisational cultures was apparent. Patient notes (i.e. when and how consistently other GPs prescribed) and patients' expectations for antibiotics gave locums a sense of the practices' approaches to prescribing. Some reflected on being more inclined to

prescribe antibiotics in higher-prescribing practices and where they would not feel supported by other GPs when not prescribing.

I saw a patient today who has COPD and you look back and see that's what they do and I'm more inclined to prescribe antibiotics just in case because that's what they do, rather than making my own judgement, I'm just following what the practice are doing. [L11]

4. Professional isolation

Participants described locums as more professionally isolated ('work in silos') than practice-based GPs. This was exacerbated by limited or no communication from commissioners, being less connected to professional groups and networks, and having to participate in professional training and meetings in unpaid time. Consequently, locums found keeping up-to-date with guidelines, evidence and training more challenging, and having fewer opportunities for peer learning. This could contribute to less appropriate prescribing.

[Locums] are a little bit outside... the mainstream GPs who are going to all the regular CPDs and GP updates and maybe are more aware of the problems around antibiotic stewardship and resistance. (...) as a locum you can go to no CPD meetings... you can be far away from the nourishing flow of information... and you can see how you can have a very different viewpoint about antibiotic prescribing. [L10]

Nevertheless, some participants described locums as well-trained and aware of evidence as a result of being more proactive about their professional development. Many reported being proactive about ensuring they had access to relevant resources (e.g., bookmarking online

guidelines/tools) and communicating with practices and peers (e.g., asking about training opportunities, joining meetings) in order to provide good care.

Participants discussed how practices and commissioners should better integrate and support locums, e.g., by circulating information, updates and training opportunities to all GPs registered on Performance Lists. Some suggested that AMS-related training should be mandatory, and local peer groups for locums should be encouraged. Finally, some suggested that locums should be better recognised as a considerable professional group, and involved in wider policy development.

We're a significant amount of the workforce and we prescribe lots of antibiotics... However, because we can't influence local policy, perhaps our involvement would be limited only based on our personal experience... our voices are minimally heard in general when we talk about health policy, just because locums and sessional GPs is just this nebulous group that aren't really organised very well. So I think you're missing probably lots of people that could add value to any sort of policy discussion. [L5]

Discussion

Summary

The analysis of prescribing data showed that locums were more likely than regular GPs and nurse prescribers to prescribe antibiotics for cough, sore throat, bronchitis, asthma and COPD exacerbations. The interviews found that although locums perceived appropriate antibiotic prescribing and engagement with AMS as individual GP's responsibility, they are nevertheless influenced by factors specific to, or reinforced by, the characteristics of locum work. Table 3 summarises the main influences reported by the interviewees on locums' antibiotic prescribing, and suggestions for potential improvements.

<Table 3>

Strengths and limitations

This is the first study to identify the role of locums in antibiotic prescribing and stewardship general practice in England. A mixed-methods design allowed answering two complementary questions: the in-depth qualitative data provided possible explanations for the quantitative finding. The quantitative data was derived from a large database and used established analysis methods. The qualitative data involved a purposeful sample and reached saturation on the themes reported. Trustworthiness and credibility were ensured by involving multiple researchers in the analysis and interpretation, keeping of analytic notes, and sharing the findings with participants. Relevant guidelines were followed for reporting of mixed-methods (27) and qualitative (28) studies (checklists are available in Supplementary Document 2).

However, it is likely that a certain degree of misclassification affected the quantitative analyses. An unknown proportion of the consultations performed by locums might be incorrectly attributed to other GPs due to the wrong identifier being used when entering the information about the consultation into the practice software. Given that default identifiers are more likely associated with individuals working in the practice, this may have resulted in a dilution bias reducing any difference between locums and other GPs. While we focused on patients without relevant comorbidities or complications and excluded recurrent and chronic presentations, we cannot exclude the possibility that some of the (absence of) differences are explained by other differences in case-mix seen by nurse prescribers, locums and other GPs. The quantitative data that we had access to was from 2013-15; prescribing patterns may have changed since then. It is possible that locums who volunteered to be interviewed had different views and experiences to non-volunteers. Finally, our findings are also limited to locums practising in England and their relevance to other regions in the UK may not necessarily be transferable.

Comparison with existing literature

Although research on locums is limited, our findings are generally in line with other studies. We previously found that health professionals perceived locums as contributing to sub-optimal antibiotic prescribing,(13,14) and this study shows that locums may indeed be more likely to prescribe antibiotics for some conditions. A survey published in 2000 found that 31% of GPs employing locums in England were dissatisfied with locums' clinical competence and under- or over-prescribing.(19) As in our interviews, the literature points to some factors which may affect the quality of locum care and prescribing; for example, locums may be less aware of local policies, less familiar with the practice population, and less likely to participate in audits, professional development and networks.(20) Moreover, we found that locums consider appropriate antibiotic prescribing a GP's responsibility (regardless of their role as locums), but some may perceive no vested interest in knowing or improving antibiotic prescribing rates in the practices where they work as locums. Lack of continuity of care may also affect doctor-patient relationships, potentially creating barriers to prudent antibiotic prescribing.(29) Our findings show some similarity to influences on antibiotic prescribing in out-of-hours: lack of prior relationship with patients (with similarly mixed views on the direction of this influence), lack of follow-up, changing workforce and inconsistencies between prescribers.(30) Strategies and resources to address such specific challenges seem to be lacking for locums as for out-of-hours prescribers.(31) Effective AMS interventions can benefit from being informed by qualitative studies that identify behavioural influences on antibiotic prescribing.(29,32–34) For example, communication training to help address antibiotics without extending consultation time may help locums, similarly to all GPs (35) and out-of-hours prescribers.(36) Interventions targeting sub-groups of GPs (e.g., early-career) can also help.(37) Thus, targeted interventions for locums to promote prudent antibiotic prescribing by addressing the identified influences may be beneficial.

Our qualitative analysis identified many influences on locums' antibiotic prescribing that related to interpersonal and organisational factors (e.g., inadequate inductions, communication and

feedback), and contextual influences (e.g., varied systems, guidelines, professional isolation). Similarly, previous literature showed that most factors affecting the quality and safety of locum practice related to the organisational context and ways in which organisations deploy and support locums,(20) highlighting that locums ‘can only work as well as their working environment’ (p. 2).(16) Moreover, we found that locums may adjust their antibiotic prescribing to different practices where they work, influenced by different patient populations and prescribing cultures. An Australian study showed that while targeting antibiotic-related education and feedback at GP trainees may be helpful, inconsistencies in antibiotic prescribing among practice doctors contributed to internal conflicts for GP trainees, limiting the impact of the intervention.(37) Similarly, other studies highlighted the role of organisational, social and cultural contexts on antibiotic prescribing and AMS.(13,38–40) Therefore, effective AMS interventions may benefit from targeting practice teams and supporting better integration of locums into practice teams and wider professional networks.

It is also important to recognise that locums are a diverse group with varied working patterns and approaches, so not all factors are equally relevant to every locum. Moreover, our interviewees revealed (developing) different ways for dealing with challenges and opportunities for locums to contribute to improving antibiotic prescribing and processes in practices where they work (e.g., through being proactive, identifying what works well or could be improved, suggesting ‘new’ no-antibiotic approaches to patients). The role and contributions of locums in patient care, and both challenges *and* opportunities for practices and locums need recognising.(16) Importantly, these findings might also be relevant to other prescribing issues (e.g., over-the-counter medications, opioids), and locum work in out-of-hours services.

Implications for practice and research

Suggestions for improving antibiotic prescribing are summarised in Table 2. Locums could be supported in more prudent antibiotic prescribing, for example, by improving inductions and communication about practices’ approaches to prudent antibiotic prescribing; auditing and providing feedback on locums’ antibiotic prescribing; providing (free) access to AMS training and/or

making it mandatory; including locums in relevant updates and communication; including antibiotic prescribing audits and training in GP appraisals. In order to enable accurate identification of, and audit and feedback on, locums' prescribing, it is critical to ensure that prescriptions issued by locums include their names and can be linked in the clinical systems and databased to their roles. Moreover, managing variation in prescribing guidelines and clinical systems, enabling easy access to guidelines, and IT solutions may help locums working across practices and areas. Finally, future research and AMS interventions could target locums (to address specific professional issues), and practice teams for consistent, practice-based approaches to AMS.

Conclusion

This study showed that locums may contribute to higher antibiotic prescribing and identified possible reasons. Locums face specific challenges to optimising antibiotic prescribing and engaging with AMS, including dealing with variation between practices and areas, more acutely unwell and unfamiliar patients, limited communication, feedback and support, and professional isolation. They also have opportunities to contribute to AMS, for example, through more flexibility in consultations, ability to try 'new', no-antibiotic approaches with unfamiliar patients, and ability to identify and share good practice. These challenges need to be addressed and opportunities utilized. As locums are a considerable and growing part of the GP workforce, their role in AMS and practices' responsibilities towards enabling optimal prescribing by locums need to be recognised.

Additional information

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and collection, analysis, and interpretation of data, and in writing the manuscript. The views expressed are solely those of the authors.

Ethical approval

The research was conducted in accordance with the Declaration of Helsinki and national and institutional standards. The study was approved by the University of Oxford's Medical Sciences Inter-Divisional Research Ethics Committee (reference: R58969). The data collection scheme for The Health Improvement Network is approved by the UK Multicentre Research Ethics Committee (reference: 07H1102103). In accordance with this approval, the study protocol was reviewed and approved by an independent Scientific Review Committee (references: 16THIN071, 16THIN071-A1). Following an approved process, each interview participant gave verbal consent to participation in the study, and a written record of the verbal consent was made and retained by the participant and the research team.

Competing interests

The authors have no conflicts of interest to declare.

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Table 1. Interviewee characteristics

Characteristic	Sample
Sex	12 men, 7 women
Length of time since qualified as a GP (up to the time of the interview)	2 months – 22 years (median 5 years)
Length of time working as a locum	2 months – 10 years (median 3 years)
Typical number of sessions per week worked as a locum	2 – 8 sessions (median 5)
Typical number of different practices per month worked in as a locum	2 – 8 (median 4)
Other roles alongside locum work	13 Salaried GPs: 4 Extended hours, GP hubs: 3 Out-of-hours, urgent care, A&E: 5 Academic, GP trainers, examiners: 8
Primary medical qualification obtained outside the UK	3
Training/experience prior to qualifying as GP	9
Geographical areas of work (Note: number of locums exceeds 19 as some work across multiple areas)	West Midlands – 1 locum East of England – 2 locums North West – 2 locums London – 3 locums South West – 5 locums South East – 8 locums
Number of Clinical Commissioning Groups (CCG) typically working in as a locum	1 CCG – 8 locums 2 CCGs – 5 locums 3 CCGs – 3 locums 4+ CCGs – 4 locums (in London & South East)

Table 2. Additional quotes supporting qualitative findings

Theme	Illustrative quotes
Antibiotic prescribing is a complex but individual issue	<ul style="list-style-type: none"> • ‘I don’t really vary my practice between working as a salaried and a locum. I think the easy thing to do as a locum is to prescribe antibiotics more than you should but it’s bad medicine, and I’m aware of the risks... it’s something that personally I take an interest in.’ [L8] • ‘Locum GPs are a large part of the GP workforce... So yes, they have an important part to play in appropriate prescribing and reducing inappropriate prescriptions generally (...) On the other side... I don’t think it’s particularly helpful to target locum GPs to improve stewardship. I think primarily it may be more impactful to target patient education... Also, a system wide approach could be more useful.’ [L12] • ‘...it’s really difficult to see prescribing patterns amongst locums because often I prescribe and for whatever reason, the prescriptions come out, I’ve signed them, but they’re linked to somebody else’s name.’ [L5]
Nature and patterns of locum work (i.e. variation; control & flexibility; unfamiliar patients & acute cases)	<ul style="list-style-type: none"> • ‘Every practice doing something slightly differently, that’s inevitable to a degree but for something like antimicrobial prescribing, actually having the same guidelines locally and using the same tools, I think it is something that is very achievable. As a locum working in lots of different practices it is very hard... to be aware of what every practice’s local policy is’ [L8] • ‘I will only see patients at 15-minute appointment slots because I think I give a better service and it’s safer that way. (...) Because I always demand 15-minute appointments, it’s quite easy. I do a very thorough history and examination. Most of the time, people, once you’ve examined them properly and have gone over the top in terms of your clinical examination, they’re quite happy that you’ve in inverted commas, ‘done your job’. Then they really trust you, and you give them the time to explain to them that they don’t need antibiotics.’ [L5] • ‘I’ve been to surgeries where they’ve just been managed by locums for a long time, and every patient you see is really mismanaged. You can see that things have been missed, and patients are unwell, and they don’t speak English, and the surgery is just a mess, then you just think, ‘It’s not worth going back. It’s too risky.’ [L16] • ‘...because I’m a locum, I’m seeing all the acute illnesses... You’re going to look at my statistics and say, ‘Oh, this locum is prescribing loads of antibiotics compared to the partners in this practice.’ But if you compare my patient group, it will be different because I won’t be seeing the more non-acute presentations, because the practice will be prioritising that for the partners or the salaried.’ [L5]
Relationships between practices and locums (i.e. communication & feedback; influence over practice’s prescribing &	<ul style="list-style-type: none"> • ‘If I’m working regularly in a place, then I’m much more likely to be told, to be included in emails to the rest of the staff. But in general I’m less likely, as a locum, to be aware of the strategies that are being implemented. (...) having strategies to make locums aware of what practices are doing to decrease antimicrobial use, and tools that they are using, especially IT tools, that that would be really useful.... if there are particular initiatives’ [L8] • ‘You would never get someone saying to you “look, I want you to prescribe less antibiotics” or “this is how we do it here”. No. It’s a bit of a wild west. (...) If a practice is over-prescribing antibiotics, then there will be some communication within the practice... As a locum, you’re in, you’re out, there’s not really that level of responsibility. There isn’t any comeback for prescribing antibiotics or anyone looking at your antibiotic prescribing levels, so there’s probably more scrutiny if you’re a practice with fewer locums and you’re a regular doctor there.’ [L10] • ‘There’s no benefit to [locums] whether they prescribe lots of antibiotics or don’t... it doesn’t affect them individually.’ [L9] • ‘Locum GPs have worked in a clinical role across a number of practices and I think we are therefore well placed to spot strengths and also weaknesses in individual practices and individual GPs’ approaches. If practices or CCGs wanted to use us to provide some kind of advice or

<p>processes; influence of practice culture)</p>	<p>consultancy to help people improve their prescribing, including antimicrobial stewardship, I think they'd find a kind of significant untapped resource there. (...) it just doesn't occur to people... that locums might have something to contribute there...' [L15]</p> <ul style="list-style-type: none"> • '...there is always that slight pressure to not have a complaint and not have an issue from patients and from partners (...) so you just have to go along with it to some degree, because you don't know how well supported you will be by the rest of the institution. With time and, I guess, from seeing what other colleagues are doing in that practice, you can get a sense of if that works. (...) often it's easier to prescribe than not to... as of yet, no one is going to be punished for over-prescribing, you will get punished for under-prescribing...' [L7]
<p>Professional isolation (i.e. wider communication & networks; proactivity)</p>	<ul style="list-style-type: none"> • 'There are real problems nationally with locum GPs being kept in touch with what's going on locally and that includes, for example, incentive schemes, educational opportunities... locum GPs are as much part of the NHS labour market as any other GPs. They're seeing exactly the same patients in the same practices and I think it would help, not just with antibiotic prescribing but with all sorts of aspects of good and economical clinical care, if locum GPs were better communicated with about what's going on.' [L15] • 'I think the new contract's going to help with trying to get us some sort of CPD time possibly funded by PCNs that if you work a certain number of shifts for a PCN, you might get a free educational session paid for. As it stands all my CPD and my educational days I have to just lose income for to attend.' [L18] • 'As a locum you have to be very prepared to ask, otherwise it goes wrong and the patient doesn't get the care that they need. (...) The onus tends to be on us rather than on the practice and I would quite like it if practices were better at having some sort of information sheet which told you, "This is what we do."' [L3] • 'I have a number of tabs that open automatically on my desktop when I open Google Chrome... so it's immediately accessible... and if antimicrobial stewardship, or strategies to decrease antimicrobial prescribing, if there was a central repository or a local repository that I could have up, that could be really useful.' [L8] • 'If locum GPs were involved in the CCG, then they could take [antimicrobial stewardship] on as part of whatever role they're doing and try and get the message out a bit better. Also there are locum GP groups, they're not particularly well used I find, but I think if you had antimicrobial modules or mandatory training, then that forces the issue on people. Because everyone's so busy... they're not going to do things voluntarily unless they really have to. I think if you make something as important so it's mandatory, then they will.' [L4] • '...locums still feel very undervalued, I think. So if we're going to work with practices both for antibiotics and just in general, the practices need to try and see things from the locum's point of view a bit better than they currently do...' [L6]

Table 3. Summary of perceived influences on locums' antibiotic prescribing, strategies and suggestions

Challenges & reasons for higher antibiotic prescribing	Opportunities & reasons for lower antibiotic prescribing	Strategies used by locums to manage challenges	Suggestions
<ul style="list-style-type: none"> • See more acute patients • See more unfamiliar patients with limited follow-up (and wanting to avoid work for others) • May feel less accountable for their prescribing (no audit or feedback) • May feel less invested in or concerned by antibiotic prescribing in practices where they work as locums • Less (access to) training & peer learning • May be under more pressure from patients seeking antibiotics • May feel under more time pressure (antibiotic prescribing is seen as quicker than not prescribing) • Less aware of practices' AMS initiatives • May feel influenced by practices' high-prescribing culture & feel unsupported when not prescribing antibiotics (want to avoid risks & complaints) 	<ul style="list-style-type: none"> • No pre-existing relationship and expectations from patients (easier to suggest a new no-antibiotic approach, less worried about impact on the relationship) • Well trained and aware of the evidence • May work more flexibly and take longer in consultations if needed to provide good care 	<ul style="list-style-type: none"> • Use typical AMS strategies (e.g. guidelines, clinical scores etc.) • Select practices that are 'good' to work in, and avoid those perceived as more disorganised and with more staff turnover • Work locally and in regular, longer-term practices • Ensure extra time to familiarise with new practices • Keep own notes/information/links related to local guidelines, processes, patients to follow-up • Agree/request sufficient time for good quality care • Initiate communication with colleagues, take time to develop good relationships • Ask for support when needed • Rely on IT prompts for first-line antibiotic • Ask practices for information about relevant training or meetings & attend them • Join local GP groups or locum organisations 	<ul style="list-style-type: none"> • Audit locums' prescribing • Enable locums to issue prescriptions signed with their names, and link locums' prescribing to their roles • Provide feedback to locums, especially on individual antibiotic prescribing, invite locums' feedback/ suggestions for improvements to practices • Use appraisal/revalidation to influence antibiotic prescribing (e.g. require antibiotic prescribing audit, training) • Adopt similar IT systems, guidelines, processes etc. across regions • Improve inductions, including information about practice's AMS approach & support for prudent antibiotic prescribing • Use IT prompts and solutions to promote appropriate prescribing • Include locums in update mailing lists (e.g., from commissioners, via local Performers List) • Organise locum peer groups, or include locums in local GP groups • Provide free access to & encourage participation in AMS training • Need whole-system approach to AMS, including 'educating patients'

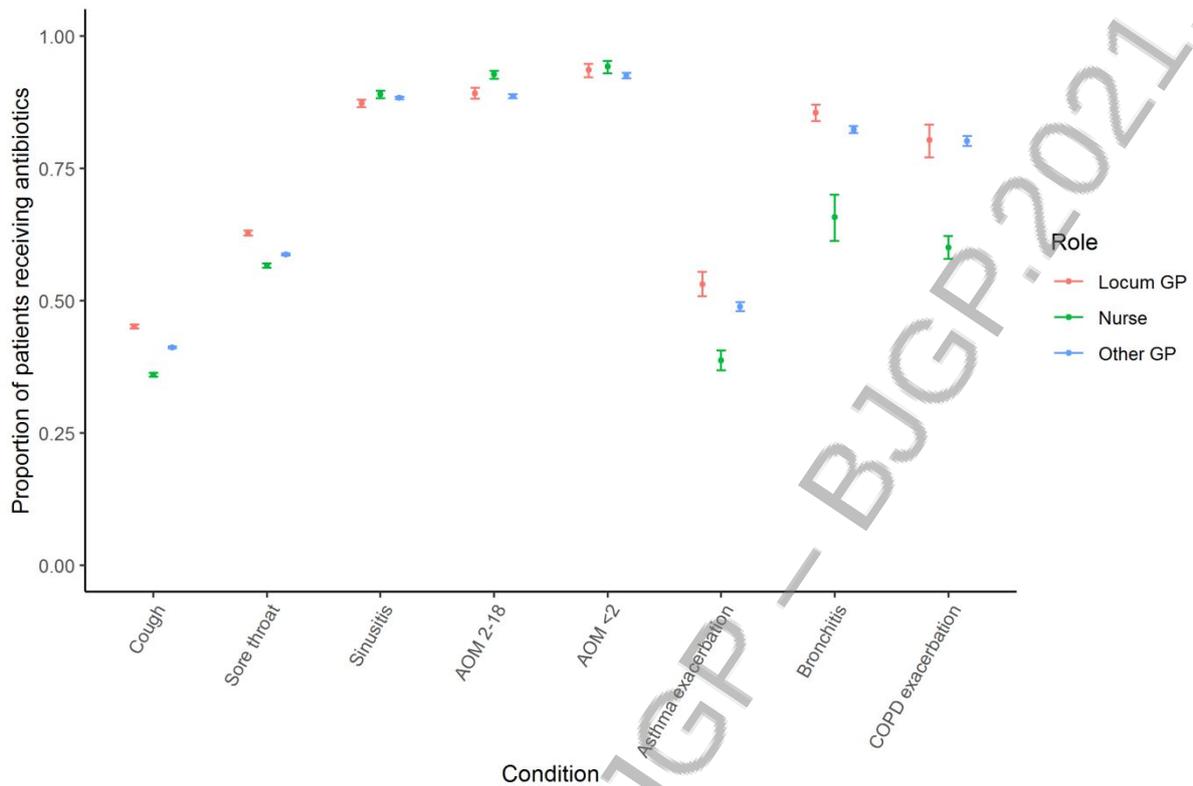


Figure 1. Proportion of patients without relevant comorbidities receiving antibiotics when consulting with acute respiratory conditions with locum GPs, other GPs, or nurse prescribers in primary care.

(AOM: acute otitis media; COPD: Chronic Obstructive Pulmonary Disease.)

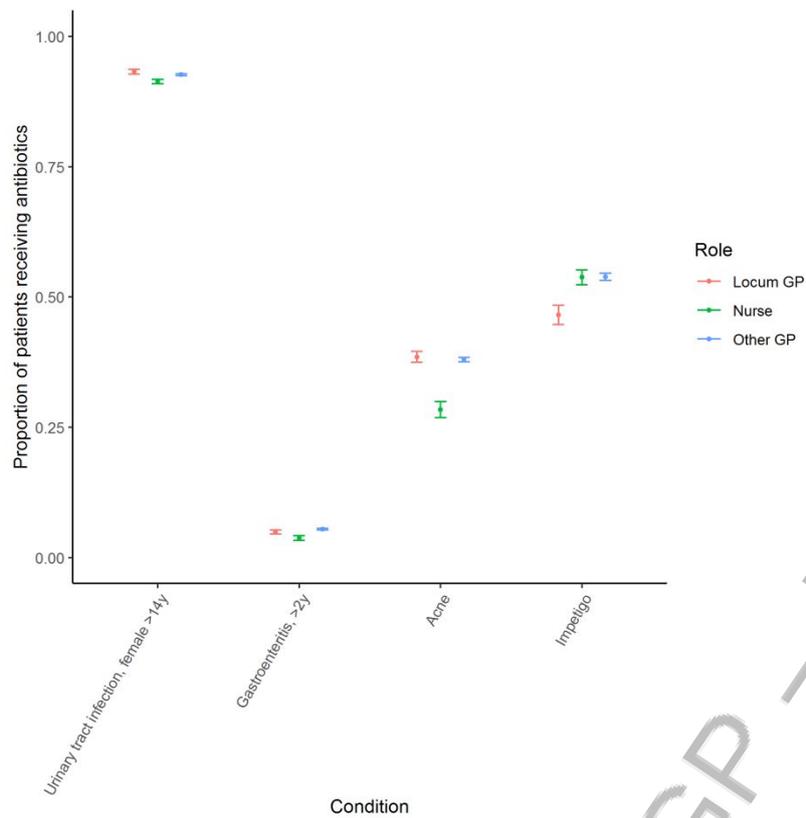


Figure 2. Proportion of patients without relevant comorbidities receiving antibiotics when consulting with non-respiratory infections with locum GPs, other GPs, or nurse prescribers in primary care.

Supplementary Data

Supplementary Document 1: Interview topic guide

Supplementary Document 2: Reporting checklists for mixed-methods and qualitative studies