

## Qualitative Research

# Focus on early-career GPs: qualitative evaluation of a multi-faceted educational intervention to improve antibiotic prescribing

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### Abstract

**Background.** We conducted an educational intervention emphasizing rational antibiotic prescribing in early-career General Practitioners (GP) in vocational training (trainees). The intervention consisted of an online introduction module, an online communication training module, face-to-face workshops, and cases to be discussed one-on-one by the trainee-supervisor dyad during regular scheduled education sessions.

**Objectives.** To explore the participants' experiences with the intervention.

**Methods.** A qualitative study of 14 GP trainees and supervisors. Interviews followed a semi-structured interview guide, were transcribed and analysed using concurrent thematic analysis.

**Results.** Overall, the intervention was well received. Resources were not often used in practice, but GP trainees used the information in communicating with patients. The intervention improved trainees' confidence and provided new communication strategies, e.g. explicitly asking about patients' expectations and talking patients through the examination to form an overall clinical picture. Trainees seemed eager to learn and adapt their practice, whereas GP supervisors rather commented that the intervention was reinforcing. None of the participants reported prescribing conflicts between trainee and supervisor. However, most participants identified conflicts within the GP practice or with specialists: other doctors who prescribe more antibiotics perpetuate patients' ideas that antibiotics will fix everything, which in turn causes conflict with the patient and undermines attempts to improve antibiotic prescribing.

**Conclusion.** The educational intervention was received positively. Early-career GPs thought it influenced their prescribing behaviour and improved their confidence in non-prescribing. Interventions that target teams (e.g. entire practice) could minimize conflict, ensure consistency of messages and support overall antibiotic stewardship in primary care.

**Key words:** anti-bacterial agents, education, qualitative research, general practice, microbial drug resistance.

## Introduction

Antibiotic resistance is a major public health concern as it threatens the effective prevention and treatment of increasingly diverse infections (1). Infections caused by resistant bacteria often fail to respond to treatment and result in prolonged illness, high health care costs and death. Antibiotic resistance is directly related to over-prescribing of antibiotics; lower levels of antibiotic resistance are reported in countries where fewer antibiotics are prescribed (2). Furthermore, antibiotics are often prescribed in conditions for which there is no evidence of benefit (3). In a recent study, early-career general practitioners (GPs) in training prescribed antibiotics in 22% of consultations for URIs, and 73% of consultations for bronchitis/bronchiolitis (4). This over-prescribing, and the fact that the majority of antibiotics are prescribed in primary care (2), highlights the importance of interventions that target GPs. Countries with high use of antibiotics (e.g. Australia) have a responsibility to address and implement strategies and interventions that encourage rational prescribing of antibiotics (5).

The most successful interventions for reducing antibiotic prescribing in primary care are multi-faceted (including combinations of audit and feedback, small group meetings and academic detailing) (6) and active, rather than passive (7). Nevertheless, the overall effect of these interventions is often modest and they are expensive to implement (8). Given the magnitude of the problem, there is a pressing need to explore other avenues. Therefore, we conducted and trialled a multi-faceted educational intervention to decrease antibiotic prescribing in early-career GPs who are in vocational training (9). The rationale behind the Changing Antibiotic Prescribing (ChAP) study is that an intervention might be more efficacious among early-career GPs, as they are still at a stage of their clinical careers where prescribing patterns may not yet be firmly established and thus, if appropriately supported, more amenable to change. In fact, early-career clinicians may be 'change-agents' influencing the antibiotic prescribing of more senior colleagues (10). The intervention was also offered to their supervisors who are experienced GPs, because they play an important role in influencing the behaviour of trainees (11). To our knowledge this is the first intervention study to address prescribing behaviour of GPs who are still in vocational training.

In this article, we describe a qualitative evaluation of the ChAP intervention. The objectives of this study are to explore early-career GPs' and supervisors' experiences with the intervention, which messages they have retained, and how they have implemented their learnings in practice. We sought in-depth insight beyond the scope of a quantitative evaluation in order to inform the development and implementation of future projects that target appropriate antibiotic prescribing by GPs.

## Methods

### Participants

This study included Australian early-career GPs—doctors participating in a general practice specialist vocational training program (further referred to as trainees)—and their supervisors who are experienced GPs. In Australia, GP training is provided by geographically based regional training providers (RTPs), and GP trainees are placed in private practices under the supervision of an experienced GP in an apprenticeship model. Post-graduate general practice

training involves blended in-practice clinical teaching with regular out-of-practice education sessions facilitated by the RTP. This model of apprenticeship-like, workplace-based training augmented by dedicated educational sessions is similar to many international programs, particularly those in the UK, Belgium, the Netherlands, and Scandinavian countries (12).

The educational intervention was delivered by two RTPs (the intervention group) in a non-equivalent control group design trial.

Participants for this qualitative study were recruited by an email invitation from the two RTPs in the intervention group. We invited 68 trainees and 121 supervisors. We aimed to recruit approximately 15 trainees and supervisors or until thematic saturation was achieved. After inclusion of five female trainees, a reminder was sent to male trainees, leading to the inclusion of two additional participants. A total of seven GP trainees and seven GP supervisors responded to the invitation and were included in the study. No additional reminders were sent and recruitment was stopped as no new themes were emerging from the data.

### The intervention

The ChAP study (Changing the Antibiotic Prescribing of General Practice Registrars through better adherence to antibiotic guidelines) was an educational intervention for GP trainees (and their supervisors) in order to improve evidence-based antibiotic prescribing for non-pneumonia respiratory tract infections (RTI) (9). It consisted of an online introduction module, an online communication training module, face-to-face workshops (separately for trainees and supervisors), and cases to be discussed one-on-one by the trainee-supervisor dyad during regular scheduled education sessions.

The online elements of the intervention were derived from the European INTRO study, which was particularly based on theories of behaviour change, focussing on increasing one's self-efficacy (13,14).

The online introduction module drew on existing successful theory-based interventions to reduce antibiotic prescribing in primary care. It provided background to the problem of over-prescription of antibiotics and it included evidence-based data on over-prescribing and its individual and societal consequences. The communication training provided exemplar questions to ask patients, and demonstrated use of resources such as an information booklet. It followed the STAR model (Stemming the Tide of Antibiotic Resistance) (14), which aimed to persuade GPs why a reduction in prescribing was necessary and then showed them how it could be accomplished. Two patient booklets on the management of a common cold (one adapted from the INTRO study and one developed by the Australian National Prescribing Service) and decision aids (Cates plots) illustrating the effectiveness of antibiotics in respiratory infections were provided at the workshop (15). The content of the INTRO booklet was based on previously validated content and the Common Sense Model, which describes the dimensions of symptoms important to patients as well as the relevant dimensions of medication (14). The workshops were delivered by clinicians (GPs and an infectious diseases consultant) and focussed on the key messages, demonstrated use of the Cates plots, and provided role-play communication training. They emphasized the underlying principles that the default management of non-pneumonia RTIs is non-prescription of antibiotics, that the complexity of the consultation skills employed in the consultation is predicated on the complexity of the consultation, not

the complexity of the medical condition, and that attempts to treat non-pneumonia RTIs on the basis of presumed viral or bacterial aetiology are problematic, rather RTIs should be diagnosed and treated syndromically. The cases for discussion by the trainee-supervisor dyads served as a non-compulsory reinforcing exercise.

### Study design and analysis

All participants were interviewed by telephone. Interviews followed a semi-structured interview guide (see Supplementary Appendix), which was informed by a similar large-scale European project (16,17). Interviewees were unaware of the results of the intervention trial at the time of interview. The interview schedule was the same for GP trainees and supervisors and interview questions explored which elements of the intervention were found useful and why, which elements changed practice, and which parts of the intervention could be improved. Hence, supervisors' interviews were also used to obtain their views on the value of the intervention for themselves as well as the value for training purposes. A single researcher (LD) conducted the interviews.

All interviews were digitally recorded and transcribed verbatim. Interview data were analysed using a theoretical approach of thematic analysis (18). Two researchers (LD and SA) conducted independent, line-by-line coding of the first two interviews. Two sets of initial themes were created which were compared, discussed by LD and SA to create a final thematic framework. Themes and subthemes were initially identified and were then further explored in the next phase of data gathering. Any data, which did not fit under the existing themes, was coded as a new item.

### Ethics

The human research ethics committee of the University of Newcastle (H-2009-0323) and The University of Queensland (2014000743) approved this study. Participation was voluntary and each participant signed informed consent forms. All recordings and transcripts were de-identified.

### Results

Seven GP trainees and seven GP supervisors who participated in the educational intervention (Table 1) were interviewed between August and October 2015.

Three main themes emerged from our analyses: general views on the intervention, how GPs implemented their learnings in practice and harmonizing antibiotic prescribing. Within each theme, different subthemes were identified for GP trainees and supervisors. These are discussed in more detail below.

#### General views on the intervention

The intervention was well received by all GP trainees and supervisors. The different formats (online and face-to-face) and the timing (e.g. before flu-season) were perceived as important advantages. Also the fact that the team delivering the workshop included an infectious diseases consultant was mentioned as an important advantage as this added to the credibility of the message.

*'It was in the right season as well, like in the coming weeks I was – you know – a dozen people who came in with that and I could be like 'ah' you know like it was, the timing was right.'* (GP trainee 3)  
*'A really good choice of speaker [...]. The fact that it was coming from an infectious disease consultant and the fact that he wasn't pushing any drugs or anything, you know sponsored by*

**Table 1.** Demographics of GP trainees and GP supervisors who participated in the intervention and the qualitative interviews (August–October 2015)

	Sex	Age	Practice location	Stage of training
GP trainees				
1	Female	28	Major city	Year 2–term 3/4
2	Female	29	Remote	Year 2–term 3
3	Female	28	Inner region	Year 2–term 4
4	Female	50	Inner region	Year 1–term 2
5	Female	32	Major city	Year 2–term 3
6	Male	28	Major city	Year 2–term 4
7	Male	34	Remote	Year 2–term 3
GP supervisors				
1	Male	47	Inner region	
2	Male	61	Inner region	
3	Male	59	Major city	
4	Male	57	Major city	
5	Female	46	Major city	
6	Male	48	Major city	
7	Male	33	Major city	

*a drug company, you know, it carried a lot more weight.'* (GP supervisor 7)

Resources (booklets and Cates plots) were not often used in practice, but the information was deemed valuable and used in communicating with patients as it was explained in a way that is easy to understand for patients.

*'I found that – even though I haven't used it (Cates plots) directly with patients – I think having the information behind me as to actually give patients when counselling through 'why don't they need any antibiotics' I found that really helpful.'* (GP trainee 2)

GP trainees were more likely to find the resources helpful compared to supervisors, as supervisors were more likely to know the patient personally and had enough confidence in their communication skills. Trainees appeared to be more eager to learn and improve their practice and thought they would be more receptive to the intervention than their supervisors. GP supervisors on the other hand found the intervention reinforcing.

*'I think it's a good resource for the registrars (GP trainees) when they are getting patients who they haven't seen before, who they don't know very well, whereas I have a tendency to be seeing patients I have been seeing for many years.'* (GP supervisor 4)

*'I suppose a lot of it is changing habits and when you get doctors like my supervisors, who have been working 40 years, you know they got their way of doing things, so to change that culture is quite a huge thing, it's good, it's easier for us, because we're only just starting out, we're still training, and still in exams and learning and so we haven't really kind of developed our own cultures, how we do GP, but I suppose the people that have been doing it a lot longer, it might be a bit more tricky, to change that.'* (GP trainee 2)

*'I guess it's just reinforcing the same thing [...] my practice of prescribing antibiotics has decreased over the last couple of years as part of the general push and that's good.'* (GP supervisor 5)

#### How GPs implemented their learnings in practice

GP trainees especially seemed to have retained the strategy to look at the overall clinical picture and the evidence-based information, which was incorporated in their communication with patients. For

example, trainees felt that talking patients through the clinical examination and discussing their findings with the patient is reassuring and strengthens the doctor–patient relationship. The intervention seemed to improve the trainees' confidence and provided new communication strategies.

*'I think it just improved my confidence and my consultation skills.'* (GP trainee 1)

*'You know sort of actually putting together a bit more of a clinical picture when it's actually needed and when it's not, I think I found that. I think I definitely got better at that [...] it helped me be more confident and I find that actually talking to patients through your clinical findings I think they really appreciate that and you can see that they feel reassured that you have done a thorough job.'* (GP trainee 2)

In contrast, GP supervisors generally did not mention any specific changes to their practice. Only one supervisor mentioned a specific change: he was surprised to find out that when explicitly asking patients about their expectations, his views on patients' expectations did not necessarily match their views (i.e. patients did not necessarily want antibiotics):

*'By asking them and just having that conversation, it surprised me how much support there was from the parents to not prescribe, so that was great, that was something new and I think it was an expectation that 'we' felt, but it wasn't actually, it didn't turn out it was actually the patients' expectation.'* (GP supervisor 6)

### Harmonizing antibiotic prescribing

None of the participants reported any prescribing conflict between GP supervisor and trainee. However, at the practice level, trainees seemed to struggle with the lack of consistency in antibiotic prescribing strategies among doctors. Trainees thought the patients' beliefs about antibiotics reflected previous prescribing by other doctors. Different prescribing strategies within the practice were felt to cause internal conflict for the GP trainee (conflict with both patients and other GPs), potentially undermining patients' trust in their management and limiting the impact of the intervention on the trainee's prescribing behaviour.

*'If we can actually get everyone in the practice on board with this and then the consistency of things would make it a lot easier on the people who are doing it [...] what I am very conscious of is that I know if I don't give antibiotics and then they go and see a different doctor later in the week, there is a high chance they will get the antibiotics, which may then reflect to the patients that I didn't - in their perception - do a good job or do the right thing, so I am conscious of that, but normally I'll try to get my own patients back.'* (GP trainee 2)

*'That's always tricky, they've always had it from another doctor and then they come and see me for the first time and then I say - oh you don't need it this time.'* (GP trainee 6)

In this respect, some GPs were pro-active and tried to promote intra-practice harmonization of prescribing by presenting their learnings in a practice team meeting.

*'We spoke about it in a team meeting, and I fed back the information that came from that [workshop], to the rest of the doctors in our group, in our practice, and it went down well, but I am not 100% sure how that's impacted their practice.'* (GP supervisor 6)

In contrast to the GP trainees, and despite the intervention, supervisors still identified patient and specialist colleague barriers to rational prescribing.

*'So the message that we have been giving in general practice is not being reinforced necessarily by our specialist colleagues [...] they may be the ones who perpetuate the myth that an antibiotic will fix everything.'* (GP supervisor 3)

*'I find middle-aged men the hardest because they have this expectation ... that the antibiotic is going to get them better.'* (GP supervisor 6)

## Conclusions

### Summary

The intervention was well-received by early-career GPs (trainees) and supervisors. Early-career GPs, especially, thought it had an impact on their practice. The communication skills (e.g. explicitly asking about patients' expectations, talking patients through their examination to form an overall clinical picture) improved participants' confidence in non-prescribing. The available resources (booklets and Cates plots) were not often used in practice, but the information was integrated in their communication with patients. It seemed that GP trainees were more eager to learn and adapt their practice compared to supervisors. GP supervisors told us the intervention was mostly reinforcing, but there was also acknowledgement that it was helpful in identifying misunderstandings about expectations for antibiotics. GP trainees did not find themselves in conflict with their supervisors' prescribing habits. However, they were conscious of the fact that other doctors (specialists or other GPs in the practice) may prescribe more antibiotics, which may perpetuate patients' ideas that antibiotics will fix their symptoms.

### Strengths and limitations

The most important strength of this study is that to our knowledge is the first qualitative evaluation of an antibiotic prescribing intervention targeting early-career GPs in vocational training that concurrently involves their supervisors. Our study provides extensive information about the early-career GPs' and supervisors' (established GPs) experiences with the intervention, which messages they have retained, and how they have implemented their learnings in practice. This information cannot be retrieved from a quantitative evaluation and is especially relevant for the development of future interventions.

Nevertheless, this study also has some limitations. For example, the intervention was conducted between November 2014 and December 2014, the qualitative interviews only started in August 2015. However, we do not believe this biased our results, as this long period between the intervention and the qualitative evaluation allowed us to assess what participants retained from the intervention in the long term, and how it has influenced their clinical practice today. Another possible drawback is that interviews were conducted via telephone as opposed to face-to-face, resulting in loss of contextual and nonverbal information. Nonetheless, telephone interviews may allow participants to feel relaxed and able to disclose sensitive information, and there is no evidence that they produce lower quality data compared to face-to-face interviews (19).

### Comparison with existing literature

Previous studies have shown a discrepancy between education and practice, and that GP trainees tend to develop prescribing habits similar to their supervisors (11,20). For example, despite formal training on rational prescribing during medical training, GP trainees prescribed antibiotics in 73% of encounters for acute

bronchitis/bronchiolitis (4). Although this is slightly less than prescription data from established GPs (21), it highlights the importance of facilitating appropriate prescribing in the workplace and the essential role of the supervisor.

A study of our own research group showed that the relationship between early-career GP and the supervisor was a very powerful dynamic, and in some cases a barrier to evidence-based prescribing (11). In contrast with these findings, none of the participants of the current study reported any conflict with their supervisors' prescribing habits. In the current study however, the intervention was also offered to the supervisors, aligning the GP trainees' and supervisors' views and knowledge on antibiotic prescribing. Hence, involving the supervisor in the intervention might have stimulated a sense of shared purpose between the GP trainee and their supervisor. Nonetheless, the GP trainees in our study did seem to struggle with the lack of consistency in antibiotic prescribing strategies among other GPs of the same practice. The fear expressed by the GP trainees in our study, that individual doctors attempting to prescribe more appropriately, could be undermined by the ongoing prescribing behaviour of other GPs in the same practice also highlights the importance of interventions ensuring consistency of messages within practice teams. Supervisors on the other hand identified specialists' prescribing habits as a barrier to rational prescribing; they blamed specialists for perpetuating the idea that antibiotics are effective for most infections. Similarly, Dallas *et al.* (11) showed that GP trainees who previously trained in the hospital found the transition to general practice difficult as they had routinely prescribed antibiotics for respiratory infections in the hospital. However, the severity of respiratory infections in general practice is very different from the hospital setting, making it very difficult to assess the validity of the aforementioned statement that specialists perpetuate the idea that antibiotics are effective for most infections. Future research should explore this further.

Interestingly, the intervention did not really seem to impact the supervisors' practice whereas GP trainees mentioned it improved their confidence and communication skills. GP supervisors seemed to be less reflective about their own prescribing, possibly because they are speaking from a position as a teacher and role model and may be less inclined to acknowledge that their prescribing behaviour could still be improved. Nevertheless, GP supervisors found the intervention reinforcing, indicating that they were to some degree receptive to the messages and some acknowledged that it was helpful in identifying misunderstandings about patient expectations for antibiotics.

Furthermore, the majority of studies on antibiotic prescribing behaviour of GPs focus on established GPs, while there is a paucity of research including GPs in vocational training (4). Although some studies in established GPs suggest that clinicians do not want education, but rather a decision-making tool, we found that early-career GPs and supervisors valued the educational session. It was reassuring that the intervention seemed to impact early-career GPs' perceived behaviour. The quantitative evaluation and future studies will have to demonstrate if the intervention was effective in changing levels of antibiotic prescribing, and how long the effect is sustained.

Although this study focussed mainly on early-career GPs, our results are similar to qualitative evaluations of other interventions targeting antibiotic prescribing of established GPs. The evaluation of the STAR program (Stemming the Tide of Antibiotic Resistance) and the large European study, GRACE INTRO (Genomics to combat Resistance against Antibiotics in Community-acquired LRTI in Europe INternet TRaining for antibiOtic use), also found that participants developed new communication skills and that the tools

and evidence-based information are perceived useful in negotiating with the patient (16,22). However, in contrast with the baseline evaluation of the GRACE INTRO study (16), we found that after the training our GP trainees were confident enough to use the provided information in their communication with patients, rather than using the tools in defending a decision not to prescribe antibiotics. Our study participants were interviewed about 8 months after the intervention. This might explain why they no longer felt the need to use the material; they had sufficient time to practice and adapt their communication skills.

We also found that both early-career GPs and supervisors were surprised that patients did not necessarily expect them to prescribe antibiotics when explicitly asked. This is in line with other studies that showed that GPs easily misjudge patients' expectations by assuming they want antibiotics when in reality the patients want to be examined properly and reassured (23).

### Implications for practice

This qualitative evaluation of a multi-faceted educational intervention in early-career GPs suggests that the intervention provided new communication skills and improved the early-career GPs' confidence in not prescribing antibiotics. This is an important finding that could have a long-term impact on improved antibiotic stewardship. Novel is the finding that targeting teams (e.g. whole of practice) is essential to ensure consistency of messages and practice.

### Supplementary Data

Supplementary data is available at *Family Practice* online.

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### Declarations

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### References

1. World Health Organization. Antimicrobial resistance. <http://www.who.int/mediacentre/factsheets/fs194/en> (accessed on 26 October 2015).
2. Goossens H, Ferech M, Vander Stichele R *et al.*; ESAC Project Group. Outpatient antibiotic use in Europe and association with resistance: a cross-national database study. *Lancet* 2005; 365: 579–87.
3. Kenaley T, Arroll B. Antibiotics for the common cold and acute purulent rhinitis. *Cochrane Database Syst Rev* 2013; 6: CD000247.
4. Dallas A, Magin P, Morgan S *et al.* Antibiotic prescribing for respiratory infections: a cross-sectional analysis of the ReCEnT study exploring the habits of early-career doctors in primary care. *Fam Pract* 2015; 32: 49–55.
5. McKenzie D, Rawlins M, Del Mar C. Antimicrobial stewardship: what's it all about? *Aust Prescr* 2013; 36: 116–20.
6. Arnold SR, Straus SE. Interventions to improve antibiotic prescribing practices in ambulatory care. *Cochrane Database Syst Rev* 2005; 4: CD003539.

7. Ranji SR, Steinman MA, Shojania KG *et al.* Interventions to reduce unnecessary antibiotic prescribing: a systematic review and quantitative analysis. *Med Care* 2008; 46: 847–62.
8. Butler CC, Simpson SA, Dunstan F *et al.* Effectiveness of multifaceted educational programme to reduce antibiotic dispensing in primary care: practice based randomised controlled trial. *BMJ* 2012; 344: d8173.
9. van Driel ML, Morgan S, Tapley A *et al.* Changing the Antibiotic Prescribing of general practice registrars: the ChAP study protocol for a prospective controlled study of a multimodal educational intervention. *BMC Fam Pract* 2016; 17: 1–8.
10. Davey P. The 2015 Garrod Lecture: Why is improvement difficult? *J Antimicrob Chemother* 2015; 70: 2931–44.
11. Dallas A, van Driel M, van de Mortel T *et al.* Antibiotic prescribing for the future: exploring the attitudes of trainees in general practice. *Br J Gen Pract* 2014; 64: e561–7.
12. Hays RB, Morgan S. Australian and overseas models of general practice training. *Med J Aust* 2011; 194: S63–4.
13. Little P, Stuart B, Francis N *et al.*; GRACE Consortium. Effects of internet-based training on antibiotic prescribing rates for acute respiratory-tract infections: a multinational, cluster, randomised, factorial, controlled trial. *Lancet* 2013; 382: 1175–82.
14. Yardley L, Douglas E, Anthierens S *et al.*; GRACE Consortium. Evaluation of a web-based intervention to reduce antibiotic prescribing for LRTI in six European countries: quantitative process analysis of the GRACE/INTRO randomised controlled trial. *Implement Sci* 2013; 8: 134.
15. Cates C. Cates plot. [http://www.nntonline.net/visualrx/cates\\_plot/](http://www.nntonline.net/visualrx/cates_plot/) (accessed on 25 May 2016).
16. Anthierens S, Tonkin-Crine S, Cals JW *et al.*; GRACE/CHAMP INTRO Team. Clinicians' views and experiences of interventions to enhance the quality of antibiotic prescribing for acute respiratory tract infections. *J Gen Intern Med* 2015; 30: 408–16.
17. Anthierens S, Tonkin-Crine S, Douglas E *et al.*; GRACE INTRO Study Team. General practitioners' views on the acceptability and applicability of a web-based intervention to reduce antibiotic prescribing for acute cough in multiple European countries: a qualitative study prior to a randomised trial. *BMC Fam Pract* 2012; 13: 101.
18. Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol* 2006; 3: 77–101.
19. Novick G. Is there a bias against telephone interviews in qualitative research? *Res Nurs Health* 2008; 31: 391–8.
20. Mincey BA, Parkulo MA. Antibiotic prescribing practices in a teaching clinic: comparison of resident and staff physicians. *South Med J* 2001; 94: 365–9.
21. Swannell C. Antibiotics still overprescribed. <https://www.mja.com.au/insight/2014/18/antibiotics-still-overprescribed> (accessed on 26 May 2016).
22. Bekkers MJ, Simpson SA, Dunstan F *et al.*; STAR Study Team. Enhancing the quality of antibiotic prescribing in primary care: qualitative evaluation of a blended learning intervention. *BMC Fam Pract* 2010; 11: 34.
23. van Driel ML, De Sutter A, Deveugele M *et al.* Are sore throat patients who hope for antibiotics actually asking for pain relief? *Ann Fam Med* 2006; 4: 494–9.