

Clinical influences on antibiotic prescribing decisions for lower respiratory tract infection: a nine country qualitative study of variation in care

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ABSTRACT

Objectives: There is variation in antibiotic prescribing for lower respiratory tract infections (LRTI) in primary care that does not benefit patients. This study aims to investigate clinicians' accounts of clinical influences on antibiotic prescribing decisions for LRTI to better understand variation and identify opportunities for improvement.

Design: Multi country qualitative interview study. Semi-structured interviews using open-ended questions and a patient scenario. Data were subjected to five-stage analytic framework approach (familiarisation, developing a thematic framework from the interview questions and emerging themes, indexing, charting and mapping to search for interpretations), with interviewers commenting on preliminary reports.

Setting: Primary care.

Participants: 80 primary care clinicians randomly selected from primary care research networks based in nine European cities.

Results: Clinicians reported four main individual clinical factors that guided their antibiotic prescribing decision: auscultation, fever, discoloured sputum and breathlessness. These were considered alongside a general impression of the patient derived from building a picture of the illness course, using intuition and familiarity with the patient. Comorbidity and older age were considered main risk factors for poor outcomes. Clinical factors were similar across networks, apart from C reactive protein near patient testing in Tromsø. Clinicians developed ways to handle diagnostic and management uncertainty through their own clinical routines.

Conclusions: Clinicians emphasised the importance of auscultation, fever, discoloured sputum and breathlessness, general impression of the illness course, familiarity with the patient, comorbidity, and age in informing their antibiotic prescribing decisions for LRTI. As some of these factors may be overemphasised given the evolving evidence base, greater standardisation of assessment and integration of findings may help reduce unhelpful variation in

ARTICLE SUMMARY

Article focus

- Clinicians' accounts of clinical influences on antibiotic prescribing decisions for LRTI.
- Understand variation and identify opportunities for improvement.

Key messages

- Clinicians reported four main clinical factors that guided their antibiotic prescribing decision: auscultation findings, fever, discoloured sputum and breathlessness. Clinical factors were similar across networks, apart from C reactive protein near patient testing used in Tromsø.
- These clinical factors were considered alongside a general impression of the patient derived from consideration of illness course, intuition and familiarity with the patient.
- Clinicians developed ways to handle diagnostic and management uncertainty through their own clinical routines.

Strengths and limitations of this study

- This is the first study to use semi-structured qualitative interviews to capture clinicians' views about LRTI management across a broad range of contrasting European countries.
- The clinicians who participated were affiliated to a research network so may not have been representative of all general practitioners in their country.
- Qualitative interviews gather reports of behaviour and attitude rather than actual behaviour, but by allowing clinicians to introduce and elaborate on themes spontaneously, we were able to gain an impression of the themes that held most prominence to the clinicians themselves.

management. Non-clinical influences will also need to be addressed.

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BACKGROUND

Antibiotic resistance is increasingly impacting on human health.¹ There is wide variation between some European countries in antibiotic prescribing for patients in primary care with lower respiratory tract infection (LRTI), and antibiotic prescribing is associated with increased antimicrobial resistance.^{2–4} In the GRACE observational study of variation in antibiotic prescribing for acute cough, Butler and colleagues found that patients included in Bratislava, Milan, Balatonfüred, Łódź and Cardiff networks were twice as likely to be prescribed antibiotics than the overall mean, even once variation in clinical presentation had been taken into account. Patients included by the Tromsø, Antwerp and Jönköping networks were four times less likely to be prescribed antibiotics than the overall mean.⁴ However, large differences in antibiotic prescribing did not translate to clinically important differences in patient recovery. Trial evidence suggests that most antibiotic prescriptions do not help such patients to get better any quicker.^{5–7} Variation in prescribing that does not improve patients' outcomes, and unnecessary antibiotics help drive selection of resistant organisms.^{1 4}

Physical examination and medical history do not clearly differentiate clinical syndromes, aetiology and prognosis.^{8–11} However, clinical assessment is all most primary care clinicians have to guide them, and little is known about the routine processes clinicians follow to gather information on patients' signs and symptoms in order to make management decisions. Research exploring clinical influences on antibiotic prescribing has largely used quantitative methods and pre-determined clinical categories.^{10 12–14} There are few qualitative research studies exploring a deeper understanding of the clinical factors that influence clinicians' prescribing decisions in LRTI. Coenen and colleagues identified factors general practitioners (GPs) reported using in diagnostic decisions regarding patients with cough and also quantified the factors in a questionnaire study.^{8 15} However, that study was limited to one region in Belgium and did not provide an in-depth description of the multiple components which make up clinical method. Fischer and colleagues¹⁶ conducted a direct observational study of family practitioners' decision making for patients with RTI in Germany but did not provide information on the process and ordering of clinical factors. Furthermore, there are no large qualitative studies that offer a wider European comparison.

We carried out a qualitative study in nine contrasting European countries to explore primary care clinicians' accounts of the *clinical processes* that inform their management of patients with symptoms of LRTI, particularly in relation to decisions about antibiotic prescribing. A further paper will report the *non-clinical* factors that clinicians report as shaping prescribing decisions.

METHODS

Setting and recruitment

We conducted semi-structured face-to-face interviews with 80 primary care clinicians in nine primary care research networks across Europe based in the cities of: Antwerp (10), Balatonfüred (10), Barcelona (10), Cardiff (8), Łódź (10), Milan (9), Southampton (6), Tromsø (7) and Utrecht (10). The nine networks had a track record of conducting research and were selected to achieve a geographical spread from 14 participating in the clinical platform of the GRACE (Genomics to combat Resistance against Antibiotics in Community-acquired LRTI in Europe, <http://www.grace-lrti.org>) Network of Excellence study on the presentation, management and outcome of acute cough in Europe. Primary care clinicians were randomly selected from participating healthcare practices to generate a maximum target of 10 clinicians per network. As recruitment had to be carried out locally by facilitators within each network and individual clinician characteristics (such as age and gender) were not available to the Cardiff research team prior to consent, it was not possible to purposefully sample clinicians according to specific criteria. It was therefore felt that random sampling was more methodologically sound than convenience sampling, which could be open to bias. Our study design did not allow for us to check data saturation at the time of data collection as there was a necessary time delay between data collection and analysis while the interviews were transcribed then translated into English for analysis. However, this was taken into account when the sample size was determined and we ensured that it was sufficiently large to capture a range of contrasting experiences. A national network facilitator oversaw recruitment, interviews, transcription and translation of data. Recruitment took place between January 2007 and February 2008. Informed written consent was taken at the point of recruitment.

Data collection

The interview guide was developed collaboratively with the interviewers after literature review and consideration of the aims of the project. Interviewers were given face-to-face training and the interview guide was revised in the light of feedback from the pilot interviews. Study documents required by ethics committees were translated and back translated to ensure accuracy.

Interviews were conducted in a place selected by the participants (usually the clinician's surgery) by the trained interviewer in the clinician's chosen language and audio-recorded. Interviews were semi-structured and consisted of four broad topic sections (factors affecting management of patients with symptoms of LRTI, management of patients with symptoms of LRTI, future of management of patients with symptoms of LRTI and attitudes to antibiotic resistance). In order to encourage clinicians to think experientially, each clinician was also given a typical scenario to reflect upon—an adult patient in their early 40s with productive cough, fever and

increased heart rate—and asked what they would normally do to diagnose the patient and decide on treatment. The same scenario was used by all interviewers to provide consistency and allow comparison and contrast in clinicians' responses across the different European settings. All interviews were transcribed and translated into English by the interviewer or translation service when required.

Analysis

Transcripts were analysed in Cardiff using a framework approach.¹⁷ This five-stage approach allows themes to be explored in relation to the prior research objectives and for new themes to emerge from the data. The first three stages, 'familiarisation', 'identifying a thematic framework' and 'indexing', are common to other forms of qualitative data analysis. The fourth stage, 'charting', involves retrieving the coded data and producing summaries of the talk produced on each theme, for each individual participant, and visually arranging it in a table to build an overall picture of the whole data set. This allowed easier comparisons across networks to identify variation and similarities in the final stage of interpretation of data. The fifth stage, 'mapping', involves the research team using the charts to map and interpret the data set as a whole and connect with the original research objectives.

LB-H and LC developed a thematic framework on the basis of research objectives and emerging themes, which was revised after discussion with the Steering Group and after being applied to more transcripts. Transcripts were double-coded until consensus was reached. The thematic framework was applied to data using the qualitative software package, NVivo 8.¹⁸ Preliminary analytic themes were validated by the interviewers at a workshop. Interviewers made fieldnotes after each interview, providing contextual detail for the central research team, and were referred to when emerging reports of data were discussed.

Ethical considerations

Ethical approval was managed and obtained for the qualitative study by the local facilitator within each country. All transcripts were anonymised and identifiable details deleted.

RESULTS

The gender of clinicians was balanced overall (41% females, $n=78$) with five networks interviewing more females than male clinicians (Barcelona, Cardiff, Łódź, Milan and Southampton). The approximate age of clinicians ranged from 30 to 67 years (mean 43 years ($n=71$)). The number of years clinicians had been in practice ranged from not yet a full year to 33 years (mean 16 years ($n=75$)).

Clinical factors

Clinicians' accounts revealed four clinical factors that influenced their antibiotic prescribing decision for

LRTI. These were chest sounds on auscultation, fever, discoloured sputum and shortness of breath. Representative quotes are followed with a code that refers to the network and the clinicians' unique study number.

Chest auscultation was consistently mentioned across all nine networks as influencing clinicians' decision to prescribe antibiotics. Clinicians talked about auscultating for a variety of sounds using descriptive concepts: crepitations, dullness, wheeze and polyphonic wheeze, crackles, rhonchi, whistling and muffling sound, as well as interpreting concepts: consolidation and sounds of sputum or congestion. It was one of the first aspects of examination clinicians said they carried out in order to decide the next course of action, that is, to continue with examination, diagnose, treat the patient and consider referral for further investigations if necessary: "Listen to the lungs. That would be my first step and depending on what you then hear or what comes out of the additional story, you have to do some more" (Utrecht 44). Clinicians reported that they would be more likely to prescribe antibiotics on hearing chest sounds: "If I would hear crepitations or rhonchi or wheezing or whatever, I'd take into account the antecedents of the patient, if it is a chronic bronchitis patient, well managed, then I'd be more tempted to start up antibiotics straight away" (Antwerp 77). A clear chest also helped clinician in deciding when antibiotics were *not* necessary.

However, one clinician questioned the value of relying on auscultation in deciding whether to prescribe: "It's a difficult issue because I don't know that we really know how accurate even lung signs are as a predictor so, but you kind of get the feeling if somebody has quite focal signs and are more unwell then...I think my threshold for giving antibiotics at that stage might, would be lower" (Southampton 85).

Clinicians reported that fever had an influence on their decision to prescribe antibiotics. There was slight variation in the duration of fever clinicians considered as indicating that antibiotics should be prescribed. For example, two clinicians (Antwerp 35 and 63) in the Antwerp-based network said they might prescribe antibiotics if the fever has lasted 3 days and 'still looks bad', while a clinician in Balatonfüred (Balatonfüred 286) stated he might prescribe after 5 days of fever. Another clinician stated that fever, alone, was not enough to warrant prescribing antibiotics: "Even if they had a fever and it was just a flu like illness which of course is carried round by a cough, I wouldn't prescribe antibiotics unless I felt there was a significant chance of respiratory tract infection" (Southampton 29).

The colour of sputum was mentioned by many clinicians across the networks as influencing decision to prescribe, with the exception of Tromsø, and particularly in the Southampton and Barcelona networks. The presence of yellow/green sputum was considered alongside the nature (dense, smelly), amount (increased), usually in relation to cough. However, three clinicians stated that the colour of sputum was of little or no help deciding on

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whether to prescribe antibiotics. Despite this caution, these clinicians felt that there was limited evidence on which to base decisions and therefore that coloured sputum might still 'steer' a decision: "Producing coloured sputum, that should not be taken into account when you decide on prescribing antibiotics. But still, I take it into account. Because like you know, as a GP, you've got not a lot to base yourself on...If there is coloured sputum and also...other worrying signs, then we are one step closer to prescribing antibiotics" (Antwerp 77).

Some clinicians indicated that they would count the patient's respiratory rate and check for tachypnoea. They also reported checking for dyspnoea, difficulty breathing and rapid breathing. Some asked patients if they had had experienced chest pain. This was then taken into account, alongside the other clinical factors, in deciding whether to prescribe.

Risk factors

Clinicians' accounts revealed that they would interpret these clinical factors in light of two major risk factors: comorbidity and older age. Clinicians reported concern that patients who fell into these two categories might deteriorate rapidly and suggested that they would be 'quicker' to prescribe antibiotics, rather than adopting a 'wait and see' approach.

Clinicians frequently reported considering patients' comorbidity and particularly took into account chronic obstructive pulmonary disease (COPD), as well as asthma, circulatory disease, diabetes and heart disease: "In the elderly, patients with COPD or heart disease, I am more easily inclined to prescribe antibiotics, maybe from the very start" (Milan 51). Many noted whether patients suffered from recurrent RTIs.

Clinicians reported that older age, particularly patients over the age of 60 or 65, was considered in the prescribing decision: "Elderly people, however, it is necessary more often to protect with the antibiotic. With them more quickly, more quickly complications take place" (Łódź 106).

General impression and familiarity with the patient

Clinicians indicated that these clinical and risk factors were combined and then considered alongside their general impression of the patient to decide whether or not to prescribe an antibiotic. Clinicians' general impressions of the patient were developed from building up a picture of the illness course, their intuition and/or familiarity with the patient.

Clinicians reported the need to build a picture of the illness course. The most important features of this were asking patients about the duration and, to a lesser extent, severity of their symptoms. An assessment of illness severity sometimes included an assessment of how symptoms limited activities of daily living, such as ability to go to work, eat and drink or walk normally. They also considered the overall impression of how ill the patient was. Assessments such as 'very ill', 'weakened' and 'seriously ill' were used.

Clinicians revealed that sometimes they got 'a feeling' which could override the decision they would make purely based on the clinical factors. One clinician explained that absence of signs on auscultation might still prompt further action if they chose to rely on their intuition instead: "I can feel it in my bones...I can listen to your lungs now and at this moment I don't have any signs...of concern, but it doesn't give me enough certainty...maybe further examination is needed or...let's give antibiotics now after all...it is a feeling of...this is different from the routine" (Antwerp 147).

Other clinicians talked of their familiarity with the patient, which can help them in their decision on whether or not to prescribe antibiotics. Clinicians' familiarity with the individual patient was important, particularly in the Balatonfüred, Łódź and Cardiff networks where over half the clinicians mentioned it. Familiarity had a bearing on decision making in relation to knowledge of recurrent infections ("I'm probably more likely to prescribe earlier in patients who I know well and who I know have had (recurrent) history" Cardiff 98). Through familiarity with what is normal for the patient, clinicians were able to make a more informed evaluation of usual health status: "I have been treating these patients for years, so in most cases I know how the patient behaves, what he looks like in what condition he is when he is healthy" (Łódź 120). However, while clinicians in the Balatonfüred and Łódź networks indicated that this was due to continuity of care, clinicians in the Cardiff network talked more of performing notes review in order to gather background medical history.

Combining factors and zone of uncertainty

Clinicians talked about thresholds or tipping points at which they would prescribe antibiotics: "I think the tipping point is partly clinical and partly to do with how ill they appear and partly to do with patient preference" (Southampton 43). They frequently talked about combining factors and implied that clinical factors were given different weightings. They rarely talked about one single factor that conclusively 'trumped' all other factors in the decision to prescribe antibiotics: "the reason for prescribing...is based upon combinations of signs and symptoms...there is no individual cardinal symptom that says 'I will treat'" (Cardiff 42). Clinicians could be seen as using their professional knowledge and attitude to 'build up' a diagnosis with different clinical factors including the patient's clinical history and the findings from the examination, like 'pieces of jigsaw' (Cardiff 28).

However, this need to combine clinical findings, along with the lack of conclusive evidence to support diagnosis and management of LRTI in primary care, led some clinicians (particularly those in the Cardiff and Antwerp network) to describe a zone of uncertainty in making management decisions. Some felt that they never reached certainty and were always working with probabilities: "That feeling, that assessing...it of course always

stays an estimation, uh. You can still be wrong about it" (Antwerp 77). This was because they did not know for certain, in routine practice, whether they were dealing with a bacterial or viral infection: "Due to the fact that I don't have a bacteriologic diagnosis, I work only with probabilities" (Balatonfüred 328). This led to some questioning the rationality and accuracy of their decision making: "There's always a grey area...there are always going to be umm combinations of symptoms and signs that do not persuade you totally that this person requires antibiotics and then your judgement is based upon many things that are not always logical" (Cardiff 42).

Despite this uncertainty, clinicians easily listed clinical factors they would usually consider. They handled this uncertainty in different ways. Some gave a systematic standardised formula of factors they would consider, particularly in relation to the examination of the patient: "What I do mostly, it is also a bit working in a standardized way...So mostly, when I do it well, then it will be like this, so first quickly looking at the throat, and then quickly, er, listening to the heart, and then to the lungs. And what I mostly do as well, is measuring a blood pressure" (Antwerp 63). Some clinicians accepted that uncertainty was 'part of the job' as a GP and lived with it, as this clinician illustrates; "As a family doctor you have learned to deal with limits and uncertainties. That is part of our profession. If you don't feel good about that, then you don't stay a family doctor" (Antwerp 147). One clinician in Antwerp handled uncertainty by considering the patient's state in relation to thresholds of different levels of activity, rather than try to apply a diagnostic label to the patient, which he felt was impossible to make with any certainty. These thresholds ranged from simply treating the symptoms to prescribing antibiotics, referring the patient and finally hospitalisation: "The most important choice is, do you restrict yourself to taking care of the symptoms or do you proceed to antibiotics, or referral, hospitalisation and so on. So, in the end...have your limits been crossed in order to take action...Giving that name, like, ouch, this is a bronchitis, or, ouch, this is a pneumonia, certainly with a stethoscope I am not capable of determining that, so I consciously don't really make a choice to use those terms" (Antwerp 147).

Clinicians' accounts of decision making did not necessarily rely on making a diagnosis first (with some clinicians emphasising the uncertainty and difficulty in confirming an accurate diagnosis in practice). Clinicians varied their focus when presented with a patient with symptoms of LRTI; some placed an emphasis on identifying a diagnostic label, some on distinguishing the cause of the infection (viral vs bacterial), some on deciding on management and others doing all these simultaneously.

Use of point of care tests and uncertainty

All clinicians in the Tromsø network reported routinely using a C reactive protein (CRP) point of care test due to the 'extra information' this provided for the immediate decision on whether or not to prescribe antibiotics.

However, many clinicians in the Tromsø-based network also expressed caution and awareness of the dangers of over-reliance on the test when deciding about prescribing antibiotics. Clinicians cautioned against 'treating a CRP result' rather than the patient and misinterpreting and responding to misleading CRP results.

In contrast, CRP tests were not routinely done in the remaining eight networks. The majority of tests, for most networks, were analysed in a location remote to the primary care centre (usually a laboratory or hospital) and therefore did not influence immediate management decisions.

DISCUSSION

Principal findings

This trans-European study used qualitative methods to explore reported, rather than actual, practice and allowed clinicians to reflect on the importance of different clinical factors rather than reproduce a list of categories pre-determined by researchers.

Chest auscultation was the most consistently mentioned examination procedure used to guide decisions, a finding in keeping with previous research^{8 15 16 19 20} and with the GRACE-01 observational study conducted within these same networks where auscultation was performed on 99% (n=2690) of the patients who attended with symptoms of acute cough. Clinicians reported listening for a wide variety of auscultatory abnormalities, implying a lack of consistency in identifying and interpreting findings. Hopstaken and colleagues²¹ found that the significance of abnormal auscultation was overestimated and associated with inappropriate antibiotic prescribing. The diagnostic importance of auscultation abnormalities may be overestimated.^{22 23} Normal chest auscultation might be more useful clinically, as auscultation may have a greater negative than positive predictive value.²⁴

The presence of fever was also used in decision making. However, there was some variation in how long patients should have had fever for it to be 'meaningful', and there were differences in reported practice as to when temperature was taken. Some clinicians reported that asking patients their temperature was enough. This suggests a lack of standardised practice in clinical method.

A notable feature in clinicians' decision making was the influence of discoloured sputum on management. Many clinicians talked about this but few explicitly questioned the value of sputum colour in guiding decisions. Yellow and/or green sputum has previously been found to be associated with antibiotic prescribing for RTI, despite it being a weak diagnostic marker for bacterial infection.^{9 20 25 26} We found an emphasis on combining factors and therefore focusing on one finding and describing poor predictive value for one sign or symptom is not consistent with the clinical method followed by clinicians. Individual items are not acted

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upon in isolation, but they contribute to a 'gestalt' regarding severity assessment and management.

Additional tests were not reported as generally influencing the immediate management decision, particularly in relation to decision to prescribe antibiotics, with the exception of the Tromsø network. While all clinicians in this network reported that tests were routinely carried out due to the value of the extra information they provided, they still expressed caution about over-reliance on the test.²⁰⁻²⁷ Clinicians in other networks mentioned an array of potential investigations that could be ordered but these were not used routinely and did not influence empirical management.

We found that clinicians across all networks appeared to combine clinical factors assigning them different weightings to guide decisions. This fits with Atkinson's notion of diagnosis as professional detective work or a 'puzzle-solving activity'.²⁸ However, Fischer *et al*¹⁶ found that family practitioners performed a 'simplified process', in line with simple heuristics that led to a decision to prescribe antibiotics (or not). For some clinicians, decision making was clearly not a process in which the various factors are taken and considered in a step-by-step manner. Rather, decision making was presented as a blend of accumulating factors used to discount certain possibilities and point in the direction of others. While this might sound chaotic, individual clinicians talked about working in a systematic or standardised way and had developed their own method to ensure all factors that they felt were relevant were considered. This indicated that management decisions are complex and may explain why they differ from clinician to clinician.²⁹

While the issue of diagnostic and management uncertainty has been acknowledged by some clinicians and identified in research, clinicians largely described their own routine processes that they had developed and followed in order to make decisions.⁸⁻¹⁵⁻¹⁹⁻³⁰⁻³¹ It is possible that, rather than focus on the uncertainty, clinicians developed ways to handle this uncertainty through their own ritual of clinical processes and practice.

However, overall, important variation does not seem to occur in the clinical factors clinicians report as influencing their antibiotic prescribing decisions, with the exception of the near patient test in the Tromsø network. It is possible that they weigh and integrate factors differently in different European settings, but it is unlikely that variation in management can be satisfactorily explained by these subtle differences and clinical method alone and there is a need to consider non-clinical factors to understand variation across European networks. We will report on clinicians' accounts of the non-clinical factors that shape antibiotic prescribing in a further paper.

Strengths and limitations

This is the first study to use semi-structured qualitative interviews to capture clinicians' views about LRTI management across a broad range of contrasting Euro-

pean countries. It allowed us to explore practice in different cultural and healthcare delivery systems.

The clinicians who participated were all affiliated to a research network and so may not have been representative of all GPs in their country. Qualitative research methods aim to generate further understanding rather than generalise. They gather clinicians' reports of practice, rather than actual practice. Qualitative methods were chosen because our aim was to generate data important to clinicians themselves rather than quantify responses to questionnaire items identified by researchers. By allowing clinicians to introduce and elaborate on themes spontaneously, we were able to gain an impression of the themes that held most prominence to the clinicians themselves.

Implications

Clinicians clearly consider a range of clinical factors in making a management decision for LRTI and manage uncertainty by following their own formula to gather evidence to inform their decision making. However, the components used are similar across networks, except Tromsø where CRP near patient testing is routinely used. It is possible that standardising the way key components of clinical method are used may help reduce unhelpful variation in antibiotic prescribing decisions (especially possible over-reliance on auscultatory abnormalities and sputum colour). However, non-clinical factors may also explain an important component of this unhelpful prescribing variation.

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Competing interests None.

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REFERENCES

1. Goossens H, Ferech M, Vander Stichele R, *et al.* Outpatient antibiotic use in Europe and association with resistance: a cross national database study. *Lancet* 2005;365:579–87.
2. Macfarlane J, Lewis S, Macfarlane R, *et al.* Contemporary use of antibiotics in 1089 adults presenting with acute lower respiratory tract illness in general practice in the UK: implications for developing management guidelines. *Respir Med* 1997;91:427–34.
3. Akkerman A, Kuyvenhoven M, van der Wouden J, *et al.* Prescribing antibiotics for respiratory tract infections by GPs: management and prescriber characteristics. *Br J Gen Pract* 2005;55:114–18.
4. Butler CC, Hood K, Verheij T, *et al.* Variation in antibiotic prescribing and its impact on recovery in patients with acute cough in primary care: prospective study in 13 countries. *BMJ* 2009;338:b2242.
5. Smucny J, Fahey T, Becker L, *et al.* Antibiotics for acute bronchitis. *Cochrane Database Syst Rev* 2000;(4):CD000245.
6. Macfarlane J, Holmes W, Gard P, *et al.* Prospective study of the incidence, aetiology and outcome of adult lower respiratory tract illness in the community. *Thorax* 2001;56:109–14.
7. Little P, Rumsby K, Kelly J, *et al.* Information leaflet and antibiotic prescribing strategies for acute lower respiratory tract infection: a randomized controlled trial. *JAMA* 2005;293:3029–35.
8. Coenen S, Van Royen P, Vermeire E, *et al.* Antibiotics for coughing in general practice: a qualitative decision analysis. *Fam Pract* 2000;17:380–5.
9. Fischer T, Fischer S, Kochen M, *et al.* Influence of patient symptoms and physical findings on general practitioners' treatment of respiratory tract infections: a direct observation study. *BMC Fam Pract* 2005;6:6.
10. Hopstaken RM, Stobberingh EE, Knottnerus JA, *et al.* Clinical items not helpful in differentiating viral from bacterial lower respiratory tract infections in general practice. *J Clin Epidemiol* 2005;58:175–83.
11. Cals JW, Butler CC, Hopstaken RM, *et al.* Effect of point of care testing for C reactive protein and training in communication skills on antibiotic use in lower respiratory tract infections: cluster randomised trial. *BMJ* 2009;338:b1374.
12. Howie JG. Further observations on diagnosis and management of general practice respiratory illness using simulated patient consultations. *BMJ* 1974;2:540–3.
13. Holmes WF, Macfarlane JT, Macfarlane RM, *et al.* Symptoms, signs, and prescribing for acute lower respiratory tract illness. *Br J Gen Pract* 2001;51:177–81.
14. McIsaac WJ, To T. Antibiotics for lower respiratory tract infections. Still too frequently prescribed? *Can Fam Physician* 2004;50:569–75.
15. Coenen S, Michiels B, Van Royen P, *et al.* Antibiotics for coughing in general practice: a questionnaire study to quantify and condense the reasons for prescribing. *BMC Fam Pract* 2002;3:16.
16. Fischer T, Fischer S, Himmel W, *et al.* Family practitioners' diagnostic decision-making processes regarding patients with respiratory tract infections: an observational study. *Med Decis Making* 2008;28:810–18.
17. Ritchie J, Spencer L. Qualitative data analysis for applied policy research. In: Bryman A, Burgess R, eds. *Analyzing Qualitative Data*. London: Routledge, 1994:173–94.
18. NVIVO Qualitative data analysis software, QSR international Pty Ltd. Version 8. 2008.
19. Coenen S, Michiels B, Renard D, *et al.* Antibiotics for coughing in general practice: the effect of perceived patient demand. *Br J Gen Pract* 2006;56:183–90.
20. Jakobsen K, Melbye H, Kelly M, *et al.* Influence of CRP testing and clinical findings on antibiotic prescribing in adults presenting with acute cough in primary care. *Scand J Prim Health Care* 2010;28:229–36.
21. Hopstaken RM, Butler CC, Muris JW, *et al.* Do clinical findings in lower respiratory tract infection help general practitioners prescribe antibiotics appropriately? An observational cohort study in general practice. *Fam Pract* 2006;23:180–7.
22. Osmer JC, Cole BK. The stethoscope and roentgenogram in acute pneumonitis. *South Med J* 1966;59:75–7.
23. Melbye H, Straume B, Aasebø U, *et al.* Diagnosis of pneumonia in adults in general practice. *Scand J Prim Health Care* 1992;10:226–33.
24. Metlay JP, Kapoor WN, Fine MJ. Does this patient have community-acquired pneumonia? Diagnosing pneumonia by history and physical examination. *JAMA* 1997;278:1440–5.
25. Altiner A, Wilm S, Daübener W, *et al.* Sputum colour for diagnosis of a bacterial infection in patients with acute cough. *Scand J Infect Dis* 2009;27:70–3.
26. Butler CC, Kelly MJ, Hood K, *et al.* Antibiotic prescribing for discoloured sputum in acute cough/lower respiratory tract infection. *Eur Respir J* 2011;38:119–25.
27. Wood F, Brookes-Howell L, Hood K, *et al.* An ideal test? A multi-country qualitative study of clinicians' and patients' views of point of care tests for lower respiratory tract infection in primary care. *Fam Pract* 2011:1–9.
28. Atkinson P. *Medical Talk and Medical Work*. London: Sage, 1995.
29. Simpson S, Wood F, Butler CC. General practitioners' perceptions of antimicrobial resistance: a qualitative study. *J Antimicrob Chemother* 2007;59:292–6.
30. Kumar S, Little P, Britten N. Why do general practitioners prescribe antibiotics for sore throat? Grounded theory interview study. *BMJ* 2003;326:138–43.
31. Wood F, Simpson S, Butler CC. Socially responsible antibiotic choices in primary care: a qualitative study of GPs' decisions to prescribe broad-spectrum and fluoroquinolone antibiotics. *Fam Pract* 2007;24:427–34.

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