Minimising inappropriate prescribing of antibiotics

In an era of rapidly increasing antibiotic resistance, appropriate antibiotic prescribing is a challenge for general practice. This article presents strategies for reducing inappropriate prescribing, and gives a guide to antibiotic use in some common infections. The ultimate price of increasing resistance is high, both medically and financially.

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Community-acquired infections are one of the most common reasons for people consulting their GP and are a cause of significant morbidity and time lost from work. Many of these infections can present diagnostic difficulty, particularly distinguishing between bacterial and viral causes. Assessing the need for an antibiotic and explaining the need or otherwise to the patient are important skills for every GP. In the current era of rapidly increasing antibiotic resistance it is of vital importance that antibiotic use is rational if we are to continue to have safe, effective and affordable agents.

The problem of resistance

As with many other common drugs, there is a broad variety of antibiotics from which to choose. The judicious practitioner usually confines his or her prescribing to a relatively small number of drugs, and becomes familiar with their strengths, limitations, adverse reactions and drug interactions. Most GPs are aware that their judgements can be backed up by a high quality regulatory system and ready access to prescribing guidelines, such as the widely recognised *Therapeutic guidelines: antibiotic*, now in its 10th edition.[1]

Despite this, there are still significant problems

IN SUMMARY

- **Australia is a higher user of antibiotics than most similar countries in Europe and North America.**
- **Despite the GP belief to the contrary, only about one-third of patients expect antibiotics and only some are vehement about their need.**
- **Prescribing for respiratory infections is the major area of antibiotic use in general practice. Yet, 90% of all respiratory tract infections are viral.**
- **Strategies for reducing inappropriate prescribing include: eliciting patients' expectations and anxieties, providing an adequate explanation and easy access for review, explaining that not prescribing is for health reasons, and using a delayed prescription strategy where appropriate.**

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with antibiotics in Australia. Some are problems peculiar to hospital practice, but many are community based and therefore in the sphere of influence of general practice. The principal problems are:

- high antibiotic use compared with similar Western countries
- increasing resistance in common community-acquired bacterial pathogens (Table).

Higher use in Australia

The bulk of antibiotic prescribing in Australia occurs in general practice. Most of this (about 75%) is for respiratory tract infection. What is surprising is that Australia is a higher user of antibiotics than most similar Western countries in Europe and North America.[2] (Figure 1 compares the use in these countries in 1989 and 1994; the pattern has changed little since then.) Given that infection rates in these comparator countries are unlikely to be different from those in Australia, it is clear that antibiotic use in Australia is excessive.

The precise reasons for this are not clear, but it is reasonable to assume that there are strong cultural components. These are the patient's expectation for antibiotic prescriptions for all infections, and the training and experience of the prescribers. The problem has been exacerbated over the last few years by an increasing tendency to prescribe higher doses and broader spectrum agents. Some of this may be due to the increasing levels of bacterial resistance found in the community. However, there is a positive feedback loop inherent in using higher doses and broader spectrum agents to overcome resistance, because resistances will increase further when this is done. The co-operation of both parties – that is, the patient and the prescriber – is required to break this vicious cycle.

The antibiotic burden

One conceptual approach to the problem is to regard the amount of antibiotic used as a 'burden' that the community has to bear. The antibiotic burden can be defined as a combination of the total amount of antibiotics used and the breadth of their spectra. It is this burden that applies the antibiotic pressure to organisms to select for and promote resistance.

To illustrate the size of this burden in Australia, over the financial years between 1992 and 1996 the average yearly amount of amoxycillin

Escherichia coli.

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Table. Important resistances in community-acquired pathogens

Species and antibiotic	% resistant*
Escherichia coli	
Amoxycillin and ampicillin	46%
Trimethoprim	17%
Trimethoprim–sulfamethoxazole	17%
First-generation cephalosporins	13%
Amoxycillin–clavulanate	9%
Gentamicin	1%
***Staphylococcus aureus* (non-MRSA)**	
Penicillin	90%
Erythromycin and roxithromycin	13%
Trimethoprim–sulfamethoxazole	2%
Streptococcus pyogenes	
Penicillin	0%
Erythromycin	4%
Streptococcus pneumoniae	
Penicillin and amoxycillin	9%
Erythromycin and roxithromycin	16%
Tetracycline	16%
Cefaclor	21%
Trimethoprim–sulfamethoxazole	33%
Haemophilus influenzae	
Amoxycillin and ampicillin	19%
Erythromycin and roxithromycin	NS†
Tetracycline	3%
Cefaclor	2%
Trimethoprim–sulfamethoxazole	11%
Moraxella catarrhalis	
Amoxycillin and ampicillin	86%
Erythromycin and roxithromycin	3%
Tetracycline	2%
Cefaclor	3%
Trimethoprim–sulfamethoxazole	8%

*Data for *S. pneumoniae* from: Turnidge JD, Bell JM, Collignon PJ, on behalf of the Pneumococcal Study Group. Rapidly emerging antimicrobial resistances in *Streptococcus pneumoniae* in Australia. Med J Aust 1999; 170: 152-155. Remaining data from: Bell JM, Turnidge JD. National Antimicrobial Resistance Surveillance Program, 1998 report.
†Not susceptible: *Haemophilus influenzae* generally tests as resistant in routine laboratory testing.

either ingested by or injected into humans was 74,500 kg, or 74.5 tonnes! Erythromycin was second at 44,300 kg. It is obvious that this generates enormous antibiotic pressure to select for resistance, much of which comes about through the inadvertent exposure of normal flora, rather than by the selection of resistance in the target pathogen. The amount of amoxycillin use has promoted increasing resistance levels in *Escherichia coli*, *Haemophilus influenzae* and *Streptococcus pneumoniae*.

Efforts to address the problem

While there have been significant national efforts to address the problem of antibiotic overuse in Australia,[3] the professional responsibility finally rests with the prescriber. Efforts have been directed at updating the prescriber on the role of antibiotics in the common respiratory infections – for example, a newsletter by the National Prescribing Service, and the DATIS (Drug and Therapeutics Information Service) project in Adelaide. In addition, there has been one excellent study conducted in Melbourne aimed at educating both the practitioners and the patients simultaneously.[4] Over a six-month period, the study was able to show an 8% drop overall in antibiotic prescriptions, and a 10% increase in compliance with antibiotic guidelines for common infections such as acute sore throat, acute otitis media and acute bronchitis.

Attitudes to antibiotic prescribing

A pivotal study conducted in Wales has directly tackled the complex issues of GP and patient attitudes and behaviours related to the use of antibiotics for sore throat.[5] Its conclusions can be generally applied to the broad range of common infections in general practice, and they provide us with valuable insights about the best strategies for addressing inappropriate use. These are discussed in the following sections.

GPs' attitudes and practices

Prescribing for respiratory infections presents a serious dilemma for the GP. He or she often feels compromised by having to prescribe antibiotics for obvious viral infections but feels that the

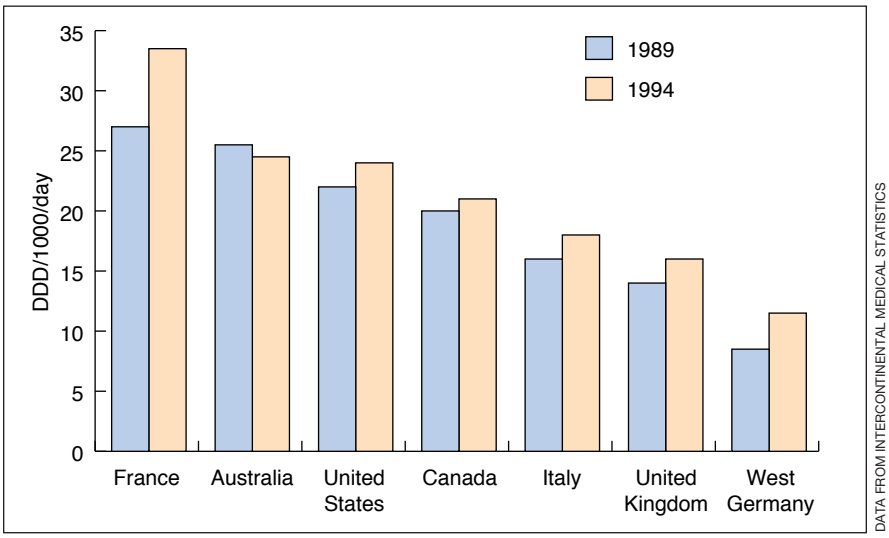

Figure 1. Oral antibiotic use in some developed countries in 1989 and 1994. Use is measured as defined daily doses (DDD) per 1000 persons per day. Adapted from: McManus P, et al. Med J Aust 1997; 167: 124-127.

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patients require something more than reassurance and hates not meeting patient expectations. Interestingly, when asked to assess their own practice, most GPs rate themselves as 'average' or 'below average' prescribers of antibiotics.

The most common reason for prescribing antibiotics irrationally is a concern that the relationship with the patient, and hence the therapeutic power of the interaction, will be jeopardised. A concern that the patients who want antibiotics will go to another doctor to get them is frequently voiced. Other reasons include the pressure of time, no energy to resist demand, fear of medicolegal problems, and concern that the patient will think the GP has not provided any treatment for the illness.

All GPs understand that there is overprescribing for viral conditions, but many find it difficult to see great harm for an individual patient if antibiotics are prescribed 'once or twice a year for an upper respiratory infection'. There is also recognition that a short term saving in workload (by prescribing early, for a viral infection) is likely to increase workload in the long term because of repeat visits for prescriptions with subsequent viral infections.

Patients' attitudes

According to the Welsh study, the patients provide an interesting contrast to the GPs.[5] For instance, despite the GP belief to the contrary, only about one-third of patients expect antibiotics, and of these only some are vehement about their need. The other two-thirds consult for reassurance, equally divided into those who definitely do not want antibiotics and those who would take them if advised to do so. Those who do consult for reassurance are happy with a good explanation, advice on pain relief and prevention of recurrence. However, they do hate hearing the description 'it's just a virus', and they wish for a clearer explanation.

One important point is that few patients openly express their expectations because they have come for professional advice. Many understand that antibiotics aren't the answer to all coughs, colds and sore throats. Far fewer know the side effects of antibiotics and even less about the association with resistance. Of course, there is a strong belief in some patients that antibiotics must work because their condition gets better within a few days when taking them.

In the following sections, we provide some tips on how to reduce antibiotic prescribing (summarised in the box on this page). In addition we will address some of the important issues in antibiotic use for common infections.

Strategies for reducing inappropriate prescribing

Take the problem seriously

Many of the common infections for which patients seek help are viral and/or rapidly self-resolving. It is therefore easy to dismiss them as trivial with an incorrect turn of phrase or tone. Taking the problem seriously will be the first significant step to gaining the patient's confidence. It is important to communicate to patients that diagnosing a virus is not a doctor's way of saying there is nothing wrong and that the doctor acknowledges how ill the patient feels, and to give helpful advice on managing the symptoms.

Elicit the patient's or parent's expectation

All consultations should attempt to determine the explicit and tacit expectations of patients or parents for antibiotics when they attend with what they presume is an infection. It has been shown that doctors are influenced by their perception of whether the patient expects an antibiotic, and by the social context of the prescription. It is important for prescribers to be aware of this and base their decisions on clinical symptoms and signs, not simply 'guessing' the patient's needs and acting accordingly. As the Welsh study was able to show, doctors' views of the patients' expectations are often not the true expectations.[5] Simple questions will eliminate this misunderstanding.

Strategies for reducing inappropriate prescribing

- Take the problem seriously.
- Elicit the patient's or parent's expectation.
- Explore the patient's or parent's anxieties.
- Provide a 'value added' consultation.
- Provide an adequate explanation.
- Provide easy access for review.
- Explain that not prescribing is for health and not financial reasons.
- Use a delayed prescription strategy where appropriate.

Explore the patient's or parent's anxieties

Whether an antibiotic prescription is required or not, it is essential that the real concerns of the patient or parent be addressed. It may be that the principal problem is one of pain relief, loss of sleep, or irrational beliefs about the cause. Infections that occur near an important event, such as an upcoming exam, business trip or holiday, are frequent causes of consultation when otherwise the patient would not seek medical assistance. Again, a simple question can make this explicit.

Provide a 'value added' consultation

Patients expect that the practitioner will take the time to perform a thorough examination. The additional time spent provides the opportunity to ask the questions mentioned above and to get

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to learn the patient's understanding and expectations. For patients who have a definite wish for antibiotics when you know they will not be helpful, take the time to explore their knowledge of side effects and resistant bacteria.

Provide an adequate explanation

A good explanation of the illness is always worthwhile, and an investment in the future should there be a recurrence. Explanations of the difference between viruses and bacteria can be difficult and confusing to patients, but if reinforced by written material or repeated explanation they are likely to be beneficial in the long term. As an alternative or addition, it is worthwhile to explain study findings of lack of efficacy when this applies.

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Figure 2. Tonsils obstructing the airway.

Much can be gained by altering the perception that antibiotics are 'harmless'. As antibiotics are specifically designed as 'magic bullets' to do selective harm to the bacteria and not to the host, it is easy for the patient to believe that they have no adverse reactions. Most reactions, like gastrointestinal upset, rash or candidiasis, are just bothersome, but often result in additional treatments or additional courses of different antibiotics. Some reactions, such as anaphylaxis, are potentially life-threatening. The need to inform the patient about these is now greater than ever.

When you are prescribing antibiotics, providing simple written information (such as consumer product information), in addition to a verbal explanation while writing the script, will be educational for many patients. Such information can even be a useful additional tool for the patient who insists on an antibiotic script when antibiotics are not indicated.

Provide access for review

Patients respond to the personal touch of being given access to review by the doctor. As all practitioners are aware, review is one of the most powerful diagnostic tools. If this is offered when antibiotics are not prescribed, a patient's confidence in the practitioner is improved, and his or her belief that the problem has been taken seriously will be reinforced.

Explain that not prescribing is for health and not financial reasons

It is obvious but vital that doctors are prepared to explain the reasons why antibiotics are not indicated and the possible harm in terms of adverse effects, such as diarrhoea and vaginal thrush, and increased resistance that may result from an unnecessary prescription.

Use a delayed prescription strategy where appropriate

In some situations, writing a prescription to be used if certain symptoms develop is a reasonable course of action. This is particularly the case in rural areas where the patient may have to travel a considerable distance to be seen and cannot easily return to the GP if a bacterial secondary infection develops. For example, an elderly patient prone to exacerbations of bronchitis, who complains of a dry cough and mild retrosternal pain that is most likely a symptom of viral tracheitis, could be

Consultant's comment

This article provides timely practical advice on how we as doctors can have an impact into changing the rates at which antibiotic resistance is developing. Antibiotic resistance has been mainly regarded as a problem for hospital-acquired infections, but internationally as well as in Australia many common bacteria, such as *Escherichia coli, Haemophilus influenzae* and *Streptococcus pneumoniae*, are associated with significant and increasing rates of resistance. In addition, we are beginning to see problems in the community with strains of *Staphylococcus aureus* that are resistant to beta lactam agents (i.e. flucloxacillin, cephalothin).

In the medium to long term, the amount of antibiotic resistance that is seen in the community and the rate at which it rises is proportional to the total amount of antibiotic used. It is also influenced by whether the antibiotics used are broad spectrum or narrow spectrum. Therefore, if we can modify both medical practice and patient expectations, so that antibiotics are given only in those cases where there is a high likelihood that they will make a difference to the patient's outcome, we should be able to influence this rate of rise of antibiotic resistance. This article is a major contribution addressing this important problem.

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given a prescription for an appropriate antibiotic and asked to have it filled only if he or she develops fever (>38°C) and purulent sputum. This technique fulfils the patient's expectations without prescribing inappropriately.

Rethinking the role of antibiotics in common infections

Surveys repeatedly show that about three-quarters of all antibiotic prescriptions in general practice are for respiratory tract infections, and the vast bulk are for upper respiratory problems. Yet, 90% of all respiratory tract infections are viral – suggesting that there is a large amount of unnecessary prescribing in this area.

It is therefore valid to question the use of antibiotics for common respiratory infections, and examine critically whether use is necessary and appropriate. A great deal of critical analysis of the role of antibiotics in the common respiratory conditions has been conducted in the last seven years, and much has been learned about their limited role in many. These respiratory infections, as well as some other common infection problems where antibiotics have restricted benefits, are discussed below.

Respiratory tract infections

Coryza and purulent rhinitis

Few would dispute that coryza is viral in origin, and thus antibiotics are not required. However, in young children purulent nasal discharge is a common cause of consultation, and green nasal secretions can alarm an inexperienced parent and tempt the practitioner to prescribe antibiotics. Prospective studies have failed to demonstrate a significant benefit from antibiotic treatment, including the prevention of acute otitis media.[6]

Purulent nasal discharge is also not uncommon in adults with coryza, but in adults it warrants more serious clinical consideration as a potential indicator of underlying sinusitis (see page 78).

Sore throat

In Australia, about 90% of cases of sore throat attract an antibiotic prescription.[2,4] This is rather extraordinary given that the great majority of sore throats are viral. Antibiotic prescribing is especially common for children aged 1 to 4 years, who are less likely than older children to have streptococcal infection. Studies have shown that the outcomes are unchanged if antibiotics are given for undifferentiated sore throat, even if the strategy of delayed prescribing for worsening symptoms is employed.[7] Critical analysis of the literature has shown that even in proven streptococcal pharyngitis the benefits of treatment are marginal in terms of symptom control, and of doubtful value given that rheumatogenic and nephritogenic strains are rare.[8]

The latest recommendations suggest that antibiotics be prescribed only under the following circumstances:[1]

- severe tonsillitis displaying features of *Streptococcus pyogenes* infection (Figure 2)
- patients aged 2 to 25 years from communities with a high incidence of acute rheumatic fever (especially Aboriginal communities in northern and central Australia)
- existing rheumatic heart disease at any age
- scarlet fever
- peritonsillar cellulitis or abscess (quinsy).

Alternatively, a clinical scoring system for decision making – scoring for fever, cough, cervical adenopathy, tonsillar swelling or exudate and age category – has recently been validated in Canada and is easy to apply.[9]

In recent years, the principal agent chosen when antibiotics are prescribed has been amoxycillin rather than phenoxymethylpenicillin, despite the fact that amoxycillin is not superior against *S. pyogenes*. This may well be related to the more convenient dosage schedule and better absorption of amoxycillin, in

Figure 3a. Early acute suppurative otitis media with diffuse redness and opacity.

Figure 3b. Established acute suppurative otitis media with a bulging tympanic membrane.

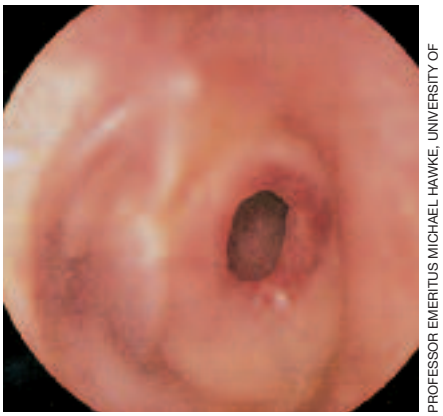

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Figure 3c. Acute antero-inferior perforation complicating acute suppurative otitis media.

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ignorance of the fact that phenoxymethylpenicillin can be given twice daily to achieve adequate levels and equivalent efficacy.

Otitis media

Otitis media has two important manifestations: acute otitis media and otitis media with effusion. The first is an acute inflammatory reaction presumably caused or triggered by viruses, which is complicated by bacterial superinfection about half of the time.

The role of antibiotics has been shown in a meta-analysis to be quite limited,[10] with 81% spontaneous cure rate at seven days without antibiotics, and only 14% of patients apparently benefiting from antimicrobial therapy. The challenge is to distinguish those who might benefit from antibiotics from the majority who will not. At present there is no proven strategy. Most authorities recommend treatment for patients with demonstrable mucopus in the middle ear, as evidenced by pain, deafness and bulging of the tympanic membrane on otoscopy (Figures 3a to c).[1] If there is doubt about the presence of pus, it is appropriate to withhold antibiotics and review in one to two days. In the absence of a history of frequent recurrence and treatment or allergy, amoxycillin is considered the drug of choice. Courses longer than five days are unnecessary.[11]

Otitis media with effusion ('glue ear') is effectively chronic middle-ear effusion. If it follows acute otitis media, which most do, spontaneous resolution within three months is usual. The role of bacteria in this condition is far from clear, and routine use of antibiotics, as recommended by some ENT specialists, is of unproven value.

Sinusitis

Although many of us were taught otherwise, it is now clear that not all cases of acute sinusitis require antibacterial treatment. As with acute otitis media, about 70% of sinusitis cases resolve spontaneously and only one case in six to seven appears to benefit from antibiotics.[12]

Again, strategies for distinguishing those who would benefit from antibiotics have not been developed, but the following are commonsense criteria:[1]

- persistent mucopurulent nasal discharge (more than seven days)
- prolonged fever
- facial pain
- tenderness over the sinuses
- headache.

Amoxycillin remains the first-line therapy, and is as effective as broader spectrum agents.[13]

Acute bronchitis

Viruses are responsible for most cases of acute bronchitis in the absence of

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underlying airways disease.

Purulent sputum is a common reason for seeing the GP; however, this does not differentiate a bacterial infection from a viral infection. In a variety of meta-analyses the benefits of antibiotics were very marginal,[14] and 85% of cases resolve satisfactorily without treatment. Antibiotics should be avoided in most of these cases.

Acute exacerbations of chronic obstructive airways disease

Patients with chronic obstructive airways disease (COAD) are frequently colonised by potentially pathogenic bacteria such as *S. pneumoniae, H. influenzae* and *Moraxella catarrhalis*. However, the role of these bacteria in acute exacerbations is unclear. Only about half of the exacerbations appear to involve bacteria. A recent meta-analysis of the efficacy of antibiotics in acute exacerbations of COAD indicated that the benefit was small, but statistically significant, in terms of resolution and peak expiratory flow rate (10 to 20% of patients benefited).[15]

Until subgroups that might benefit from antibiotics are identified in future studies, reasonable practice is to prescribe them only when the patient has both increased cough and dyspnoea together with increased sputum purulence and/or volume. Amoxycillin is the drug of choice unless bacteria resistant to it have been demonstrated on a sputum culture (current episode or previously).

Other common infections

Dysuria and frequency

It is incorrect to assume that all patients who present with dysuria and frequency have cystitis. The symptom of dysuria itself implies urethritis, and this condition should be considered in either sex, particularly if it is the only symptom – in which case, sexually transmitted infections and chemical or even mechanical causes should be considered.

In the diagnosis of clearcut symptoms of urinary tract infection (UTI), urinalysis is easily performed in the surgery and can have high negative predictive value. If the dipstick is negative for blood, protein and leucocyte esterase (i.e. all three), then the likelihood of bacterial urinary infection is less than 1%, and antibacterial therapy is not indicated in the first instance. Instead, it is better to take further history and to investigate these patients.

Asymptomatic UTI in elderly women

It is not uncommon to demonstrate bacteriuria in older (usually postmenopausal) women. Urinalysis is often positive and urine microscopy frequently demonstrates pyuria as well. In the absence of symptoms, it is inappropriate to treat this condition. Long term studies

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have not demonstrated any serious harm for asymptomatic bacteriuria in this group, and treatment will often result in symptomatic disease as the bacteriuria returns (as it almost always does).

Lower limb redness (suspected cellulitis)

Patients with chronic lower limb skin and venous disease frequently develop red patches. Not all of this is cellulitis, and therefore antibiotic therapy should be based on additional findings suggesting tissue infection, especially swelling, tenderness and fever.

Colonised lower limb ulcers

Skin breaches and rashes are frequently colonised with 'pathogenic' bacteria, especially *Staphylococcus aureus*. Skin ulcers are no exception. They are often colonised by Gram-negative bacteria as well as *S. aureus*.

Ulcers with slough are frequently thought to be infected, and cultures are taken. Of course, these are likely to grow the bacteria noted above, and the laboratory may also report sensitivities (as it will not have the benefit of knowing the clinical context). It is very tempting, but wrong, to treat these positive cultures. Antibiotics are required for these ulcers only when there is definite clinical evidence of surrounding cellulitis, and then agents to cover *S. aureus* are all that is required.

Impetigo

Not all impetigo requires systemic antibiotics. Topical therapy with antiseptics or mupirocin (Bactroban) is adequate for single or small numbers of lesions. Failed topical therapy or large numbers of lesions should be treated with an antistreptococcal or antistaphylococcal agent. In this circumstance, flucloxacillin (Flopen, Floxapen, Flucil, Staphylex) or dicloxacillin (Diclocil, Dicloxsig, Distaph) alone will cover both pathogens.

Summary

As medicine takes on the mantle of focusing more on 'customer' needs, prescribers should increase their awareness and anticipation of patients' desires and expectations, while maintaining their professional integrity. In terms of antibiotics, these requirements must be balanced with the need to:

- prescribe only when necessary
- minimise the selective pressure for resistance (i.e. minimise the antibiotic burden)
- provide clear explanations, whether prescribing or not.

The ultimate price of increasing antibiotic resistance is high, both medically and financially. This message needs widespread communication to our patients. Community practitioners are best placed to deliver this message. MT

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FORUM

Letters to the Editor

Amendment
Minimising inappropriate prescribing of antibiotics

Regarding the article 'Minimising inappropriate prescribing of antibiotics' by Turnidge and Zwar (*Medicine Today*, May 2000), since the Table on page 72 was originally prepared, the breakpoints (concentrations of antibiotic used to categorise bacteria as susceptible, intermediate or resistant) for amoxycillin and cefaclor against *Streptococcus pneumoniae* have been changed. This has followed a review of clinical and bacteriological response rates in a number of infections.

As a consequence, some of the figures quoted in the Table have changed. The rates of resistance of *S. pneumoniae* based on the new breakpoints are:

- penicillin, 8.7% (a further 16.8% of strains are considered intermediate in susceptibility)
- amoxycillin, 0.1% (a further 0.2% of strains are considered intermediate in susceptibility)
- cefaclor, 19.3% (a further 4.5% of strains are considered intermediate in susceptibility).

Although the drugs have a similar potency, there is a difference between penicillin and amoxycillin breakpoints related to their clinical application. Penicillin (G) is used for the treatment of invasive infections (bacteraemia, meningitis), and a broader and lower range of minimal inhibitory concentrations (MICs) is considered intermediate because of the need to cover strains in meningitis. The breakpoints for amoxycillin are to be applied to strains causing noninvasive infections. For invasive infections, resistance rates to amoxycillin should be considered the same as those of penicillin.

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