

# Antibiotics and antimicrobial resistance: avoiding a post-antibiotic era

The discovery of antibiotics was a significant turning point in human history, transforming the treatment of infectious diseases. However, the use of antibiotics is increasingly threatened by the concomitant development of resistant bacterial strains – largely contributed to by the misuse of antibiotics. This *Policy Brief* considers factors influencing the overuse and inappropriate use of antibiotics in primary care, and ways to address antimicrobial resistance (AMR) and avoid entering a post-antibiotic era.

## Why is this important?

We rely on antibiotics to treat bacterial infections, and antibiotics are critical to medical advances such as organ transplantation, neonatology and cancer chemotherapy. Antibiotics are commonly prescribed in general practice, particularly for the treatment of acute respiratory illnesses, notwithstanding limited evidence of benefit. Antibiotic use in primary care makes a significant contribution to AMR.<sup>1</sup> As AMR grows, so does the threat to the routine treatment of common bacterial infections, treatment of severe infections and modern medical procedures. This threat is compounded by the lack of development of new antibiotics.

GPs may incorrectly regard AMR as a problem falling outside their control and one that largely affects hospital patients.<sup>2</sup> However, GPs can make a significant contribution to reducing AMR, particularly by changing prescribing behaviour.

## Why do some doctors inappropriately prescribe antibiotics?

The changing management of acute bronchitis in Britain from the 1950s provides insight into how we have reached the current situation. Antibiotics were first used to treat or prevent secondary complications. However, for a variety of reasons antibiotics became the primary treatment, despite limited effectiveness.

The reasons included:<sup>3</sup>

- Adoption of antibiotic therapy encouraged GPs to see bacteria as the primary cause of acute bronchitis.
- Availability of oral antibiotics enabled patients to self-administer medicine.
- Penicillin's marked safety gave a false sense of security about antibiotics.
- A preventative strategy to nip infections in the bud was adopted as making an accurate diagnosis and differentiating bronchitis from early bronchopneumonia was difficult.
- Newly hospital-trained doctors did not receive adequate experience of common, self-limiting conditions seen in general practice and relied on antibiotics.
- A second antibiotic was tried if recovery was not rapid, cementing further dependence on antibiotics.

## Key messages

- The overuse and inappropriate use of antibiotics in primary care makes a significant contribution to antimicrobial resistance (AMR).
- GPs play an important role in preventing and delaying the AMR process.
- Before prescribing antibiotics, GPs should pause and consider whether it is necessary to give antibiotics to the individual patient before them.
- GPs could consider giving an alternative 'package' to patients where appropriate, e.g. delayed prescription, note for work, symptomatic remedies.
- A study in one region found that the lowest level of antibiotic prescribing was for rural Māori. This suggests that often antibiotics are prescribed for those least in need.
- Enhanced surveillance and monitoring, research and development and national stewardship may help to tackle the growing threat of AMR.

- Increased workloads and long hours contributed to greater prescribing.
- Doctors' ambitions to intervene with drugs grew along with the pharmaceutical industry's ability to supply an increasing range of remedies.
- The habit of prescribing antibiotics persisted despite viruses being identified as the most common aetiological agents in the 1970s.

Other contributors to the continued overuse or inappropriate use of antibiotics include:

- perception that AMR is only a theoretical or of minimal risk;<sup>1</sup>
- 'decision fatigue', where doctors are more likely to prescribe unnecessary antibiotics – the easy, safe option – as sessions progress;<sup>4</sup>
- patients' expectation or demand, e.g. behaviour of patients who consult frequently and obtain antibiotics regularly;
- patients attributing symptom resolution to antibiotics, which maintains a cycle of 'medicalising' self-limiting illnesses.

In modern, developed countries, rates of serious complications of respiratory tract infections are now low and there is no convincing evidence that lower rates of prescribing are associated with more complications. Thus, much of the historically high volume of prescribing to prevent complications is inappropriate.<sup>5</sup> Unnecessary antibiotics also needlessly expose patients to side effects.

### Antimicrobial resistance

Penicillin resistance was apparent by the late 1940s and increasing AMR is now a worldwide problem. High levels of consumption of antibiotics is the main cause of high rates of antibiotic-resistant bacteria,<sup>6</sup> and antibiotic use in primary care makes a significant contribution. There is strong evidence of an association at the individual patient level between the prescribing of antibiotics in primary care and AMR at different sites, including the urinary and respiratory tracts and skin.<sup>1</sup>

Rates of resistance have been shown to be highest in the month directly after prescription and detectable for up to 12 months, thus increasing the population carriage of organisms resistant to first-line antibiotics.

In addition to the use of antibiotics in humans, other key drivers of AMR include:<sup>7</sup>

- use and overuse of antibiotics in animals;
- transmission of antimicrobial-resistant organisms in community and health care settings (e.g. by overcrowding, inadequate hygiene and inadequate immunisation);
- increasing globalisation resulting in the importation of antimicrobial-resistant pathogens.

### The New Zealand context

Antibiotic consumption in New Zealand has risen rapidly. A paper looking at funded prescriptions found that, between 2005 and 2012, the annual per capita antimicrobial consumption by community-based patients increased by 43 percent (an average annual increase of greater than six percent).<sup>6</sup> Thus, the level in recent years is comparable with those European countries that are widely considered to have high levels of consumption.

A study in Te Tairāwhiti found that 51 percent of the population received a prescription for one or more antibiotics during the study year,<sup>8</sup> and concluded that 'the level of antibiotic use in the general population is high, despite campaigns to try to reduce unnecessary use.' While this report raises concern about the overprescribing of antibiotics in the general population, it noted that the lowest level of prescribing was for rural Māori despite the high prevalence of acute rheumatic fever and treatment guidelines recommending use of antibiotics for sore throat in this population. This suggests that often antibiotics are prescribed for those least in need.

Over recent years, New Zealand has seen an increase in the number of antimicrobial-resistant pathogens including

community-associated methicillin-resistant *Staphylococcus aureus*, bacteria producing an extended spectrum beta-lactamase (ESBL) (e.g. *E. coli* and *Klebsiella pneumoniae*) and multi-resistant *Neisseria gonorrhoeae*.<sup>6</sup>

### Tackling antimicrobial resistance

Actions that may prevent or delay the process of AMR include:

- prudent use of antibiotics;
- better infection prevention and control practices;
- enhanced surveillance of AMR and monitoring antibiotic use;
- development of new antibiotics;
- antimicrobial stewardship.

### Prudent use

bpac<sup>nz</sup>'s general principles of antibiotic prescribing are a helpful guide to prudent use:<sup>9</sup>

- Only prescribe antibiotics for bacterial infection if:
  - symptoms are significant or severe
  - there is a high risk of complications
  - the infection is not resolving or is unlikely to resolve
- Use first-line antibiotics first
- Reserve broad spectrum antibiotics for indicated conditions only.

There are very few indications for the use of topical antibiotics.<sup>10</sup>

Other actions that GPs might take are:

- Provide patients with an alternative 'package' to take home where relevant, e.g. a note for work; a bag containing paracetamol, lemons and a tip sheet; or antihistamines/decongestants for symptomatic relief from the cold or flu.<sup>11</sup>
- A public commitment via a signed statement posted in the GP's room declaring they will prescribe antibiotics according to guidelines.

- Delayed or 'back-pocket' prescriptions (to fill later if no improvement) are effective in reducing antibiotic use and decreasing the number of consultations.<sup>12,13</sup> This strategy provides a safety net for patients who might otherwise develop complications and is useful for those expecting antibiotics. It also allows patients to take more responsibility for their own health care and avoids a visit to another GP to obtain a prescription.

Increasing awareness plays an important role in the prudent use of antibiotics and can help change expectations of doctors and patients. PHARMAC's annual campaign, 'Wise Use of Antibiotics' is one strategy that has contributed to a reduction in the volume of antibiotics prescribed.<sup>14,\*</sup> bpac<sup>nz</sup>'s education programme (e.g. *Best Practice Journal*) and practice feedback (e.g. personalised prescribing reports) aim to increase GPs' knowledge of antibiotic treatment and has resulted in GPs making changes to their clinical practice.<sup>15</sup>

### Infection prevention and control

Improved hand hygiene practices is one example of a measure to help reduce health care-acquired infections, including antibiotic-resistant infections.<sup>†</sup>

### Surveillance of antimicrobial resistance

GPs seldom report problems associated with AMR in their own practice.<sup>16</sup> The ESR undertakes national surveillance of AMR among human pathogens. ESR collects and analyses AMR data from various sources such as routine diagnostic susceptibility testing in clinical laboratories. This information is used to compile national AMR data.<sup>17</sup>

### Monitoring antibiotic use

Data on antibiotic use would provide a baseline, permit benchmarking comparisons, help to identify areas for targeted interventions and

assess the effect of interventions.<sup>7</sup> bpac<sup>nz</sup>'s prescribing reports provide GPs and practices with personalised data alongside national prescribing information and allows for self-reflection. At the DHB level, antimicrobial consumption surveys were conducted at three DHBs in 2010/2012 to determine the defined daily doses of antibiotics dispensed. This enabled consumption to be compared between the DHBs and internationally. Setting national targets for reductions in antibiotic use with regular reporting against these targets may encourage reductions in antibiotic use.<sup>6</sup>

### Research and development

Since the 1990s, pharmaceutical companies have devoted minimal resources to the development of new antimicrobials. However, it is vital that the development of novel antibiotics continues as AMR emerges. Advancement of drug development requires efforts to boost scientific research and facilitate clinical trials.

### Antimicrobial stewardship

Antimicrobial stewardship in primary care is essential. This is an organisational or health care system-wide approach to promoting and monitoring judicious use of antimicrobials to preserve their future effectiveness.<sup>18</sup>

There have been calls for a national approach to AMR.<sup>19</sup> National antimicrobial stewardship of surveillance and prudent antibiotic use involving coordinated interventions across all health care settings would optimise use of antimicrobial therapy. This could include national antimicrobial guidelines with regional variation.

Other future actions include:

- rapid point-of-care diagnostic tests that distinguish between viral and bacterial infections and identify bacterial drug susceptibilities;
- preventing bacterial disease with effective vaccines, such as the pneumococcal vaccine.<sup>20</sup>



### Further information:

[Antibiotic choices for common infections](#) (bpac<sup>nz</sup>; 2013)

[Is the cupboard bare? The threat of antibiotic resistance](#) (bpac<sup>nz</sup>; 2013)

[Antimicrobial Resistance in New Zealand: What is my role in primary care?](#) (bpac<sup>nz</sup>; 2013)

[Topical antibiotics: very few indications for use](#) (bpac<sup>nz</sup>; 2013)

\* There were almost 25 000 fewer prescriptions for those 18 years old and younger during the winter months of 2007 compared with the year before. (PHARMAC Annual Review 2008). This campaign is no longer actively promoted.

† See Hand Hygiene New Zealand at [www.handhygiene.org.nz](http://www.handhygiene.org.nz)

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