




# Navigating uncertainty: managing respiratory tract infections

With winter upon us, it is timely to reflect on antibiotic prescribing practices for respiratory tract infections (RTIs) and associated conditions, e.g. sinusitis, otitis media. In most instances, antibiotics are not necessary for RTIs as they are self-limiting and almost always caused by viruses; antibiotic use exposes patients to the harms of treatment, e.g. adverse effects and antibiotic resistance, without clinical benefit.

## KEY PRACTICE POINTS:

- Most RTIs are of viral origin, rather than bacterial, and in either case, the infection is likely to be self-limiting and the negligible benefit of antibiotic treatment does not outweigh the potential harms
- Provide patients or caregivers with information about the expected duration of RTI symptoms, advice for symptomatic relief and when to seek further medical advice
- Antibiotics may be considered for people with a suspected or confirmed bacterial RTI who are at high risk of complications, e.g. those with immunosuppression, or in specific clinical scenarios, e.g. all cases of bacterial pneumonia, bilateral acute otitis media in children aged under two years
- Always consider the possibility of meningococcal disease in people presenting with influenza-like illness; ensure that patients and/or caregivers know when to seek urgent medical advice
- Throat swabs and antibiotic treatment for Group A Streptococcus infection are only indicated for people who present with sore throat who have risk factors for rheumatic fever

 This article revisits key concepts covered in our 2018 articles: “Cold season: managing without antibiotics” ([www.bpac.org.nz/2018/cold-season.aspx](http://www.bpac.org.nz/2018/cold-season.aspx)) and “Antibiotics: the future is short” ([www.bpac.org.nz/2018/antibiotics.aspx](http://www.bpac.org.nz/2018/antibiotics.aspx)).

## Uncertainty in general practice: a familiar foe

*“If there is one certainty in general practice, it is the inherent presence of uncertainty.”<sup>1</sup>*

Diagnostic uncertainty is an unavoidable aspect of medical practice. Non-specific presentations, unclear or conflicting examination or test results, and inconsistent treatment responses are not uncommon.<sup>1</sup> The way in which uncertainty is navigated can significantly impact prescribing practices, the ordering of tests and other clinical investigations, and patient interactions and expectations.

Following through a set strategy can help to manage uncertainty, for example:<sup>1</sup>

- Establish what symptoms the patient is most concerned about and what outcome they are seeking
- After history and examination, rule out red flags/serious diagnoses
- Consider the need (if any) for investigations, use clinical risk prediction tools, consider the “test of time” for a diagnosis to emerge
- Put a plan in place for follow-up and review if symptoms deteriorate or do not resolve

### Uncertainty may contribute to inappropriate antibiotic prescribing

Every winter in New Zealand there is an increase in the number of people presenting to primary care with symptoms such as cough, sore throat and ears, and sinus congestion, usually as the result of a respiratory tract infection (RTI) (See: “Why do we get sicker in winter”).<sup>2,3</sup> Antibiotic dispensing is 30–40% higher in winter than summer in New Zealand; this is more than double the seasonal variation in the United Kingdom, suggesting some people are receiving antibiotics unnecessarily.<sup>2,3</sup>

Most RTIs are caused by viruses and are self-limiting, and antibiotics are not appropriate. However, in some cases it is difficult to be certain if an infection is viral or bacterial, who would most benefit from antibiotic treatment and the likelihood of complications.<sup>4</sup> Concern about missing a significant infection which does require antibiotics, e.g. bacterial pneumonia, can influence the prescribing decision, along with other factors such as patient expectations about receiving an antibiotic, or clinicians’ assumptions about these expectations, and the ability or likelihood of a patient to return for a follow-up appointment.

## Antibiotics are usually unnecessary for “winter ills”

There are two main decision points when determining whether antibiotic treatment is indicated for a patient presenting with an RTI:

1. Is the infection viral or bacterial?
2. If bacterial, is antibiotic treatment indicated (and which antibiotic and for how long) and is it needed for this particular patient?

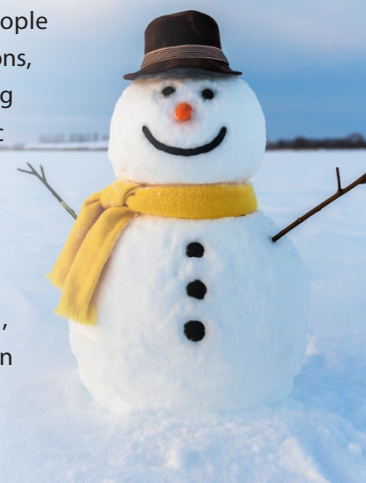
In a typical primary care setting, it is often not possible to definitively determine the type of infection (viral versus bacterial). Instead, clinicians rely on their clinical findings and judgement to make a presumption about the infection type and consequently whether antibiotic treatment is indicated.

Bacterial infection may be suspected in patients who are very unwell with persistent and/or worsening symptoms (see Table 1 for details), however, this can be difficult to establish in patients who present early in the course of illness. Investigations such as requesting a full blood count and C-reactive protein (CRP) level may assist with diagnosis in some circumstances (see: “Using CRP testing to guide antibiotic prescribing”). Even if an infection is presumed to be bacterial, and antibiotics are indicated for that infection, not all patients will require antibiotics, e.g. otitis media or sore throat in people without risk factors. Most RTIs are self-limiting and the benefits of treatment will often not outweigh the risks, e.g. adverse effects such as nausea, diarrhoea, rash, *Candida albicans* or *Clostridium difficile* infection, hypersensitivity reactions and development of antibiotic resistance, both in the individual and population. For example, a Cochrane review on antibiotic use in children for otitis media found that the number needed to treat for a small reduction in pain at two to three days was 24, but the number


### Why do we get sicker in winter?

Viral RTIs can occur at any time of year, however, the incidence increases in the colder months. Factors such as spending more time in closer proximity to others in homes or workplaces with little ventilation, enhanced survivability of air-borne pathogens in colder temperatures, seasonal changes in immune function increasing susceptibility to infection and activation of dormant viruses within the respiratory tract have been proposed to explain the seasonality of viral illnesses.<sup>5</sup>

Viral illnesses can make some people more vulnerable to bacterial infections, which may occur during or following the illness.<sup>5</sup> People with chronic conditions, e.g. chronic obstructive pulmonary disease (COPD), or who have weakened immune systems are at greater risk for developing complications, e.g. pneumonia, exacerbation of COPD, following an RTI.



needed to harm (defined as vomiting, diarrhoea or rash) was 13.<sup>6</sup> Overall, antibiotics made little difference to the outcomes of children with acute otitis media in terms of effects on pain, short-term hearing loss or eardrum perforations.<sup>6</sup>

 For further information on the limited effectiveness of antibiotics for winter illnesses, see: [www.bpac.org.nz/2018/cold-season.aspx](http://www.bpac.org.nz/2018/cold-season.aspx)

N.B. Clinicians should have a high level of suspicion of meningococcal disease, i.e. meningococcal meningitis and meningococcal septicaemia, in people presenting with influenza-like illness (see: “Consider meningococcal disease in people presenting with non-specific influenza-like symptoms”).

### Communicating the decision not to prescribe antibiotics

Patients or caregivers presenting to primary care are generally seeking symptomatic relief and reassurance that they, or their child, do not have a more serious illness. Asking “what can I do for you today” is a useful conversation opener because it allows the patient to describe the symptoms they are most concerned about and to express their expectations for treatment. Although there has been much work done on increasing understanding about the role of antibiotics, there are still many patients that believe that antibiotic treatment is necessary for a RTI, and they may express frustration or disappointment that a prescription is not offered.

**Effective communication is the most important treatment for uncomplicated RTIs.** Ensure the patient feels validated for presenting for assessment and explain that just because an antibiotic is not indicated, it does not mean they are not unwell.

Discussion should cover:

- What illness they are likely to have
- The expected duration of symptoms (Table 1); a medical certificate may be required
- The role of antibiotics in RTI; most infections are viral and self-limiting, antibiotics will not help their symptoms and may cause harm, e.g. adverse effects, antibiotic resistance
- Symptomatic management advice (Table 1); a prescription for a supportive treatment may be appropriate
- A plan for review if symptoms persist or worsen, e.g. a follow-up appointment or a phone call to the practice
- When to seek urgent medical care, e.g. shortness of breath, stridor, fever >40°C, neck stiffness and rash


## Consider meningococcal disease in people presenting with non-specific influenza-like symptoms


The first stage of meningococcal disease, i.e. meningococcal meningitis and meningococcal septicaemia, is associated with non-specific symptoms which closely resemble those of influenza, e.g. fever, lethargy, nausea, vomiting, headache, muscle and joint pain. Patients may not display specific symptoms and signs, e.g. photophobia, rash, neck stiffness, for the first four to six hours of illness; infants may not display specific symptoms and signs at all. Check or enquire about meningococcal vaccination status, however, clinicians should still consider meningococcal disease in any patient presenting with influenza-like illness as the vaccines do not cover all strains.

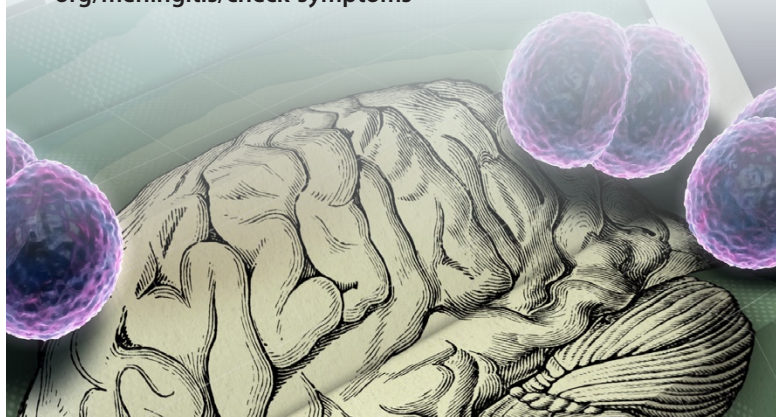
There has been an increase in meningococcal disease caused by serogroup W in New Zealand since 2017, particularly in Northland.<sup>7</sup> Infection with this strain may involve presentation with the classical signs of meningococcal disease but also atypically with gastrointestinal symptoms, as well as pneumonia, septic arthritis, endocarditis or epi/supraglottitis.<sup>7</sup>


All patients with suspected meningococcal disease should be immediately referred to hospital; an antibiotic should be initiated on suspicion of diagnosis if this does not delay transfer (see: [www.bpac.org.nz/antibiotics/guide.aspx](http://www.bpac.org.nz/antibiotics/guide.aspx) for further information).

If the patient’s present condition does not warrant immediate referral, put in place a plan for review and monitoring, i.e. by a parent, caregiver or friend who has been advised on the symptoms and signs of meningococcal

 For further information on meningococcal disease, see: [www.bpac.org.nz/bpj/2014/march/meningococcal.aspx](http://www.bpac.org.nz/bpj/2014/march/meningococcal.aspx)

 Patient information on the symptoms and signs of meningococcal disease is available here: [www.meningitis.org/meningitis/check-symptoms](http://www.meningitis.org/meningitis/check-symptoms)



 Patient information is available here:

- “A cold or the flu?” – practical information and links to other resources: [www.healthnavigator.org.nz/health-a-z/c/cold-or-the-flu/](http://www.healthnavigator.org.nz/health-a-z/c/cold-or-the-flu/)
- “Keep antibiotics working” – explaining antibiotic resistance: [www.pharmac.govt.nz/keepantibioticsworking](http://www.pharmac.govt.nz/keepantibioticsworking)
- “What to do when you have a cold” – instructions for symptomatic relief and infection prevention: [www.goodfellowunit.org/sites/default/files/webinars/common\\_cold\\_leaflet\\_2017.pdf](http://www.goodfellowunit.org/sites/default/files/webinars/common_cold_leaflet_2017.pdf)

### When should antibiotics be considered?

Specific scenarios where antibiotic treatment is indicated or should be considered for people presenting with a suspected or confirmed bacterial RTI or associated condition are outlined in Table 1.

Ideally, the decision to prescribe or not prescribe antibiotics should be made based upon the patient’s current presentation, rather than providing a prescription to fill later, e.g. if the patient’s condition deteriorates or they remain unwell (often called a “back pocket” prescription). While this practice is sometimes recommended as a strategy to reduce antibiotic prescribing, there may still be patients who receive antibiotic treatment unnecessarily, e.g. if they fill the prescription immediately without waiting to see if their symptoms improve. This practice also transfers decision-making responsibility to the patient when it should be the clinician’s decision whether antibiotic treatment is indicated. However, there may be exceptions and clinical discretion applies, e.g. if there are socioeconomic factors which influence the ability of the patient to attend a follow-up appointment. The decision and reasoning should be clearly documented in the patient’s notes.

The threshold for considering antibiotics for patients with a suspected or confirmed bacterial RTI should be low for those

### Sore throats: when to swab and who to treat

Most sore throats (including pharyngitis and tonsillitis) are of viral origin and antibiotic treatment is not appropriate. However, sore throat caused by Group A Streptococcus (GAS) infection can lead to rheumatic fever in high risk groups. A recent audit of hospital discharges in Northland has revealed that despite prevention campaigns focused on swabbing sore throats, the rate of acute rheumatic fever has only decreased slightly; from 7.7 cases per 100,000 people per year in 2012 to 7.0 cases per 100,000 in 2017.<sup>17</sup>


A throat swab to detect GAS pharyngitis, and antibiotic treatment if positive, is indicated for:<sup>18</sup>


- People presenting with sore throat who have risk factors for rheumatic fever: personal, family or household history; OR two or more of: Māori or Pacific ethnicity; age 3–35 years; living in crowded circumstances or low socioeconomic areas
- Symptomatic household contacts of people with GAS positive throat swabs
- People presenting with sore throat who are at risk of spreading GAS to vulnerable populations, e.g. healthcare and residential care workers, food handlers, school and early childhood teachers and students in high risk communities

Asymptomatic household contacts of a person with a GAS positive sore throat should be swabbed if:<sup>18</sup>

- There is a history of  $\geq 3$  cases of GAS pharyngitis in the household in the past three months; OR
- There is a personal, household or family history of rheumatic fever

N.B. Empiric antibiotic treatment should be given to people with sore throat who are at high risk of rheumatic fever while awaiting the results of the throat swab; antibiotic treatment should be discontinued if the results are negative for GAS.<sup>18</sup>

 For the recommended antibiotic regimen for GAS sore throat, see: [www.bpac.org.nz/antibiotics/guide.aspx#sore-throat](http://www.bpac.org.nz/antibiotics/guide.aspx#sore-throat)

 **Throat swabbing in pharmacies:** Some pharmacies around New Zealand are offering free sore throat consultations this winter (2019); this may include a throat swab and point-of-care test if the pharmacist suspects a bacterial infection. People who test positive for a bacterial infection or who have significant symptoms will be referred to primary care for further assessment. N.B. this is separate from rheumatic fever prevention initiatives which provide throat swabbing and antibiotic treatment through community pharmacy and school-based screening in high risk regions in the North Island.

who are at high risk of complications due to compromised immune function, such as people with:<sup>8</sup>

- Immune suppression
- Significant heart, lung, renal, liver, metabolic, autoimmune or neuromuscular disease, e.g. heart failure, COPD, bronchiectasis, severe asthma, diabetes
- History of premature birth (younger children)
- Frailty
- History of hospitalisations, particularly in the past year

N.B. Ensure that the same threshold for prescribing is applied to PSO antibiotics as for a regular prescription.

👁 For information on antibiotic prescribing regimens for respiratory tract and ear infections see: [www.bpac.org.nz/antibiotics/guide.aspx](http://www.bpac.org.nz/antibiotics/guide.aspx)

👁 For further information on symptomatic treatments, see: [www.bpac.org.nz/2018/cold-season.aspx#2-8](http://www.bpac.org.nz/2018/cold-season.aspx#2-8)

### Using CRP testing to guide antibiotic prescribing

Serum C-reactive protein (CRP) is an acute phase marker for a number of pathological processes, including infection and inflammation. Healthy people usually have a CRP of < 5 mg/L; CRP increases within four to six hours following infection and peaks at around 36 hours. The level of elevation usually corresponds to the severity of the infection. Although the test cannot definitively distinguish the type of infection, bacterial infections generally cause a greater elevation in CRP than viral infections.

For example, CRP levels can be used to help clinicians decide whether or not to prescribe an antibiotic to patients where a diagnosis of pneumonia is uncertain, e.g. the patient presents with cough and one or more other associated symptoms such as fever, sputum production, breathlessness, wheeze, chest discomfort or pain.<sup>19</sup> N.B. chest x-ray is the gold

standard for confirming pneumonia, but is not necessary for a diagnosis

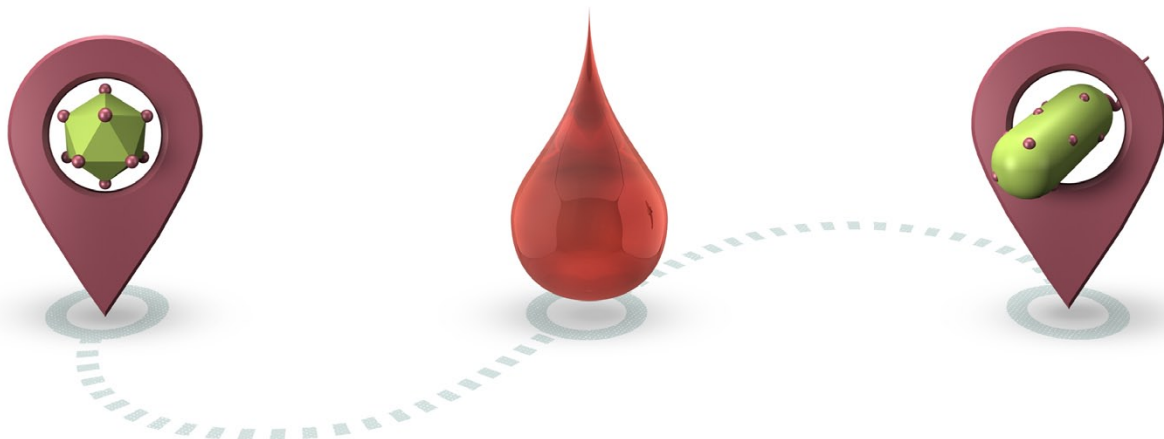
If a point-of-care testing device is available, a CRP level may also be useful to support advice to the patient that no antibiotic treatment is required, e.g. patients with symptoms of self-limiting upper RTIs.

The United Kingdom National Institute for Health and Care Excellence has made the following recommendations about CRP testing to guide antibiotic prescribing:<sup>19</sup>

- CRP < 20 mg/L suggests a viral or mild bacterial infection; antibiotics should not be offered routinely
- CRP 20–100 mg/L can be difficult to interpret; consider antibiotics if the clinical findings (history and examination) suggest a bacterial infection or the patient is at high risk of complications, however, a CRP level in this range is also not unusual for someone with influenza.
- CRP > 100 mg/L is indicative of a significant bacterial infection and antibiotics should be recommended

👁 For further information on point-of-care CRP testing, see: [www.bpac.org.nz/bpj/2015/june/crp.aspx](http://www.bpac.org.nz/bpj/2015/june/crp.aspx)

👁 **Further reading:** Can you stop antibiotics early? Clinical guidelines give advice for an appropriate duration of antibiotic treatment that will manage infection in most patients, however, this may not be optimal for every patient, based on their individual clinical factors and response to treatment. There are some scenarios where a clinician may consider stopping antibiotic treatment early or conversely, continuing antibiotic treatment beyond the initial prescribed duration. For more information, see: "Antibiotics: The future is short", ([www.bpac.org.nz/2018/antibiotics.aspx](http://www.bpac.org.nz/2018/antibiotics.aspx))



**Table 1.** Upper respiratory tract infection (URTI) symptoms and associated conditions, duration of symptoms, indication for antibiotic treatment and supportive treatments<sup>9</sup>

URTI symptom or associated condition	Typical duration	Indication for antibiotic treatment	Supportive treatments that may provide symptomatic relief <sup>10</sup>
		<p>Refer to the bpac<sup>nz</sup> antibiotic guide for treatment regimens: <a href="http://www.bpac.org.nz/antibiotics/guide.aspx">www.bpac.org.nz/antibiotics/guide.aspx</a></p> <p>N.B. Broad spectrum antibiotics such as amoxicillin clavulanate are never indicated for URIs.</p>	<p>For further information about these options, see: <a href="http://www.bpac.org.nz/2018/cold-season.aspx">www.bpac.org.nz/2018/cold-season.aspx</a></p>
<b>Sore throat</b> (including pharyngitis and tonsillitis)	One week	<p>Antibiotics are not required in most cases <b>unless</b> Group A Streptococcus (GAS) positive <b>and</b> at high risk of rheumatic fever, due to:</p> <ul style="list-style-type: none"> <li>■ Personal, family or household history of rheumatic fever</li> <li>■ Two or more of the following: Māori or Pacific ethnicity, age 3–35 years, living in crowded/low socioeconomic circumstances</li> </ul> <p>Antibiotics are indicated if peritonsillar cellulitis or abscess (quinsy) develops, but it is usually appropriate to refer these patients to hospital. Patients who develop scarlet fever require antibiotic treatment.</p>	<p>Over-the-counter (OTC) lozenges or throat sprays containing an analgesic, NSAID or antiseptic</p> <p>Oral analgesia</p>
<b>Cough</b>	Up to four weeks	<p>Antibiotics are not required in most cases.</p> <p><b>Antibiotics are indicated for:</b></p> <ul style="list-style-type: none"> <li>■ All cases of suspected pneumonia, typically diagnosed by a combination of:<sup>11,12</sup> <ul style="list-style-type: none"> <li>– Cough</li> <li>– Respiratory rate <math>\geq</math> 20 per minute</li> <li>– Temperature <math>\geq</math> 38°C</li> <li>– Pulse rate <math>&gt;</math> 100 per minute</li> <li>– Crackles on auscultation</li> <li>– Dullness to percussion</li> <li>– Oxygen saturation <math>\leq</math> 95%</li> </ul> </li> <li>■ Pertussis; if within three weeks of onset, cough of unknown duration, pregnant women, high risk contacts</li> </ul>	<p>Honey (limited evidence for benefit in children aged over one year; not recommended in children aged under one year due to a risk of botulism)<sup>13</sup></p> <p>There is a lack of evidence supporting the effectiveness of OTC cough suppressants; cough is a protective reflex to clear the lungs, therefore using a cough suppressant is not ideal, but some patients may wish to trial this at night if cough is affecting sleep. Cough suppressants are contraindicated in children aged under six years, and some products, e.g. those containing codeine, are contraindicated in children aged under 12 years.</p> <p>N.B. Gees linctus is now a prescription-only medicine and products containing dextromethorphan are pharmacist-only medicines.</p>
<b>Non-allergic rhinitis</b>	One to two weeks	Antibiotics not required.	<p>Intranasal ipratropium (Univent – funded)</p> <p>Intranasal corticosteroids<sup>†</sup></p>

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<p><b>Non-allergic rhinitis</b> (continued)</p>		<p>Nasal decongestants (limited evidence for benefit), e.g.:<sup>14,15</sup></p> <ul style="list-style-type: none"> <li>■ Xylometazoline (Otrivin) or oxymetazoline (various brands) – OTC, short-term use only (three days maximum) as can cause rebound congestion</li> <li>■ Phenylephrine (OTC) , short-term use only (seven days maximum)</li> <li>■ Pseudoephedrine for severe cases – short-term use only (seven days maximum); avoid in patients with severe hypertension, current or recent users of monoamine oxidase inhibitors and children aged &lt; 12 years<sup>16</sup></li> </ul> <p>N.B. pseudoephedrine is a controlled drug; it can now be prescribed with an electronic signature.</p>
<p><b>Sinusitis</b></p>	<p>One to two weeks</p> <p>Antibiotics not required in most cases.</p> <p><b>Consider antibiotics</b> for patients who have:</p> <ul style="list-style-type: none"> <li>■ Symptoms for &gt; 10 days</li> <li>■ Severe symptoms, e.g. fever &gt; 39°C</li> <li>■ Facial pain lasting ≥ 3 days</li> <li>■ Worsening symptoms after initial improvement</li> </ul>	<p>Nasal saline rinse (OTC or prepare solution at home and administer with suitable device; patient information is available here: <a href="http://www.healthnavigator.org.nz/medicines/s/saline-nasal-sprays-drops-rinses/#sinus">www.healthnavigator.org.nz/medicines/s/saline-nasal-sprays-drops-rinses/#sinus</a>)</p> <p>Intranasal corticosteroids<sup>†</sup> (see above)</p> <p>Oral corticosteroids (short course) may be considered for patients with chronic symptoms</p> <p>Nasal decongestants (see above)</p>
<p><b>Acute otitis media</b></p>	<p>Three days to one week</p> <p>Antibiotics are usually unnecessary as most infections are self-limiting.<sup>‡</sup></p> <p><b>Consider antibiotics</b> for children with:</p> <ul style="list-style-type: none"> <li>■ Bilateral infection who are aged under two years</li> <li>■ Otorrhoea with pain that is unresponsive to analgesia</li> <li>■ Systemic symptoms with fever lasting &gt; 48 hours</li> <li>■ Infants aged under six months</li> <li>■ Persistent or recurrent infection (≥ 3 infections in six months or ≥ 4 infections in 12 months)</li> </ul>	<p>Analgesia</p>

† May improve symptoms but is unlikely to influence symptom duration, and could cause systemic adverse effects; patients should be advised to only use the prescribed dose.

‡ A Cochrane review of the evidence for antibiotic treatment of acute otitis media found that pain (primary outcome) recovered spontaneously in 60% of children within 24 hours, whether they received placebo or antibiotics. Antibiotic treatment resulted in a 5% absolute risk reduction in pain at two or three days; 6% absolute risk reduction in pain at four to seven days<sup>6</sup>

## References

1. General Practice Supervisors Australia. Managing uncertainty in general practice. 2017. Available from: [http://gpsupervisorsaustralia.org.au/wp-content/uploads/2017/04/Guide\\_Managing-Uncertainty\\_Digital.pdf](http://gpsupervisorsaustralia.org.au/wp-content/uploads/2017/04/Guide_Managing-Uncertainty_Digital.pdf) (Accessed Jul, 2019).
2. Whyler N, Tomlin A, Tilyard M, et al. Ethnic disparities in community antibacterial dispensing in New Zealand, 2015. *NZMJ* 2018;131.
3. Health Quality & Safety Commission New Zealand. Community use of antibiotics. 2019. Available from: <https://www.hqsc.govt.nz/our-programmes/health-quality-evaluation/projects/atlas-of-healthcare-variation/community-use-of-antibiotics/> (Accessed Jul, 2019).
4. Harris AM, Hicks LA, Qaseem A, et al. Appropriate antibiotic use for acute respiratory tract infection in adults: advice for high-value care from the American College of Physicians and the Centers for Disease Control and Prevention. *Ann Intern Med* 2016;164:425. doi:10.7326/M15-1840
5. Fares A. Factors influencing the seasonal patterns of infectious diseases. *Int J Prev Med* 2013;4:128–32.
6. Venekamp RP, Sanders SL, Glasziou PP, et al. Antibiotics for acute otitis media in children. *Cochrane Database of Systematic Reviews* 2015; [Epub ahead of print]. doi:10.1002/14651858.CD000219.pub4
7. Ministry of Health. Meningococcal disease: information for general practitioners and emergency departments. 2018. Available from: <https://www.health.govt.nz/our-work/diseases-and-conditions/meningococcal/meningococcal-disease-information-general-practitioners-and-emergency-departments> (Accessed Jul, 2019).
8. National Institute for Health and Care Excellence. Cough (acute): antimicrobial prescribing. 2019. Available from: <https://www.nice.org.uk/evidence/cough-acute-recommendations#acute-cough-in-people-who-are-systemically-very-unwell-or-at-higher-risk-of-complications> (Accessed Jun, 2019).
9. bpac<sup>nz</sup>. Antibiotics: choices for common infections. 2017. Available from: <https://bpac.org.nz/antibiotics/guide.aspx> (Accessed Jul, 2019).
10. bpacnz. Cold season: managing without antibiotics. 2018. Available from: <https://bpac.org.nz/2018/cold-season.aspx> (Accessed Jul, 2019).
11. Htun TP, Sun Y, Chua HL, et al. Clinical features for diagnosis of pneumonia among adults in primary care setting: A systematic and meta-review. *Sci Rep* 2019;9:7600. doi:10.1038/s41598-019-44145-y
12. Moore M, Stuart B, Little P, et al. Predictors of pneumonia in lower respiratory tract infections: 3C prospective cough complication cohort study. *Eur Respir J* 2017;50:1700434. doi:10.1183/13993003.00434-2017
13. Ministry of Health. Botulism. 2018. Available from: <https://www.health.govt.nz/your-health/conditions-and-treatments/diseases-and-illnesses/botulism> (Accessed Jul, 2019).
14. Deckx L, De Sutter Al, Guo L, et al. Nasal decongestants in monotherapy for the common cold. *Cochrane Database of Systematic Reviews* 2016; [Epub ahead of print]. doi:10.1002/14651858.CD009612.pub2
15. van Driel ML, Scheire S, Deckx L, et al. What treatments are effective for common cold in adults and children? *BMJ* 2018;k3786. doi:10.1136/bmj.k3786
16. New Zealand Formulary (NZF). NZF v86. 2019. Available from: [www.nzf.org.nz](http://www.nzf.org.nz) (Accessed Jul, 2019).
17. Wauchop K, Shetty A, Bremner C. The epidemiology of acute rheumatic fever in Northland 2012–2017. *N Z Med J*;132.
18. Heart Foundation of New Zealand. Group A Streptococcal sore throat management guideline. 2014. Available from: <https://www.heartfoundation.org.nz/shop/heart-healthcare/non-stock-resources/gas-sore-throat-rheumatic-fever-guideline.pdf> (Accessed Jul, 2019).
19. National Institute for Health and Care Excellence. Pneumonia in adults: diagnosis and management. 2014. Available from: <https://www.nice.org.uk/guidance/cg191> (Accessed Jul, 2019).



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