New guidance notes to drive rational prescription of antimicrobials for community settings in Hong Kong

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Background

Antimicrobial resistance (AMR) has caused significant mortality and morbidity globally, and Hong Kong is no exception. It has been estimated that from 2020 to 2030, AMR-related infections in Hong Kong will result in 18 433 excess deaths with a total economic cost of US$4.3 billion.[1] Antimicrobial resistance is not only a problem of resistant bacteria such as methicillin-resistant *Staphylococcus aureus* (MRSA), carbapenem-resistant *Acinetobacter*, vancomycin-resistant *Enterococcus* and carbapenemase-producing Enterobacterales in hospitals; rising resistance to commonly used antibiotics has narrowed prescribing options, leading to treatment failure in community-acquired infections. The latest community laboratory surveillance, conducted in 2024 by the Centre for Health Protection (CHP) of the Department of Health, revealed that the urinary pathogen *Escherichia coli* was commonly resistant to ampicillin (67.2%), co-trimoxazole (32.2%), and levofloxacin (36.9%), with 16.9% of specimens testing positive for extended-spectrum beta-lactamase.[2] The same surveillance programme indicated that isolates of *Streptococcus pneumoniae* were resistant to erythromycin (75.0%) and penicillin (29.2%).[2] The local threat of AMR highlights the need for robust antibiotic stewardship. In a local study involving 19 primary care clinicians and 321 patients that investigated help-seeking behaviour and antibiotic prescribing for acute cough, there was a significant difference in antibiotic prescribing rates between private and public primary care clinicians (17.4% vs 1.6%).[3] In another local study of primary care physicians on the management of uncomplicated urinary tract infections, the proportion of *E coli* isolates matched (sensitive) to the prescribed antibiotic (amoxicillin, ampicillin, ciprofloxacin, co-trimoxazole, gentamicin, or nitrofurantoin) was 90.7% in the public sector and 59.2% in the private sector, indicating that there is room for improvement in the latter.[4]

The CHP has been tracking antimicrobial supply as a proxy for consumption through surveillance data collected from licensed wholesale traders. Over the past decade, about half of the antimicrobials prescribed each year have been prescribed by private doctors in the community (Fig 1). Interestingly, a significant 27.2% reduction in the overall defined daily dose per 1000 inhabitants per day was observed during the three pandemic years (2020-2022) compared with the pre–COVID-19 baseline, probably due to reduced respiratory infections.[5] Nevertheless, a rebound in defined daily dose was noted at the start of 2023, particularly in the private sector following the resumption of normalcy.[5] Antimicrobial consumption can be grouped according to the World Health Organization (WHO)'s AWaRe classification—Access, Watch and Reserve—based on resistance risk and medical importance, with the aim of improving appropriate antibiotic use.[6] According to the WHO, 'Access' antibiotics can be used freely, 'Watch' antibiotics require caution, and 'Reserve' antibiotics are reserved for last-resort cases. The WHO has advocated increasing the use of 'Access' antibiotics to at least 60% of total antibiotic

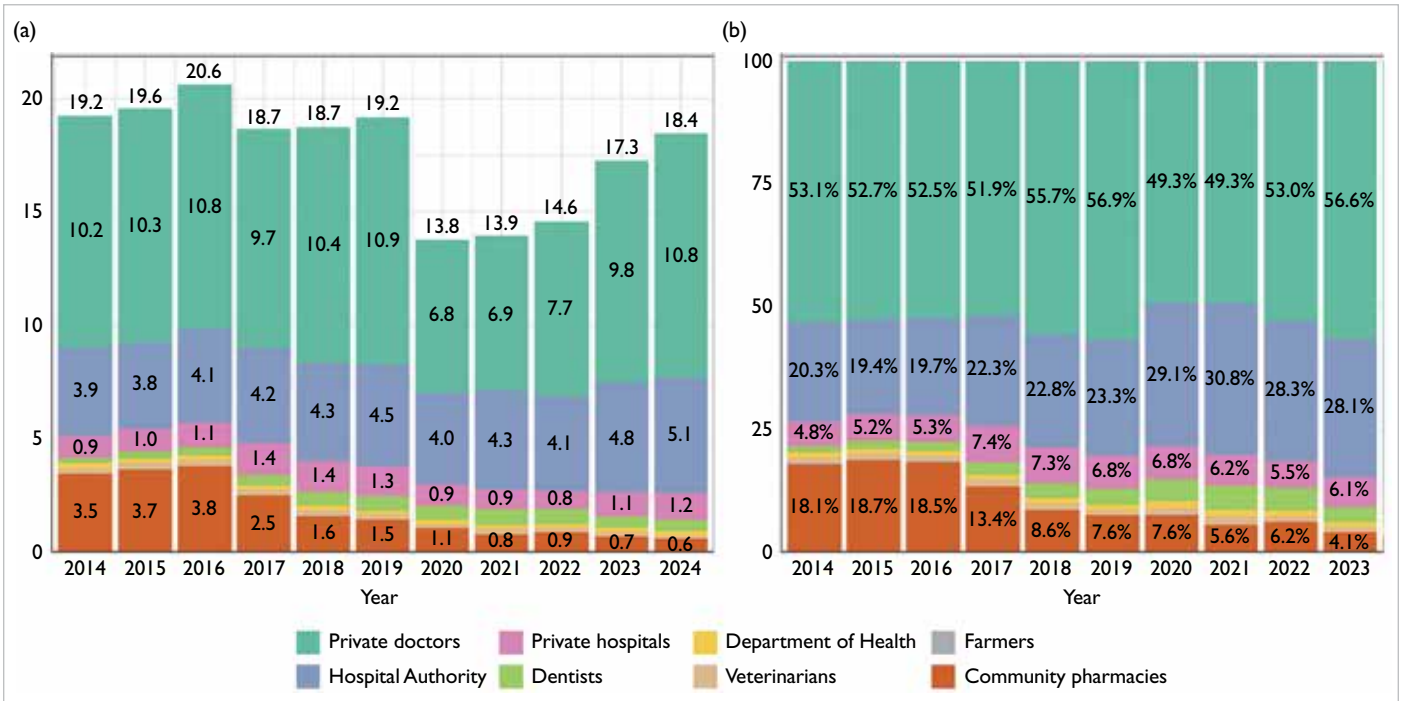

FIG 1. Distribution of antimicrobial utilisation by different sectors in Hong Kong in defined daily dose per 1000 inhabitant days (a) and percentage (b)
Source: Centre for Health Protection, Department of Health, Government of the Hong Kong Special Administrative Region

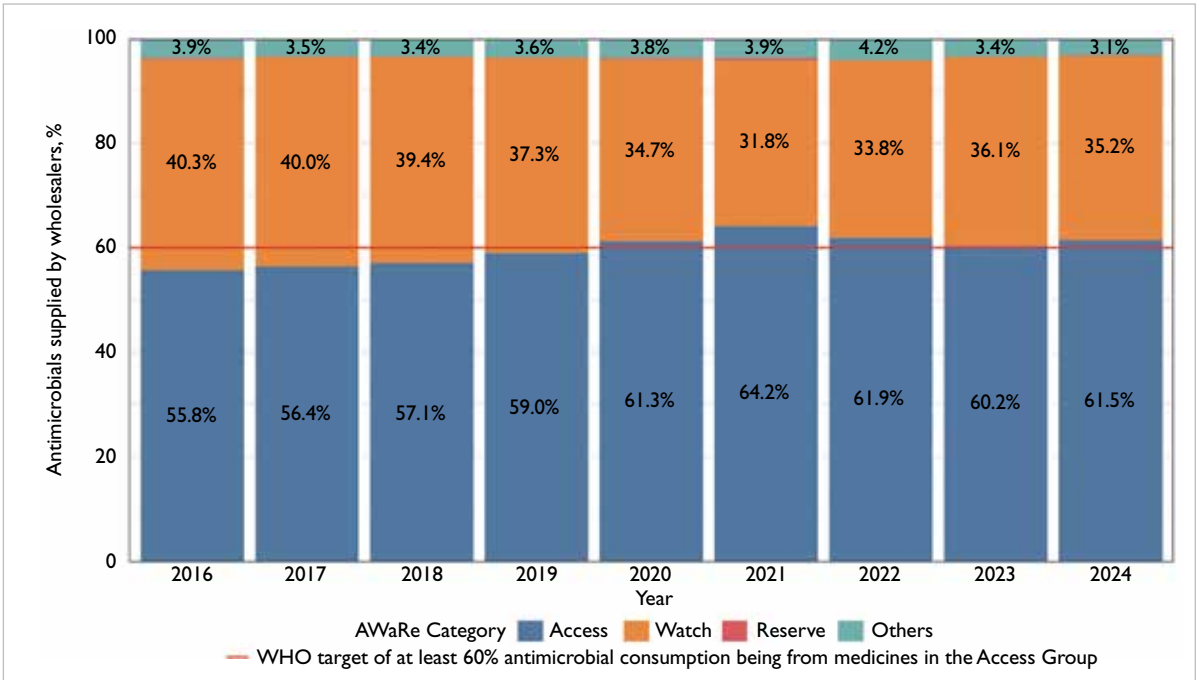

FIG 2. Distribution of antimicrobial utilisation by World Health Organization AWaRe category*
Source: Centre for Health Protection, Department of Health, Government of the Hong Kong Special Administrative Region
Abbreviation: WHO = World Health Organization
* Supply to veterinarians and farmers were excluded from analysis

consumption, while preserving 'Watch' and 'Reserve' antibiotics for conditions in which they are truly indicated.[6] In Hong Kong, since 2020, the proportion of antimicrobial use within the 'Access' group has met the WHO target of 60% of total consumption (Fig 2). It is noteworthy that the proportion of 'Access' antibiotics prescribed is the lowest among private doctors in the community compared with

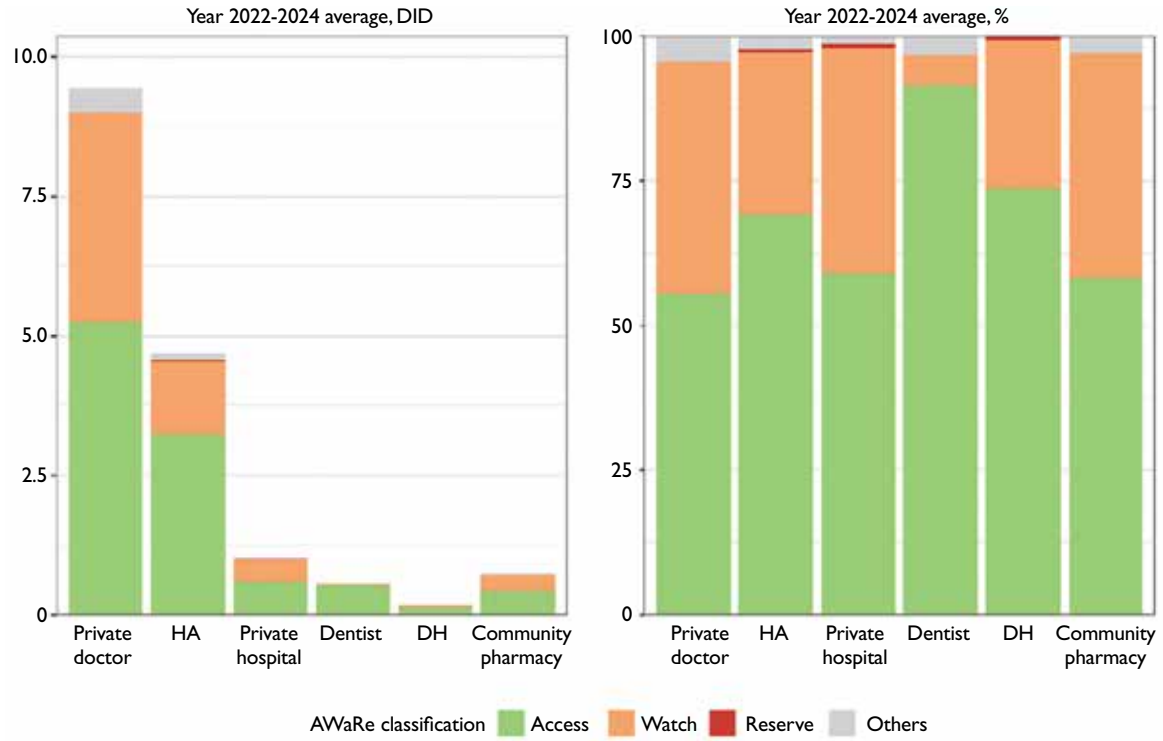

FIG 3. Antimicrobial utilisation surveillance by World Health Organization AWaRe classification of antimicrobials among different sectors*

Source: Centre for Health Protection, Department of Health, Government of the Hong Kong Special Administrative Region
Abbreviations: DH = Department of Health; DID = defined daily dose per 1000 inhabitants per day; HA = Hospital Authority
* Supply to veterinarians and farmers were excluded from analysis

other sectors, such as the Hospital Authority and private hospitals (Fig 3). Overuse of broad-spectrum antibiotics is one of the main drivers of AMR and calls for coordinated efforts to address the resistance problem.

The second Hong Kong Strategy and Action Plan on Antimicrobial Resistance (2023-2027) was launched in 2022 to address the issue of AMR under a One Health approach.[7] Among the six key areas, optimising the use of antimicrobials in humans is one of the main strategic actions. In 2017 and 2018, the CHP issued guidance notes on the use of antimicrobials for seven common conditions in a community setting, under the leadership of an Advisory Group on Antibiotic Guidance Notes in Primary Care, covering acute rhinosinusitis (ARS), acute pharyngitis, acute otitis media (AOM), acute uncomplicated cystitis in women, community-acquired pneumonia (CAP), acute exacerbations of chronic obstructive pulmonary disease (COPD), and simple (uncomplicated) skin and soft tissue infections. With the changing epidemiology of infectious diseases, evolving bacterial resistance patterns, and the latest scientific evidence for the management of different conditions, the Advisory Group has recently reviewed and updated its guidance notes. The Advisory Group has also been renamed the Advisory Group on Antibiotic Guidance Notes in Community Setting and includes new representatives from the Hong Kong College of Paediatricians, the Hong Kong College of Physicians, the Hong Kong College of Otorhinolaryngologists, and the Hong Kong Chinese Medical Association. Similar to the previous group, the Advisory Group also includes members from the Hong Kong Medical Association, Hong Kong Academy of Medicine, private medical groups, The Hong Kong Society for Infectious Diseases, Hong Kong Doctors Union, a representative from the Coordinating Committee in Family Medicine of the Hospital Authority, Chief Pharmacist's Office of the Hospital Authority, The Hong Kong Private Hospitals Association, and representatives of the CHP. Five meetings were held to deliberate on the content, from July 2024 to August 2025. In this latest edition, the Advisory Group has revised the content of the guidance notes with reference to international guidelines, up-to-date scientific research, local disease epidemiology, the latest susceptibility data from the local surveillance network, and the availability of antibiotics in the

local market. These notes serve as a key reference to optimise the use of antibiotics in the treatment of infections across both public and private sectors in the community. We have extracted the relevant content on aetiology, clinical features, and the latest recommendations on antibiotic use for these seven conditions. The recommended choice of antibiotics, including first- and second-line drugs for each condition, can be found in the online supplementary Tables 1-11. The full version of the guidance notes is available on the CHP website: https://www.chp.gov.hk/en/features/49811.html.

Acute rhinosinusitis

Aetiology and clinical features

Rhinosinusitis refers to inflammation of the mucosal lining of the nasal cavity, nasopharynx, and paranasal sinuses. Acute rhinosinusitis is clinically defined as lasting fewer than 12 weeks, whereas rhinosinusitis that persists for 12 weeks or longer without complete resolution of symptoms is defined as chronic rhinosinusitis.[8] Acute rhinosinusitis is caused predominantly by viral infection, termed acute viral rhinosinusitis or the common cold. Adults experience approximately two to five episodes per year, and schoolchildren seven to ten.[8] When secondary bacterial infection occurs, acute bacterial rhinosinusitis (ABRS) develops. It is more frequent in children than in adults.[9-11] The majority of ARS cases are caused by viral infection, with only about 2% complicated by bacterial infection.[12,13] *Streptococcus pneumoniae*, *Haemophilus influenzae* (non-typeable), and *Moraxella catarrhalis* are the main causes of ABRS.[14] *Staphylococcus aureus*, streptococcal species, and anaerobes (from odontogenic infections) may occasionally be found.[15]

Clinical features of rhinosinusitis include cough, nasal symptoms, fever, halitosis, headache, facial pain, and swelling. Cough is worse at night due to postnasal drip. The appearance of nasal discharge ranges from watery to purulent and cannot reliably distinguish between bacterial and viral infection. Fever usually resolves within 48 hours. Facial tenderness may occur when the upper molars are percussed or the cheekbones are pressed; this is less common in children than in adults. Acute viral rhinosinusitis is mostly self-limiting, typically lasting no longer than 7 to 10 days.[8,16]

Management

Most ARS symptoms start to improve after 5 days, and the majority of uncomplicated ARS cases resolve within 2 to 3 weeks. Antibiotics are generally not needed. Symptomatic management, such as paracetamol, nonsteroidal anti-inflammatory drugs, nasal decongestants, intranasal normal saline irrigation and intranasal corticosteroids, can be considered where appropriate.[8,12,17-20] Antibiotic treatment for ABRS is only slightly beneficial. A Cochrane review found that, out of 100 patients treated with antibiotics, only five experienced faster cure between days 7 and 14.[20] The number needed to benefit is 18, while the number needed to harm is about eight.[18] Antibiotic treatment causes more adverse effects than placebo in the treatment of ABRS.[19] In addition, the use of antibiotics does not prevent complications.[21] For uncomplicated ABRS cases, watchful waiting can be considered after shared decision making and education about when to return for follow-up or initiate antibiotics (eg, if symptoms do not improve within the next 3 days or worsen rapidly or significantly at any time).[12,22] Antibiotic treatment should be reserved for cases with features suggestive of ABRS; however, careful patient selection is recommended to avoid unnecessary antibiotic use and potential side-effects.[8,12]

Recommended antibiotics

The recommended antibiotics for the treatment of ABRS in adults and paediatric patients are detailed in online supplementary Tables 1 and 2, respectively. The first-line antibiotic is usually amoxicillin or amoxicillin-clavulanate. The latter is a beta-lactam/beta-lactamase inhibitor combination and is therefore active against beta-lactamase-producing bacteria, including most *H influenzae*, *M catarrhalis* and methicillin-sensitive *S aureus*. It has no added advantage against *S pneumoniae*, whose beta-lactam resistance does not rely on enzyme production. For patients with type I hypersensitivity to penicillin, antibiotics from a completely different class should be used, such as doxycycline or macrolides. If macrolides (eg, clarithromycin, erythromycin) are prescribed, follow-up after the initial course of treatment is recommended because of the relatively high rate of antibiotic resistance. A 7-day course of antibiotics is sufficient to treat acute sinusitis in both adults and children. This takes into account the overall evidence on efficacy and safety, as well as the risk of AMR.[12] A meta-analysis comparing short-course treatment (3-7 days) with long-course treatment (6-10 days) found no significant difference in cure rate or symptom improvement.[23]

Acute pharyngitis

Aetiology and clinical features

Acute pharyngitis, or acute sore throat, is a mostly self-limiting disease and usually lasts for around 1 week. Although its aetiology can be viral or bacterial, most cases are viral and antibiotics are inappropriate. Viral pharyngitis can be caused by enterovirus, rhinovirus, influenza or parainfluenza virus, coronavirus (including severe acute respiratory

syndrome coronavirus 2), adenovirus, respiratory syncytial virus, Epstein–Barr virus, herpes simplex virus, metapneumovirus, cytomegalovirus, and human immunodeficiency virus. Patients with acute sore throat and associated signs and symptoms such as conjunctivitis, coryza, cough, diarrhoea, hoarseness, discrete ulcerative stomatitis and/or viral exanthema are more likely to have a viral illness.[24,25] Conversely, symptoms such as sudden-onset sore throat, fever, and/or pain on swallowing, and physical examination findings such as pharyngeal and tonsillar erythema, an erythematous sandpaper-like rash, tonsillar hypertrophy with or without exudates, palatal petechiae, and/or anterior cervical lymphadenopathy are more suggestive of a bacterial cause.[25,26] Group A streptococcus (GAS) is the most common bacterial cause of acute pharyngitis, accounting for about 80% of bacterial cases, with the remainder usually caused by group C or group G streptococci. Group A streptococcus is responsible for 5% to 15% of sore throat consultations in adults and 20% to 30% in children.[27-29] Although symptoms of GAS pharyngitis resolve without antibiotic treatment, complications can arise and may be suppurative (eg, cervical lymphadenitis, peritonsillar abscess, mastoiditis, and retropharyngeal abscess) or non-suppurative (eg, scarlet fever, acute rheumatic fever, and post-streptococcal glomerulonephritis).[25]

Management and antibiotic treatment

Although GAS pharyngitis is mostly self-limiting, antibiotics are prescribed to relieve acute symptoms, prevention of acute and subacute complications, and reduce transmission. Antibiotic treatment can prevent suppurative complications and acute rheumatic fever, and may offer protection against the subsequent development of post-infectious glomerulonephritis.[30] Group A streptococcus is generally sensitive to penicillin and other members of the beta-lactam group of antibiotics, but shows high resistance (42.3% to 60.0% from 2016 to 2020) to erythromycin locally.[31]

Penicillin V or amoxicillin is the recommended drug of choice for patients who are not allergic to these agents (online supplementary Tables 3 and 4). Group A streptococcus resistant to penicillins and other beta-lactams has not been reported. All *Streptococcus pyogenes* isolates tested by the CHP from 2008 to 2020 were sensitive to penicillin.[31] First-generation cephalosporins (eg, cephalexin) are the first-line agents for penicillin-allergic individuals (ie, those without anaphylactic reactions). Other cephalosporins (eg, cefaclor, cefuroxime) are alternatives but are not favoured as first-line agents because of their broader spectrum of activity. As GAS resistance to macrolides (eg, erythromycin, azithromycin, and clarithromycin) is known to be common in Hong Kong, macrolides are not an appropriate first-choice antibiotic treatment.[31] Regarding the duration of antibiotics, a 10-day course is recommended by the Infectious Diseases Society of America and the United States Centers for Disease Control and Prevention to achieve maximal eradication of GAS from the pharynx for the primary prevention of acute rheumatic fever.[25] The National Institute for Health and Care Excellence guideline recommends treatment for 5 to 10 days but recognises that microbiological cure may be better with a 10-day course of phenoxymethylpenicillin compared with a 5- or 7-day course, although there were no differences in relapse or recurrence.[32] Since routine rapid antigen detection testing for GAS is not recommended and microbiological cure is the goal, a 10-day course is recommended to maximise treatment effectiveness.

Acute otitis media

Aetiology and clinical features

Acute otitis media is the acute inflammation of the middle ear. It is a common paediatric condition with peak prevalence at 6 to 18 months, while AOM in adults is rare.[33] It has been reported that 27% of infants and 37% of children with upper respiratory tract infections develop AOM.[34,35] After the introduction of pneumococcal vaccination, overseas studies showed that the incidence of AOM decreased significantly.[36,37] Acute otitis media can be caused by viruses or bacteria, but it is often difficult to distinguish between them as both can co-exist. Viruses that cause upper respiratory tract infections (eg, respiratory syncytial virus, adenovirus and influenza viruses) are present in up to two-thirds of cases.[38] The average global distribution of causative bacterial pathogens of AOM is as follows: *S pneumoniae* (30%), *H influenzae* (non-typeable) [23%], and *M catarrhalis* (5%).[39] The remaining cases are caused by other bacteria (eg, GAS). There is usually a single bacterial cause, but coinfection with other pathogens is known to occur.[40] Typical symptoms of AOM include otalgia that interferes with normal activity or sleep, new-onset ear discharge, fever, loss of appetite and difficulty hearing. It may present as ear tugging or irritability in infants and young children.

Management

Viral AOM is a mostly self-limiting infection, with symptoms (ie, otalgia) typically lasting about 3 to 7 days.[41] Most children and young people recover within 3 days without antibiotics. In a Cochrane review, 60% of children not treated with antibiotics showed improvement in symptoms within 24 hours, and over 80% had symptoms that resolved spontaneously within 3 days.[42] When determining whether to prescribe antibiotics, healthcare providers

should consider the patient's general health, the severity of the disease, the risk of complications, and the expected benefits of antibiotic therapy:

- If the patient is not improving within 48 to 72 hours and has acute, worsening symptoms; is systemically very unwell; has signs and symptoms of a more serious illness or condition; or is at high risk of complications, clinicians should offer immediate antibiotics. The patient should be referred to hospital if there is severe systemic infection or complication (eg, mastoiditis, meningitis, or facial nerve paralysis).
- Red flag signs and symptoms include a fever of 39°C or above, drowsiness, rapid breathing, rapid heart rate, severe ear pain, and signs or symptoms of intracranial complications (eg, neck stiffness, altered mental status, seizures, or focal neurological deficits).
- Children under 2 years of age with bilateral AOM, and children and young people with AOM and otorrhoea, are more likely to benefit from antibiotics.[41]

Antibiotic treatment has no early effect on pain, a slight effect over the following days, and only a modest effect on the number of children with tympanic perforations, contralateral otitis episodes and abnormal tympanometry findings in subsequent weeks, with no difference in the rare occurrence of severe complications.[42] A Cochrane review found that for patients with respiratory infections (including AOM) in whom clinicians considered it safe not to prescribe antibiotics immediately, a non-prescribing approach with advice to return if symptoms did not resolve (delayed antibiotics) resulted in the least antibiotic use, while maintaining similar patient satisfaction and clinical outcomes compared with immediate antibiotics.[43] The recommended choice of antibiotic regimen is detailed in online supplementary Table 5. Regardless of whether antibiotics are prescribed, patients and caregivers should be informed about red flag symptoms and advised to seek medical attention if symptoms worsen rapidly.

Community-acquired pneumonia

Aetiology and clinical features

Community-acquired pneumonia refers to an acute infection of the lung parenchyma in a patient who has acquired the infection outside a healthcare setting and has developed symptoms and signs in the community. Community-acquired pneumonia can be caused by a variety of pathogens, including viruses and bacteria. There is increasing recognition of viral pathogens in CAP[4] of which the most common include influenza virus, rhinovirus and parainfluenza virus. The most frequently detected bacterial pathogens are *S pneumoniae*, *H influenzae*, *S aureus*, and *Mycoplasma pneumoniae*.[44-47] Group A streptococcus and *S aureus* may cause secondary bacterial pneumonia following influenza virus infection. Common clinical features of CAP include cough, fever, pleuritic chest pain, dyspnoea, and sputum production. On physical examination, many patients are febrile, although this finding is frequently absent in older patients. Tachypnoea and tachycardia are also common. Chest examination may reveal audible crackles. Signs of consolidation, such as decreased or bronchial breath sounds and dullness to percussion, may be present.

Antibiotic therapy

Antibiotic therapy should be started as soon as CAP is suspected or established[48-53] (online supplementary Tables 6 and 7). When considering the choice of antibiotic, clinicians are advised to take into account the severity of the infection and the risk of developing complications (eg, co-morbidities such as severe lung disease or immunosuppression), local AMR patterns and prevalence, as well as any recent antibiotic use and microbiological results, if available.[54]

Streptococcus pneumoniae is one of the most common pathogens identified in local CAP.[44] In Hong Kong, there is reduced susceptibility of *S pneumoniae* to penicillin (23% to 51% resistance) and to macrolides (82% resistance to erythromycin) in the community.[55,56] Risk factors include age over 65 years, beta-lactam therapy within the last 3 months, alcoholism, multiple medical co-morbidities, and exposure to a child in a day-care centre. Amoxicillin-clavulanate is therefore recommended as the first-line empirical treatment. Doxycycline can be added if macrolide-resistant *M pneumoniae* infection is suspected. For patients with co-morbidities or those at risk of *Legionella* pneumonia, a macrolide can be added. Due to poor intrinsic activity against *S pneumoniae* and/or low oral bioavailability, certain oral cephalosporins (first-generation agents, cefaclor, cefuroxime, ceftibuten, cefixime and loracarbef) are not recommended.

Mycoplasma pneumoniae is common in children and is also seen in adults in Hong Kong.[44,57] The infection is often self-limiting without specific antibiotic therapy. Initial empirical therapy covering *M pneumoniae* is considered optional for outpatients with mild CAP. It may be indicated if the first-line agent has failed, if outpatients have severe CAP, or if the patient is a child aged over 5 years or an adolescent. Up to 40% of CAP in children aged 5 years or above has been attributed to *M pneumoniae*.[57] In Hong Kong, the macrolide resistance rate among *M pneumoniae* is high in the community, with an increasing trend from 28.2% in 2018 to 61.3% in 2024.[58] Doxycycline is recommended for the treatment of macrolide-resistant *M pneumoniae*–

associated CAP in adults and children (regardless of age or duration of therapy).[59]

Fluoroquinolones may be considered in the treatment of CAP when the first-line agent has failed, when an outpatient is allergic to first-line agents, or when there is documented infection with *S pneumoniae* with a penicillin minimum inhibitory concentration (MIC) of 4 μg/mL or above (intermediate susceptibility to penicillin). Nonetheless, excessive use of respiratory fluoroquinolones in CAP may lead to delayed diagnosis of tuberculosis and increased fluoroquinolone resistance in *Mycobacterium tuberculosis*. Fluoroquinolones should be reserved for use in outpatients who have no other treatment options. Patients should be warned of the risk of severe adverse effects, including aortic dissection or rupture of an aortic aneurysm, significant decreases in blood sugar, and disabling side-effects involving the tendons, muscles, joints, nerves, central nervous system, and mental health.[60-62]

Duration of antibiotic therapy

Most outpatients with CAP will show an adequate clinical response within 72 hours. For most patients, appropriately chosen initial antibiotic therapy should not be changed within the first 72 hours unless there is marked clinical deterioration. Clinical judgement is required when determining the duration of antibiotic therapy. Factors to consider include the patient's clinical response, severity of infection, causative pathogen, in vitro susceptibility of the pathogen, and the presence of complications and side-effects. In adults and children, a 5-day course of antibiotics (except for doxycycline) is usually effective for mild CAP in the outpatient setting.[54,63-66] Clinicians may consider stopping treatment after 5 days unless the patient fails to improve clinically or the microbiological results suggest the need for a longer course.[67]

Acute exacerbations of chronic obstructive pulmonary disease

Clinical features and causes of exacerbation

Chronic obstructive pulmonary disease is a heterogeneous lung condition characterised by chronic respiratory symptoms due to airway and/or alveolar abnormalities. It is caused by a combination of environmental (eg, passive smoking, outdoor and indoor air pollution, occupational exposure to airborne pollutants) and host factors (eg, smoking and advancing age).[68,69] In Hong Kong, the prevalence of COPD is 0.5% among individuals aged 15 years or above.[70] It is most common among those aged 75 to 84 years (2.2%), with a male predominance.[70] The most common respiratory symptoms include dyspnoea, cough, and/or sputum production. Chronic obstructive pulmonary disease is diagnosed by spirometry demonstrating a post-bronchodilator ratio of FEV_1/FVC (forced expiratory volume in 1 second to forced vital capacity) of <0.7. The disease is associated with co-morbidities such as cardiovascular disease, hypertension, and lung cancer.[71-73] It may be punctuated by acute exacerbations, defined as acute episodes of worsening respiratory symptoms within 14 days that may be accompanied by tachypnoea and/or tachycardia, and are often associated with local and systemic inflammation.[74] Acute exacerbations of COPD are mainly triggered by respiratory viral infection (eg, influenza A and rhinovirus), although bacterial infection and air pollution can also precipitate these events.[74-77] Common bacterial isolates in patients hospitalised with a COPD exacerbation include *H influenzae*, *S pneumoniae*, *Pseudomonas aeruginosa*, and *M catarrhalis*.[76,78-80]

When to prescribe antibiotics and choice of antibiotics

Appropriately prescribed antibiotics may shorten recovery time and reduce the risk of early relapse, treatment failure, and duration of hospitalisation. Antibiotics can be prescribed when there are clinical signs of bacterial infection. Evidence suggests that sputum colour and purulence can predict the presence of bacterial infection. In a pooled analysis, green or yellow sputum showed a sensitivity of 94.7% and a specificity of 15% for the presence of bacteria.[81] Studies have also shown that a positive bacterial culture was obtained in 77% to 84% of patients with purulent sputum.[82,83] According to the 2024 Global Strategy for Prevention, Diagnosis and Management of COPD report, antibiotics should be given to patients in the community if they: (a) have three cardinal symptoms, namely increased dyspnoea, increased sputum volume, and increased sputum purulence; (b) have increased sputum purulence and one other cardinal symptom; or (c) require mechanical ventilation.[74]

Empirical antibiotic therapy (online supplementary Table 8) targets likely bacterial pathogens responsible for acute exacerbations of COPD and takes into account local patterns of antibiotic resistance.[56] *Pseudomonas aeruginosa* and/or Enterobacterales infection may occur in outpatients with advanced COPD. Risk factors for *P aeruginosa* infection include chronic colonisation or previous isolation of *P aeruginosa* from sputum, very severe COPD (forced expiratory volume in 1 second <30% predicted), bronchiectasis on chest imaging, broad-spectrum antibiotic use within the past 3 months, and chronic systemic glucocorticoid use.[84-87] Amoxicillin and macrolides are not recommended because of the high resistance rates in Hong Kong. Local community data show reduced susceptibility of *S pneumoniae* to penicillin (23%-

51% resistance) and to macrolides (82% resistance to erythromycin).[55,56] In addition, 50% of *H influenzae* isolates were resistant to ampicillin, and nearly all (99%) *M catarrhalis* isolates produced beta-lactamase.[56] Amoxicillin-clavulanate or a respiratory fluoroquinolone (eg, levofloxacin) is recommended. In patients for whom amoxicillin-clavulanate is contraindicated because of non-type I penicillin allergy, a cephalosporin such as cefpodoxime or cefuroxime may be considered. Fluoroquinolones should be reserved for outpatients who have no other treatment options for acute bacterial exacerbation of chronic bronchitis because of the risk of severe adverse effects, including aortic dissection or rupture of an aortic aneurysm, significant decreases in blood sugar, or disabling side-effects involving the tendons, muscles, joints, nerves, central nervous system and mental health.[60-62] Regarding treatment duration, a systematic review of outpatients with COPD exacerbations indicated that short-course antibiotic treatment (≤5 days) did not differ significantly from long-course treatment (≥6 days) in terms of clinical cure or bacterial eradication.[88] These results concurred with those of another systematic review and meta-analysis comparing short-course (<6 days) with long-course antibiotics (>7 days).[89] In addition, there were significantly fewer adverse events with short-course antibiotics.[88-90] Based on the evidence, a 5-day course of antibiotics will generally be adequate to treat a mild-to-moderate acute exacerbation of COPD due to bacterial infection.

Acute uncomplicated cystitis in women

Aetiology and clinical features

Acute uncomplicated cystitis is characterised by local bladder signs and symptoms such as dysuria, urgency, frequency and suprapubic pain. There should be no signs or symptoms suggestive of infection spreading beyond the bladder (eg, fever, chills, rigors, unstable vital signs, flank pain or costovertebral angle tenderness). Individuals with urinary catheters are excluded from this definition.[91-97] Cystitis usually occurs when bacteria from the gastrointestinal tract enter the urethra and ascend to the bladder.[98] *Escherichia coli* is the most commonly isolated pathogen (~52%) in midstream urine samples collected in the outpatient setting of the Hospital Authority, followed by *Klebsiella pneumoniae* (~9%), *Proteus mirabilis* (~5%), and *Streptococcus agalactiae* (~3%) [unpublished data from CHP].

Antibiotic therapy

Given the very high probability of urinary tract infection based on typical symptoms, clinicians can consider empirical treatment without urine culture or dipstick urinalysis. The choice of antibiotics should take into account the symptoms, potential complications, previous urine culture results, and local antibiotic susceptibility patterns.[98] Among the *E coli* isolated from urine samples in outpatient settings of the Department of Health[56] and Hospital Authority (unpublished data), 64% to 67% were resistant to ampicillin, 36% to 46% to levofloxacin, 20% to cefpodoxime, 39% to cefuroxime, 31% to 32% to co-trimoxazole, 6% to 16% to amoxicillin-clavulanate, 2% to fosfomycin and 1% to 2% to nitrofurantoin. In the same settings, 99% to 100% of *Klebsiella pneumoniae* were resistant to ampicillin, 23% to 42% to nitrofurantoin, 12% to cefpodoxime, 35% to cefuroxime, 15% to 20% to co-trimoxazole, 10% to 17% to levofloxacin, and 8% to 14% to amoxicillin-clavulanate.[56] Judicious use of antibiotics is recommended to minimise potential collateral damage (ecological adverse effects of antimicrobial therapy, such as colonisation or infection with multidrug-resistant organisms), particularly with broad-spectrum cephalosporins and fluoroquinolones.[97]

For the choice of antibiotic therapy (online supplementary Table 9), nitrofurantoin is appropriate because of the low local resistance rate and is less likely to select for drug-resistant organisms (the preserved in vitro susceptibility of *E coli* to nitrofurantoin over many years of use suggests that it causes only minor collateral damage). Beta-lactam agents, including amoxicillin-clavulanate, are appropriate choices for therapy even in cases of intermediate susceptibility because they achieve high urinary concentrations. In view of disabling and potentially long-lasting or irreversible side-effects, fluoroquinolones should be used only when other commonly prescribed antibiotics are considered inappropriate. Co-trimoxazole is not recommended as a first-line agent given the high local resistance.[56] Antibiotic treatment is not required for asymptomatic bacteriuria except during pregnancy or prior to urological procedures associated with mucosal trauma.[91,95,99,100]

Simple (uncomplicated) skin and soft tissue infections

Aetiology and clinical features

The term 'skin and soft-tissue infections (SSTIs)' describes a wide variety of clinical conditions. Simple, or uncomplicated, SSTIs refer to superficial infections such as cellulitis, simple abscesses, impetigo and furuncles, and require antibiotics or surgical incision and drainage. Complicated SSTIs include deep soft-tissue infections (eg, deep abscesses and necrotising fasciitis) that require significant surgical intervention. When classifying patients with SSTIs, the necrotising or non-necrotising nature of the infection, the anatomical extent, the characteristics of the infection (purulent

or non-purulent), and the clinical condition of the patient should always be assessed independently.[101,102] Simple SSTIs usually present with localised clinical findings such as erythema, warmth, oedema and pain over the affected site. They are not associated with systemic signs or symptoms that indicate spread (eg, fever, tachycardia, diaphoresis, fatigue, anorexia and vomiting) or uncontrolled co-morbidities that may complicate treatment. Simple SSTIs are usually monomicrobial, mainly caused by *S aureus* and beta-haemolytic streptococci such as *S pyogenes*. In diabetic foot infection, polymicrobial infection is more likely. *Vibrio vulnificus* infection is associated with injuries related to seawater or seafood exposure. Impetigo is usually caused by *S aureus*, whereas cellulitis is usually caused by beta-haemolytic streptococci. Nonetheless, both pathogens may occur in combination in simple SSTIs.

Antibiotic therapy

Simple SSTIs are amenable to outpatient management with topical or oral antibiotics. When choosing an empirical antibiotic (online supplementary Tables 10 and 11), clinicians should consider the severity of symptoms, site of infection, risk of uncommon pathogens, previous microbiological results, MRSA status, and local resistance patterns.[103] In mild and localised impetigo, topical antibiotics are adequate treatment.[104,105] In other cases of simple SSTIs, oral antibiotics are indicated. Based on data from outpatient settings of the Hospital Authority, resistance of *S pyogenes* to penicillins and other beta-lactams has not been reported in Hong Kong; nonetheless, 37% of isolates were resistant to erythromycin (unpublished data from CHP). Coverage for community-associated MRSA (CA-MRSA) should be considered if risk factors are present (eg, history of direct contact with CA-MRSA–infected wounds, discharge or soiled areas, close contact with carriers, presence of skin lesions, poor personal hygiene, and sharing of personal items), or if the patient does not respond to first-line treatment.[106,107] Co-trimoxazole, doxycycline/minocycline, and clindamycin can be considered if CA-MRSA is suspected or confirmed. Locally, 24% to 26% of *S aureus* isolates are MRSA.[56] In addition, patients with CA-MRSA and their close contacts should receive topical decolonisation therapy.[107]

Superficial and small abscesses usually respond well to incision and drainage and seldom require antibiotics, except when they are associated with systemic signs of infection, extensive cellulitis, rapid progression or poor response to initial drainage; involve sites that are difficult to drain (eg, face, hands, and genitalia); or occur in children, older adults, or those with significant co-morbid illness or immunosuppression.[102] A 5- to 7-day course of antibiotic treatment is recommended for simple SSTIs, but this may be extended to up to 10 days at the clinician's discretion if the infection does not improve after completion of the initial course.[103,106,108-111] Since the skin requires time to return to its normal condition, full resolution should not be expected within 5 to 7 days.[103]

Conclusion

Rational prescription of antimicrobials is vital to curb the rise of resistant pathogens. At the 79th United Nations General Assembly High-Level Meeting on AMR held in September 2024, global leaders approved a political declaration committing to a clear set of targets and actions, including a 10% reduction in the estimated 4.95 million annual human deaths associated with bacterial AMR by 2030.[112] The declaration also aims for at least 70% of antibiotics used in human health worldwide to belong to the WHO Access group.[112] A territory-wide survey was conducted in 2023 to examine the awareness and practices of the general public regarding AMR in Hong Kong.[113] The results showed that when a doctor's initial assessment indicated that antibiotics were not needed, the vast majority of respondents (94.7%) accepted the doctor's advice to observe for a few more days or to wait for diagnostic test results before deciding whether to prescribe antibiotics.[113] In addition, about half (49.5%) of respondents wanted doctors to share decision making with them regarding antibiotic prescriptions.[113] We urge all doctors in both the public and private sectors to prescribe antibiotics only when clinically indicated and to refer to clinical guidelines and the current guidance notes when selecting an appropriate agent. Whenever possible, narrow-spectrum antibiotics should be used at optimal doses and for the shortest effective duration.

Author contributions

All authors contributed to the editorial, approved the final version for publication, and take responsibility for its accuracy and integrity.

Conflicts of interest

ESK Ma and MCS Wong are members of the *Hong Kong Medical Journal* Editorial Board and internal review of this editorial was independently conducted by a senior editor. Other authors have declared no conflicts of interest.

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Supplementary material

The supplementary material was provided by the authors, and some information may not have been peer reviewed. Accepted supplementary material will be published as

References

1. World Health Organization. Health and economic impacts of antimicrobial resistance in the Western Pacific Region, 2020-2030. 2023 June 13. Available from: https://www.who.int/publications/i/item/9789290620112. Accessed 31 Dec 2025.
2. Centre for Health Protection, Department of Health, Hong Kong SAR Government. Antimicrobial resistance surveillance in human–community setting. Available from: https://www.chp.gov.hk/en/static/101604.html. Accessed 19 Jan 2026.
3. Wong CK, Liu Z, Butler CC, et al. Help-seeking and antibiotic prescribing for acute cough in a Chinese primary care population: a prospective multicentre observational study. NPJ Prim Care Respir Med 2016;26:15080.
4. Wong CK, Kung K, Au-Doung PL, et al. Antibiotic resistance rates and physician antibiotic prescription patterns of uncomplicated urinary tract infections in southern Chinese primary care. PloS One 2017;12:e0177266.
5. Ma ES, Hsu E, Chow V, et al. Rebound of antibiotic use and respiratory infections after resumption of normalcy from COVID-19 in Hong Kong. Infect Drug Resist 2025;18:1325-37.
6. World Health Organization. AWaRe classification of antibiotics for evaluation and monitoring of use, 2023. 2023 July 26. Available from: https://www.who.int/publications/i/item/WHO-MHP-HPS-EML-2023.04. Accessed 16 Mar 2026.
7. Ma ES. Combating antimicrobial resistance in Hong Kong: where are we and where should we go? Hong Kong Med J 2022;28:424-6.
8. Fokkens WJ, Lund VJ, Hopkins C, et al. European position paper on rhinosinusitis and nasal polyps 2020. Rhinology 2020;58(Suppl S29):1-464.
9. Wald ER, Nash D, Eickhoff J. Effectiveness of amoxicillin/clavulanate potassium in the treatment of acute bacterial sinusitis in children. Pediatrics 2009;124:9-15.
10. DeMuri GP, Gern JE, Moyer SC, Lindstrom MJ, Lynch SV, Wald ER. Clinical features, virus identification, and sinusitis as a complication of upper respiratory tract illness in children ages 4-7 years. J Pediatr 2016;171:133-9.e1.
11. Marom T, Alvarez-Fernandez PE, Jennings K, Patel JA, McCormick DP, Chonmaitree T. Acute bacterial sinusitis complicating viral upper respiratory tract infection in young children. Pediatr Infect Dis J 2014;33:803-8.
12. National Institute for Health and Care Excellence. Sinusitis (acute): antimicrobial prescribing. 2017 October 27. Available from: https://www.nice.org.uk/guidance/ng79. Accessed 25 Mar 2025.
13. Gwaltney JM Jr, Wiesinger BA, Patrie JT. Acute community-acquired bacterial sinusitis: the value of antimicrobial treatment and the natural history. Clin Infect Dis 2004;38:227-33.
14. Chow AW, Benninger MS, Brook I, et al. IDSA clinical practice guideline for acute bacterial rhinosinusitis in children and adults. Clin Infect Dis 2012;54:e72-112.
15. Bennett JE, Dolin R, Blaser MJ. Mandell, Douglas and Bennett's Infectious Disease Essentials. 8th ed. Elsevier Health Sciences; 2016.
16. Desrosiers M, Evans GA, Keith PK, et al. Canadian clinical practice guidelines for acute and chronic rhinosinusitis [in English, French]. J Otolaryngol Head Neck Surg 2011;40 Suppl 2:S99-193.
17. Aring AM, Chan MM. Current concepts in adult acute rhinosinusitis. Am Fam Physician 2016;94:97-105.
18. Smith MJ. Evidence for the diagnosis and treatment of acute uncomplicated sinusitis in children: a systematic review. Pediatrics 2013;132:e284-96.
19. King D, Mitchell B, Williams CP, Spurling GK. Saline nasal irrigation for acute upper respiratory tract infections. Cochrane Database Syst Rev 2015;2015:CD006821.
20. Segboer C, Gevorgyan, A, Avdeeva, K, et al. Intranasal corticosteroids for non-allergic rhinitis. Cochrane Database Syst Rev 2019;2019:CD010592.
21. Hansen FS, Hoffmans R, Georgalas C, Fokkens WJ. Complications of acute rhinosinusitis in the Netherlands. Fam Pract 2012;29:147-53.
22. Rosenfeld RM, Piccirillo JF, Chandrasekhar SS, et al. Clinical practice guideline (update): adult sinusitis. Otolaryngol Head Neck Surg 2015;152(2 Suppl):S1-39.
23. Falagas ME, Karageorgopoulos DE, Grammatikos AP, Matthaiou DK. Effectiveness and safety of short vs. long duration of antibiotic therapy for acute bacterial sinusitis: a meta-analysis of randomized trials. Br J Clin Pharmacol 2009;67:161-71.
24. Chan JY, Yau F, Cheng F, Chan D, Chan B, Kwan M. Practice recommendation for the management of acute pharyngitis. Hong Kong J Paediatr (new series) 2015;20:156-62.
25. Centers for Disease Control and Prevention, United States Government. Clinical guidance for group A streptococcal pharyngitis. 2025 November 18. Available from: https://www.cdc.gov/group-a-strep/hcp/clinical-guidance/strep-throat.html. Accessed 17 Oct 2024.
26. Sauve L, Forrester AM, Top KA. Group A streptococcal pharyngitis: a practical guide to diagnosis and treatment. Paediatr Child Health 2021;26:319-20.
27. Shulman ST, Bisno AL, Clegg HW, et al. Clinical practice guideline for the diagnosis and management of group A streptococcal pharyngitis: 2012 update by the Infectious Diseases Society of America. Clin Infect Dis 2012;55:e86-102.
28. Bisno AL. Acute pharyngitis: etiology and diagnosis. Pediatrics 1996;97:949-54.
29. Ebell MH, Smith MA, Barry HC, Ives K, Carey M. The rational clinical examination. Does this patient have strep throat? JAMA 2000;284:2912-8.
30. Bateman E, Mansour S, Okafor E, Arrington K, Hong BY, Cervantes J. Examining the efficacy of antimicrobial therapy in preventing the development of postinfectious glomerulonephritis: a systematic review and meta-analysis. Infect Dis Rep 2022;14:176-83.
31. Centre for Health Protection, Department of Health,

Hong Kong SAR Government. *Streptococcus pyogenes* (pharyngeal specimens). Available from: https://www.chp.gov.hk/en/statistics/data/10/100044/6861.html. Accessed 18 Oct 2024.
32. National Institute for Health and Care Excellence. Sore throat (acute): antimicrobial prescribing. 2018 January 26. Available from: https://www.nice.org.uk/guidance/ng84. Accessed 25 Mar 2025.
33. Rijk MH, Hullegie S, Schilder AG, et al. Incidence and management of acute otitis media in adults: a primary care-based cohort study. Fam Pract 2021;38:448-53.
34. Chonmaitree T, Alvarez-Fernandez P, Jennings K, et al. Symptomatic and asymptomatic respiratory viral infections in the first year of life: association with acute otitis media development. Clin Infect Dis 2015;60:1-9.
35. Chonmaitree T, Revai K, Grady JJ, et al. Viral upper respiratory tract infection and otitis media complication in young children. Clin Infect Dis 2008;46:815-23.
36. Mohanty S, Podmore B, Cuñado Moral A, et al. Incidence of acute otitis media from 2003 to 2019 in children ≤17 years in England. BMC Public Health 2023;23:201.
37. Hu T, Done N, Petigara T, et al. Incidence of acute otitis media in children in the United States before and after the introduction of 7- and 13-valent pneumococcal conjugate vaccines during 1998-2018. BMC Infect Dis 2022;22:294.
38. Chonmaitree T. Acute otitis media is not a pure bacterial disease. Clin Infect Dis 2006;43:1423-5.
39. Mather MW, Drinnan M, Perry JD, Powell S, Wilson JA, Powell J. A systematic review and meta-analysis of antimicrobial resistance in paediatric acute otitis media. Int J Pediatr Otorhinolaryngol 2019;123:102-9.
40. Le Saux N, Robinson JL; Canadian Paediatric Society, Infectious Diseases and Immunization Committee. Management of acute otitis media in children six months of age and older [in English, French]. Paediatr Child Health 2016;21:39-50.
41. National Institute for Health and Care Excellence. Otitis media (acute): antimicrobial prescribing. 2022 March 11. Available from: https://www.nice.org.uk/guidance/ng91. Accessed 25 Mar 2025.
42. Venekamp RP, Sanders, SL, Glasziou, PP, Rovers MM. Antibiotics for acute otitis media in children. Cochrane Database Syst Rev 2023;11:CD000219.
43. Spurling GK, Dooley L, Clark J, Askew DA. Immediate versus delayed versus no antibiotics for respiratory infections. Cochrane Database Syst Rev 2023;10:CD004417.
44. Lui G, To HK, Lee N, et al. Adherence to treatment guideline improves patient outcomes in a prospective cohort of adults hospitalized for community-acquired pneumonia. Open Forum Infect Dis 2020;7:ofaa146.
45. Jain S, Williams DJ, Arnold SR, et al. Community-acquired pneumonia requiring hospitalization among U.S. children. N Engl J Med 2015;372:835-45.
46. Bénet T, Sánchez Picot V, Messaoudi M, et al. Microorganisms associated with pneumonia in children <5 years of age in developing and emerging countries: the GABRIEL pneumonia multicenter, prospective, case-control study. Clin Infect Dis 2017;65:604-12.
47. Jain S, Self WH, Wunderink RG, et al. Community-acquired pneumonia requiring hospitalization among U.S. adults. N Engl J Med 2015;373:415-27.
48. National Institute for Health and Care Excellence. Pneumonia in adults: diagnosis and management. 2023 October 31. Available from: https://www.nice.org.uk/guidance/cg191. Accessed 25 Mar 2025.
49. Lim WS, Baudouin SV, George RC, et al. BTS guidelines for the management of community acquired pneumonia in adults: update 2009. Thorax 2009;64 Suppl 3:iii1-55.
50. Levy ML, Le Jeune I, Woodhead MA, Macfarlaned JT, Lim WS; British Thoracic Society Community Acquired Pneumonia in Adults Guideline Group. Primary care summary of the British Thoracic Society Guidelines for the management of community acquired pneumonia in adults: 2009 update. Endorsed by the Royal College of General Practitioners and the Primary Care Respiratory Society UK. Prim Care Respir J 2010;19:21-7.
51. Harris M, Clark J, Coote N, et al. British Thoracic Society guidelines for the management of community acquired pneumonia in children: update 2011. Thorax 2011;66 Suppl 2:ii1-23.
52. Mandell LA, Wunderink RG, Anzueto A, et al. Infectious Diseases Society of America/American Thoracic Society consensus guidelines on the management of community-acquired pneumonia in adults. Clin Infect Dis 2007;44 Suppl 2(Suppl 2):S27-72.
53. Bradley JS, Byington CL, Shah SS, et al. The management of community-acquired pneumonia in infants and children older than 3 months of age: clinical practice guidelines by the Pediatric Infectious Diseases Society and the Infectious Diseases Society of America. Clin Infect Dis 2011;53:e25-76.
54. National Institute for Health and Care Excellence. Pneumonia (community-acquired): antimicrobial prescribing. 2019 September 16. Available from: https://www.nice.org.uk/guidance/ng138. Accessed 25 Mar 2025.
55. Centre for Health Protection, Department of Health, Hong Kong SAR Government. Ho PL, Wu TC, editors. Reducing bacterial resistance with IMPACT: interhospital multidisciplinary programme on antimicrobial chemotherapy. 6th Edition. 2025. Available from: http://www.chp.gov.hk/files/pdf/reducing_bacterial_resistance_with_impact.pdf. Accessed 30 Aug 2025.
56. Centre for Health Protection, Department of Health, Hong Kong SAR Government. Bacterial pathogen isolation and percentage of antimicrobial resistance—out-patient setting. Available from: https://www.chp.gov.hk/en/statistics/data/10/641/697/3345.html. Accessed 13 Mar 2025.
57. Lung DC, Lam DS, Chan E, et al. Practice recommendation for management of community acquired pneumonia in children. Hong Kong J Paediatr (new series) 2016;21:178-93.
58. Centre for Health Protection, Department of Health, Hong Kong SAR Government. Detection of *Mycoplasma pneumoniae* in respiratory specimens in 2024. Available from: https://www.chp.gov.hk/en/statistics/data/10/641/642/7062.html. Accessed 13 Mar 2025.
59. Kimberlin DW, Banerjee R, Barnett ED, Lynfield R, Sawyer MH, editors. Red Book: 2024-2027 Report of the Committee on Infectious Diseases. Committee on Infectious Diseases, American Academy of Pediatrics; 2024.
60. United States Food and Drug Administration. FDA warns about increased risk of ruptures or tears in the

aorta blood vessel with fluoroquinolone antibiotics in certain patients. Available from: https://web.archive.org/web/20251214152417/https://www.fda.gov/drugs/drug-safety-and-availability/fda-warns-about-increased-risk-ruptures-or-tears-aorta-blood-vessel-fluoroquinolone-antibiotics. Accessed 25 Nov 2024.
61. United States Food and Drug Administration. FDA reinforces safety information about serious low blood sugar levels and mental health side effects with fluoroquinolone antibiotics; requires label changes. Available from: https://web.archive.org/web/20251214152856/https://www.fda.gov/drugs/drug-safety-and-availability/fda-reinforces-safety-information-about-serious-low-blood-sugar-levels-and-mental-health-side. Accessed 11 Feb 2025.
62. Drug Office, Department of Health, Hong Kong SAR Government. Letters to Healthcare Providers. Fluoroquinolone antibiotics: must now only be prescribed when other commonly recommended antibiotics are inappropriate in the United Kingdom (Letter to Healthcare Professionals). 2024 January 23. Available from: https://www.drugoffice.gov.hk/eps/news/showNews/Fluoroquinolone+antibiotics%3A+must+now+only+be+prescribed+when+other+commonly+recommended+antibiotics+are+inappropriate+in+the+United+Kingdom+%28Letter+t/healthcare_providers/2024-01-23/en/52611.html. Accessed 11 Feb 2025.
63. Kuijpers SM, Buis DT, Ziesemer KA, et al. The evidence base for the optimal antibiotic treatment duration of upper and lower respiratory tract infections: an umbrella review. Lancet Infect Dis 2025;25:94-113.
64. Kuitunen I, Jääskeläinen J, Korppi M, Renko M. Antibiotic treatment duration for community-acquired pneumonia in outpatient children in high-income countries—a systematic review and meta-analysis. Clin Infect Dis 2023;76:e1123-8.
65. Gao Y, Liu M, Yang K, et al. Shorter versus longer-term antibiotic treatments for community-acquired pneumonia in children: a meta-analysis. Pediatrics 2023;151:e2022060097.
66. Mo Y, Tan WC, Cooper BS. Antibiotic duration for common bacterial infections—a systematic review. JAC Antimicrob Resist 2025;7:dlae215.
67. Metlay JP, Waterer GW, Long AC, et al. Diagnosis and treatment of adults with community-acquired pneumonia. An official clinical practice guideline of the American Thoracic Society and Infectious Diseases Society of America. Am J Respir Crit Care Med 2019;200:e45-67.
68. Rabe KF, Watz H. Chronic obstructive pulmonary disease. Lancet 2017;389:1931-40.
69. Mannino DM, Buist AS. Global burden of COPD: risk factors, prevalence, and future trends. Lancet 2007;370:765-73.
70. Non-Communicable Disease Branch, Centre for Health Protection, Department of Health, Hong Kong SAR Government. Population Health Survey 2020-22. Available from: https://www.chp.gov.hk/en/resources/29/100057.html. Accessed 19 Mar 2026.
71. Chen W, Thomas J, Sadatsafavi M, FitzGerald JM. Risk of cardiovascular comorbidity in patients with chronic obstructive pulmonary disease: a systematic review and meta-analysis. Lancet Respir Med 2015;3:631-9.
72. de Torres JP, Marín JM, Casanova C, et al. Lung cancer in patients with chronic obstructive pulmonary disease—incidence and predicting factors. Am J Respir Crit Care Med 2011;184:913-9.
73. Barnes PJ, Celli BR. Systemic manifestations and comorbidities of COPD. Eur Respir J 2009;33:1165-85.
74. Global Initiative for Chronic Obstructive Lung Disease. 2024 Gold Report. Global Strategy for Prevention, Diagnosis and Management of COPD: 2024 Report. Available from: https://goldcopd.org/2024-gold-report/. Accessed 25 Mar 2025.
75. Papi A, Bellettato CM, Braccioni F, et al. Infections and airway inflammation in chronic obstructive pulmonary disease severe exacerbations. Am J Respir Crit Care Med 2006;173:1114-21.
76. Ko FW, Ip M, Chan PK, Ng SS, Chau SS, Hui DS. A one-year prospective study of infectious etiology in patients hospitalized with acute exacerbations of COPD and concomitant pneumonia. Respir Med 2008;102:1109-16.
77. Ko FW, Ip M, Chan PK, et al. Viral etiology of acute exacerbations of COPD in Hong Kong. Chest 2007;132:900-8.
78. Ko FW, Lam RK, Li TS, et al. Sputum bacteriology in patients hospitalized with acute exacerbations of chronic obstructive pulmonary disease and concomitant pneumonia in Hong Kong. Intern Med J 2005;35:661-7.
79. Ko FW, Ng TK, Li TS, et al. Sputum bacteriology in patients with acute exacerbations of COPD in Hong Kong. Respir Med 2005;99:454-60.
80. Hui DS, Ip M, Ling T, et al. A multicentre surveillance study on the characteristics, bacterial aetiologies and in vitro antibiotic susceptibilities in patients with acute exacerbations of chronic bronchitis. Respirology 2011;16:532-9.
81. Miravitlles M, Kruesmann F, Haverstock D, Perroncel R, Choudhri SH, Arvis P. Sputum colour and bacteria in chronic bronchitis exacerbations: a pooled analysis. Eur Respir J 2012;39:1354-60.
82. Soler N, Agustí C, Angrill J, Puig De la Bellacasa J, Torres A. Bronchoscopic validation of the significance of sputum purulence in severe exacerbations of chronic obstructive pulmonary disease. Thorax 2007;62:29-35.
83. Stockley RA, O'Brien C, Pye A, Hill SL. Relationship of sputum color to nature and outpatient management of acute exacerbations of COPD. Chest 2000;117:1638-45.
84. Garcia-Vidal C, Almagro P, Romaní V, et al. *Pseudomonas aeruginosa* in patients hospitalised for COPD exacerbation: a prospective study. Eur Respir J 2009;34:1072-8.
85. Parameswaran GI, Sethi S. Pseudomonas infection in chronic obstructive pulmonary disease. Future Microbiol 2012;7:1129-32.
86. Gallego M, Pomares X, Espasa M, et al. *Pseudomonas aeruginosa* isolates in severe chronic obstructive pulmonary disease: characterization and risk factors. BMC Pulm Med 2014;14:103.
87. Boixeda R, Almagro P, Díez-Manglano J, et al. Bacterial flora in the sputum and comorbidity in patients with acute exacerbations of COPD. Int J Chron Obstruct Pulmon Dis 2015;10:2581-91.
88. Llor C, Moragas A, Miravitlles M, Mesquita P, Cordoba G. Are short courses of antibiotic therapy as effective as standard courses for COPD exacerbations? A systematic review and meta-analysis. Pulm Pharmacol Ther 2022;72:102111.

89. Stolbrink M, Amiry J, Blakey JD. Does antibiotic treatment duration affect the outcomes of exacerbations of asthma and COPD? A systematic review. Chron Respir Dis 2018;15:225-40.
90. National Institute for Health and Care Excellence. Chronic obstructive pulmonary disease (acute exacerbation): antimicrobial prescribing. 2018 December 5. Available from: https://www.nice.org.uk/guidance/ng114. Accessed 25 Mar 2025.
91. SA Health, Government of South Australia. Urinary Tract Infections (adult): Empirical Treatment Clinical Guideline. September 2023. Available from: https://www.sahealth.sa.gov.au/wps/wcm/connect/public+content/sa+health+internet/about+us/governance/policy+governance/policies/urinary+tract+infections+adult+empirical+treatment+clinical+guideline. Accessed 26 May 2025.
92. National Institute for Health and Care Excellence. Urinary tract infections in adults. 2023 February 15. Available from: https://www.nice.org.uk/guidance/qs90. Accessed 25 Mar 2025.
93. Kranz J, Bartoletti R, Bruyère F, et al. European Association of Urology Guidelines on Urological Infections: summary of the 2024 Guidelines. Eur Urol 2024;86:27-41.
94. United States Food and Drug Administration. Uncomplicated urinary tract infections: developing drugs for treatment guidance for industry. August 2019. Available from: https://www.fda.gov/regulatory-information/search-fda-guidance-documents/uncomplicated-urinary-tract-infections-developing-drugs-treatment-guidance-industry. Accessed 12 Aug 2025.
95. British Columbia. Urinary tract infections in the primary care setting–investigation. 2020 July 29. Available from: https://www2.gov.bc.ca/gov/content/health/practitioner-professional-resources/bc-guidelines/urinary-tract-infections. Accessed 21 Jul 2025.
96. Trautner BW, Cortés-Penfield NW, Gupta K, et al. IDSA 2025 Guideline update on complicated urinary tract infections. 2025 July 17. Available from: https://www.idsociety.org/practice-guideline/complicated-urinary-tract-infections/. Accessed 12 Aug 2025.
97. Gupta K, Hooton TM, Naber KG, et al. International clinical practice guidelines for the treatment of acute uncomplicated cystitis and pyelonephritis in women: a 2010 update by the Infectious Diseases Society of America and the European Society for Microbiology and Infectious Diseases. Clin Infect Dis 2011;52:e103-20.
98. National Institute for Health and Care Excellence. Urinary tract infection (lower): antimicrobial prescribing. 2018 October 31. Available from: https://www.nice.org.uk/guidance/ng109. Accessed 25 Mar 2025.
99. Nicolle LE, Gupta K, Bradley SF, et al. Clinical Practice Guideline for the Management of Asymptomatic Bacteriuria: 2019 update by the Infectious Diseases Society of America. Clin Infect Dis 2019;68:e83-110.
100. UK Health Security Agency. Diagnosis of urinary tract infections: quick reference tools for primary care. Updated 2025 July 7. Available from: https://www.gov.uk/government/publications/urinary-tract-infection-diagnosis/diagnosis-of-urinary-tract-infections-quick-reference-tools-for-primary-care. Accessed 12 Aug 2025.
101. Sartelli M, Guirao X, Hardcastle TC, et al. 2018 WSES/SIS-E consensus conference: recommendations for the management of skin and soft-tissue infections. World J Emerg Surg 2018;13:58.
102. Ramakrishnan K, Salinas RC, Agudelo Higuita NI. Skin and soft tissue infections. Am Fam Physician 2015;92:474-83.
103. National Institute for Health and Care Excellence. Cellulitis and erysipelas: antimicrobial prescribing. 2019 September 27. Available from: https://www.nice.org.uk/guidance/ng141. Accessed 25 Mar 2025.
104. Stevens DL, Bisno AL, Chambers HF, et al. Practice guidelines for the diagnosis and management of skin and soft tissue infections: 2014 update by the Infectious Diseases Society of America. Clin Infect Dis 2014;59:e10-52.
105. National Institute for Health and Care Excellence. Impetigo: antimicrobial prescribing. 2020 February 26. Available from: https://www.nice.org.uk/guidance/ng153. Accessed 25 Mar 2025.
106. Leung YH, Lai RW, Chan AC, et al. Risk factors for community-associated methicillin-resistant *Staphylococcus aureus* infection in Hong Kong. J Infect 2012;64:494-9.
107. Centre for Health Protection, Department of Health, Hong Kong SAR Government. Community-associated methicillin-resistant *Staphylococcus aureus* (CA-MRSA) infection. 2026 February 9. Available from: https://www.chp.gov.hk/en/healthtopics/content/24/5392.html. Accessed 19 Mar 2026.
108. Sartelli M, Coccolini F, Kluger Y, et al. WSES/GAIS/WSIS/SIS-E/AAST global clinical pathways for patients with skin and soft tissue infections. World J Emerg Surg 2022;17:3.
109. Stevens DL, Bisno AL, Chambers HF, et al. Practice guidelines for the diagnosis and management of skin and soft tissue infections: 2014 update by the Infectious Diseases Society of America. Clin Infect Dis 2014;59:147-59.
110. The Royal Children's Hospital Melbourne. Cellulitis and other bacterial skin infections. March 2020. Available from: https://www.rch.org.au/clinicalguide/guideline_index/cellulitis_and_skin_infections/. Accessed 18 Aug 2025.
111. Burkett E, Cranitch E, Bandiera D, Ward T. Improving the quality and choice of care setting for residents of aged care facilities with acute healthcare needs steering committee. Management of acute care needs of RACF residents: a suite of collaborative pathways for general practitioners and registered nurses. Available from: https://www.health.qld.gov.au/clinical-practice/guidelines-procedures/clinical-pathways/residential-aged-care-clinical-pathways/all-pathways/cellulitis. Accessed 18 Aug 2025.
112. World Health Organization. World leaders commit to decisive action on antimicrobial resistance. 2024 September 26. Available from: https://www.who.int/news/item/26-09-2024-world-leaders-commit-to-decisive-action-on-antimicrobial-resistance. Accessed 19 Jan 2026.
113. Ma E, Hsu E, Chow T, Ko LS, Lau KY, Ho B. Change in public knowledge, attitude and practice on antibiotic use after a territory-wide health promotion campaign in Hong Kong. J Infect Dis Ther 2024;12:604.

