



Nonpharmacological interventions for managing infections in chronic respiratory diseases: a comprehensive overview

Chiara Premuda¹, Martina Santambrogio¹, Sofia Misuraca¹, Gianmarco Putti^{1,2}, Filippo Maraz^{1,2}, Andrea Sarassi^{1,2}, Anna Bulfamante³, Francesco Blasi ^{1,2} and Andrea Gramegna ^{1,2}

¹Respiratory Unit and Cystic Fibrosis Adult Center, Fondazione IRCCS Ca' Granda Ospedale Maggiore Policlinico, Milan, Italy. ²Department of Pathophysiology and Transplantation, Università degli Studi di Milano, Milan, Italy. ³Cystic Fibrosis Centre, Fondazione IRCCS Ca' Granda Ospedale Maggiore Policlinico, Milan, Italy.

Corresponding author: Chiara Premuda (chiara.premuda@gmail.com)



Shareable abstract (@ERSpublications)

Nonpharmacological interventions, including respiratory physiotherapy, adequate hydration, nutrition, stress management and infection prevention measures, offer valuable support in the management of respiratory infections <https://bit.ly/3LcKjG4>

Cite this article as: Premuda C, Santambrogio M, Misuraca S, *et al.* Nonpharmacological interventions for managing infections in chronic respiratory diseases: a comprehensive overview. *Breathe* 2026; 22: 250058 [DOI: 10.1183/20734735.0058-2025].

Copyright ©ERS 2026

Breathe articles are open access and distributed under the terms of the Creative Commons Attribution Non-Commercial Licence 4.0. For commercial reproduction rights and permissions contact permissions@ersnet.org

Received: 30 June 2025
Accepted: 22 Oct 2025

Abstract

Respiratory tract infections are common within the general population and present a significant burden on healthcare systems, particularly in people with predisposing conditions such as chronic respiratory diseases. While pharmacological interventions remain a cornerstone of treatment, nonpharmacological strategies play a complementary role in both management and prevention of these conditions. These approaches encompass a broad range of measures, including adequate nutrition and hydration, preventive practices, stress reduction, and respiratory physiotherapy.

This review aims at providing a comprehensive overview of these non-strictly pharmacological strategies of support and prevention to be adopted in the care of patients with respiratory conditions.

Introduction

Respiratory infections can be divided into upper respiratory tract infections (URTIs) and lower respiratory tract infections (LRTIs). These syndromes are listed among the most frequent causes of outpatient visit and hospitalisation in the general population and represent a major burden for public health costs.

URTIs include conditions such as the common cold, sinusitis, pharyngitis and laryngitis. The common cold is usually of viral origin and caused by rhinoviruses, coronaviruses and adenoviruses, as well as the respiratory syncytial virus (RSV). It may present with nasal congestion, rhinorrhoea and sneezing. Rhinoviruses account for the majority of URTI episodes [1]. Acute sinusitis may follow viral URTIs and may be complicated by bacterial superinfection, with *Streptococcus pneumoniae* and *Haemophilus influenzae* being among the most common aetiologies. Bacterial sinusitis is characterised by purulent nasal discharge, and nasal obstruction associated with facial acute pain [1]. Pharyngitis can also be either viral or bacterial; group A streptococci are the most common bacterial causes. This condition may lead to late-onset complications such as rheumatic fever, when untreated [1]. Laryngitis is typically viral and presents with hoarseness, dysphonia and dry cough, but rarely requires antibiotic therapy [1].

LRTIs include more severe conditions such as acute bronchitis, pneumonia and bronchiolitis. Acute bronchitis is most often of viral aetiology and presents with symptoms such as malaise, persistent cough and wheezing. Antibiotic treatment is not indicated [2]. Pneumonia is an infection of the lung parenchyma, which can originate either in community settings or within a hospital environment. Among bacterial causes, the most frequently isolated in the adult population are *Strep. pneumoniae*, *Legionella pneumophila* and *Mycoplasma pneumoniae*. Viral pneumonia is reported to be more prevalent in children and older adults, with influenza viruses, RSV and coronaviruses accounting for the most important



pathogens, with variable incidence depending on the age group [3, 4]. Clinical features of pneumonia include fever, cough with sputum production, pleuritic chest pain and progressive dyspnoea. Bronchiolitis, primarily affecting infants aged <2 years is most often caused by RSV and presents with cough, tachypnoea, wheezing and acute respiratory failure [5].

Chronic respiratory infections may occur in individuals with underlying structural lung diseases such as COPD, bronchiectasis and cystic fibrosis. In COPD, chronic respiratory infection by *H. influenzae*, *Moraxella catarrhalis* and *Pseudomonas aeruginosa* proved to increase the risk of acute pulmonary exacerbations and faster lung function decline [6]. In people with bronchiectasis, chronic *P. aeruginosa* infection is associated with increased morbidity, mortality, exacerbations and worse quality of life [7]. In cystic fibrosis, chronic bronchial infection by *Staphylococcus aureus*, *P. aeruginosa* or other nonfermenting Gram-negative bacteria promotes a state of sustained inflammation, which is a major determinant leading to the worsening of multiple clinical outcomes including nutritional status, lung function and prognosis [8].

In these populations, the risk of infection by nontuberculous mycobacteria or fungi should also be kept in mind and managed with a holistic approach that includes nutritional and psychological support, among others [9, 10]. Such approach is particularly relevant given the high pharmacological burden often associated with these conditions, and it is in line with the management of complex diseases such as tuberculosis, where nonpharmacological strategies can also contribute to better outcomes.

Symptoms of respiratory tract infections vary depending on the location and severity of the infection. Symptoms of URTIs are often self-limiting and resolve within a few weeks [1]. LRTIs like pneumonia or pulmonary exacerbation of a chronic underlying respiratory condition cause more impactful symptoms including productive cough, pleuritic chest pain, dyspnoea and respiratory distress, often requiring medical attention and treatment. Timely recognition and classification of respiratory tract infections is essential for effective management.

The importance of nonpharmacological treatment

Nonpharmacological interventions are a vital component of the management of both acute and chronic respiratory tract infections. They are important in controlling symptoms, supporting immune function and preventing dissemination of infection. Maintaining sufficient hydration, optimal nutrition and effective stress management boosts the recovery capabilities of the patient's organism and can limit the unnecessary use of antibiotics, especially in the case of viral infections. These approaches are generally low-risk, well-tolerated, and can be sufficient for appropriate symptom management and help full recovery from mild infection-related syndromes. In addition, nonpharmacological interventions can offer support to special patient populations, such as children, the elderly, pregnant women and immunocompromised individuals. These people have an increased risk of developing respiratory infections and related complications [11, 12], but their medical treatment can be particularly challenging due to age-specific dose adjustments potential drug-drug interactions or contraindications related to pregnancy. Whenever possible, non pharmacological strategies should be used in synergy with medical treatments to reduce medication load and provide support, yet avoiding treatment delays when necessary. Special caution should be used when dealing with paediatric patients who experience frequent or unusually severe respiratory tract infections; it may be worth testing for underlying conditions such as primary immunodeficiencies, cystic fibrosis or primary ciliary dyskinesia.

Furthermore, inappropriate self-management (particularly the unsupervised use of antibiotics) raises substantial public health concerns. Timely clinical evaluation remains paramount when symptoms are severe or escalating, to ensure effective and safe patient care.

The intention of this article is therefore to provide healthcare professionals with an easily accessible comprehensive overview of interventions other than pharmacological that are worth considering when implementing the treatment plan of a patient with a chronic respiratory disease at increased risk of infection. Special attention is given to lifestyle, psychosocial and physiotherapy interventions.

The narrative review was conducted searching for literature addressing the care of patients with respiratory infections with a holistic approach. Particular attention was given to clinical guidelines, systematic reviews and original research published in the past 10 years. Relevant sources were identified through searches in biomedical databases (PubMed, Embase).

Nonpharmacological interventions

Cessation of unhealthy lifestyle habits

Lifestyle habits can significantly influence the pathophysiological mechanisms of respiratory conditions, either directly or indirectly. Common detrimental behaviours include cigarette smoking, excessive alcohol consumption, physical inactivity, inadequate nutrition or hydration, and poor hygiene practices.

Tobacco use is one of the most critical global public health challenges; it contributes to respiratory tract infection by impairing structural and immune defences, thus increasing susceptibility to pathogens [13]. Smoking cessation is recommended to reduce such risks [13]. Similarly, alcohol use disorder compromises mucociliary clearance, cough reflexes and immune cell function, therefore increasing the vulnerability to infections, including bacterial pneumonia and tuberculosis, with a negative impact on their outcomes [14].

Hydration

Adequate hydration has an important role in maintaining mucosal health and adequate respiratory function. Water intake helps in increasing the fluidity of respiratory secretions, making mucus clearance easier and reducing the risk of LRTIs. Plain water, broth, milk, fruits and vegetables are preferred sources, while caffeine, alcohol, sport and soft drinks should be limited, as they may worsen dehydration [15, 16].

In the setting of acute infections, hydration becomes critical to compensate for increased water losses due to fever or tachypnoea, and to support mucociliary function. Patients with chronic respiratory diseases like COPD and cystic fibrosis often suffer from thick and viscous mucus, which is difficult to expectorate. Maintaining a good hydration status helps to thin the mucus, facilitates clearance and reduces airway obstruction, thus decreasing infection risk. Education on appropriate fluid choices and regular intake is a cornerstone of supportive care in these patients [15].

Nutrition

Proper nutrition is crucial for maintaining immune function, promoting wound healing and preserving muscle mass. Malnutrition is associated with worse outcomes in respiratory diseases, but undernutrition and obesity also negatively impact respiratory health. Undernutrition weakens host defences, and overnutrition increases shortness of breath and inflammation [15, 16]. Western-style diets, typically rich in saturated fats and processed foods, and poor in antioxidants and fibre, are associated with increased systemic inflammation and impaired immune regulation [16]. Conversely, higher intake of proteins, fruits, fibres, vitamins and essential micronutrients has been linked to enhanced immune function, potentially reducing the frequency and severity of respiratory exacerbations and improving long-term pulmonary outcomes [15, 16]. Although more interventional studies are needed, as the evidence supporting the effectiveness of certain supplements remains weak, nutritional strategies are increasingly recognised as adjunctive tools in both prevention and management of chronic lung diseases [15–18].

During acute phases of the illness, oral intake may be limited by fatigue, dyspnoea or anorexia. When patients cannot meet energy requirements orally, oral nutritional supplements should be introduced first. In critically ill ventilated patients, early enteral nutrition *via* nasogastric tube is recommended [18].

In specific populations, such as people with cystic fibrosis, nutrition is worthy of special attention, as its optimisation is pivotal in improving patient outcomes and survival. People with cystic fibrosis need specialised and personalised nutritional plans, as on top of the chronic inflammatory status they may develop pancreatic insufficiency and cystic fibrosis-related diabetes. Their diet should be balanced on high-energy and high-protein requirements. The supplementation of liposoluble vitamins (ADEK) is also critical, due to malabsorption and increased metabolic needs, but vitamin plasma levels should be monitored regularly to avoid adverse effects [15]. In COPD, low bodyweight and reduced fat-free mass are associated with worse prognosis. The diet should be individualised on the basis of energy requirements and nutritional status, with practical recommendations including distributing intake into small frequent meals to reduce post-prandial dyspnoea and to leave more room for diaphragmatic excursion [16].

Symptoms such as nausea, fatigue and dyspnoea, as well as psychological and cognitive factors, may impair intake. Addressing these barriers through multidisciplinary support can improve overall nutritional status.

Humidification

Using a humidifier or vapouriser to relieve congestion

Seasonal viral infections frequently affect the upper respiratory tract, commonly resulting in nasal congestion [19]. Historically, room humidifiers and vapourisers have been a popular strategy to ease this

discomfort. The theory supporting their use is that by adding vapour to the air, it is possible to moisturise dry nasal passages and hydrate thick, sticky mucus secretions, making them easier to drain. While many patients report anecdotal benefits from using room humidifiers, scientific evidence from controlled clinical trials supporting this nonpharmacological treatment is still lacking. Nevertheless, the principle of humidifying dry air to reduce nasal irritation and aid mucus clearance remains a common and generally safe home remedy for nasal congestion.

Steam inhalation: benefits and precautions

Historically, steam inhalation was considered a traditional nonpharmacological treatment for common cold and nasal congestion, with the aim of draining nasal secretions and destroying the cold virus, which is known to be heat-sensitive. A systematic review found heterogeneous evidence regarding the effectiveness of inhaled steam; some studies showed a positive effect on nasal symptoms, while others reported no benefit [19]. This discrepancy can be primarily attributed to differences in the type and duration of intervention.

Impaired mucociliary clearance (MCC) is a defining feature of muco-obstructive lung diseases, such as cystic fibrosis, bronchiectasis and COPD; in these conditions, airway secretions become abnormally thick and viscous, in addition to altered ciliary beating [20]. These dysfunctions increase mucus retention and peripheral airway obstruction, leading to frequent pulmonary exacerbations, recurrent respiratory tract infections, and ultimately structural airway damage [20]. There is growing evidence that long-term humidification therapy can reduce mucus viscosity and enhance sputum expectoration. HASANI *et al.* [21] found that therapy with high-flow heated saturated air for ≥ 3 h per day significantly increased MCC, as measured by the retention of a radiolabelled tracer in patients with bronchiectasis [21]. A recent randomised controlled trial demonstrated the effectiveness of long-term heated humidified high-flow nasal therapy in reducing the frequency of pulmonary exacerbations and alleviating mucus-related symptoms in COPD patients [22]. These promising results are further supported by similar findings from smaller studies conducted in bronchiectasis population [23].

Respiratory physiotherapy

Respiratory physiotherapy is a cornerstone in the management of multiple respiratory diseases; its importance is widely recognised; and its application is strongly recommended by international guidelines [24–27]. Respiratory physiotherapy encompasses diverse interventions, including airway clearance techniques (ACTs) and exercise training, all aimed at alleviating symptoms, improving health-related quality of life, reducing exacerbation frequencies and slowing disease progression [24–27].

Nasal saline irrigation: clearing nasal passages and sinuses

Nasal irrigation represents a long-established treatment for sinonasal diseases and is widely recommended for cystic fibrosis patients [27]. Guidelines for COPD management do not specifically address sinonasal treatment; however, nasal irrigation can be a complementary approach to apply in this patient population [26]. In addition, nasal irrigation with either isotonic or hypertonic saline solution has demonstrated effectiveness in reducing nasal obstruction and nasal secretions, ultimately shortening the time to resolution of the URTI-related symptoms, with only minor adverse events [1]. Large-volume nasal irrigation seems to be more effective in penetrating the sinonasal cavity as compared to jet nebulisers and nasal sprays [28]. At present, conclusive data on the potential prophylactic efficacy of nasal irrigation against respiratory tract infections remain unavailable.

Airway clearance: different approaches

ACTs are key components of respiratory physiotherapy programmes, specifically designed to mobilise and remove secretion from the airways. There is evidence to demonstrate a role of ACTs in enhancing sputum expectoration, thus improving sputum-related symptoms, such as cough, and preventing respiratory tract infections and pulmonary exacerbations across diverse patient populations, including people with cystic fibrosis [29] and bronchiectasis [30]. However, the optimal frequency and regimen of ACTs remain undetermined. A variety of strategies for secretion clearance exist, including noninstrumental approaches, positive airway pressure strategies with or without oscillation, and techniques including the use of specific devices. However, no single ACT has yet demonstrated superiority in short- or long-term efficacy [29, 30]. Indeed, most recommendations on airway clearance suggest personalising ACT based on the clinical characteristics and preferences of each patient [30, 31].

Mucoactive agents, such as hypertonic saline, appear to be effective adjuncts to ACTs. Hypertonic saline works by rehydrating thick mucus, thereby enhancing sputum expectoration. There is robust evidence supporting the use of hypertonic saline in the cystic fibrosis population, where it has been shown

to improve symptom control and reduce the frequency of pulmonary exacerbations [32]. While its use is well-established in cystic fibrosis, more research is needed for a better understanding of its benefits in patients with COPD and bronchiectasis.

Few studies have investigated the effectiveness of ACTs during acute pulmonary exacerbations in bronchiectasis; clear evidence is lacking, primarily because of a scarcity of clinical trials, the wide variety of ACTs investigated, and the tendency to focus mainly on short-term outcomes (single sessions or interventions lasting <15 days). More robust research is needed to determine the optimal role of ACTs during these critical periods [33].

The benefits of regular physical activity

Physical activity is a cornerstone of overall health and proved to reduce the severity and duration of acute respiratory infections and to lower the rate of hospitalisation in people with COPD [34, 35]. Personalised exercise programmes and a gradual return to activity after illness are crucial to ensure effectiveness and long-term adherence [35].

Stress management and psychological support

Respiratory diseases, especially if chronic, are associated with poorer quality of life and psychological wellbeing [36]. Infectious exacerbations are pivotal events in the history of chronic respiratory diseases with relevant impact on such end-points, possibly leading to depression, anxiety and feelings of isolation or guilt [37].

The relationship between mind and respiratory health is mutual and depends on multiple factors, that go beyond the purpose of this review. Given this bidirectional influence of psychological distress and respiratory diseases, patients' psychological health could be considered as a proper treatable trait of respiratory diseases [38]. Therefore, psychological support, including cognitive behavioural therapy, motivational interviews, mindfulness-based meditation and systemic therapy, is certainly one of the mainstays of the care of people with acute or chronic respiratory diseases [39].

Preventive measures

Hand hygiene

Frequent and proper handwashing plays a crucial role in preventing respiratory tract infections [40]. Many respiratory illnesses are caused by viruses and bacteria that spread through droplets when an infected person coughs, sneezes or talks [41]. These droplets may contaminate surfaces or be transmitted to the hands, and when an individual subsequently touches their mouth, nose or eyes, the pathogen can enter the body and lead to infection [41]. Handwashing interrupts this cycle of transmission by removing dirt, viruses and bacteria from the skin, thus significantly reducing the risk of infection [40]. Proper washing technique is just as important as frequency.

In situations where soap and water are not available, using an alcohol-based hand sanitiser is an effective alternative [40]. Encouraging regular and correct hand hygiene is one of the simplest yet most effective ways to limit the spread of respiratory tract infections, protect vulnerable populations and reduce the burden on healthcare systems [40].

Respiratory etiquette

Covering the mouth and nose when coughing or sneezing is a fundamental preventive measure to reduce the spread of respiratory tract infections. This practice, often referred to as "respiratory etiquette", is especially important in public spaces, healthcare settings, schools and during outbreaks or flu seasons [42]. To minimise the risk of transmitting pathogens with respiratory droplets, it is recommended to use a tissue or the inside of the elbow to cover the mouth and nose during a cough or sneeze [42]. Promoting this behaviour as part of standard hygiene practices significantly contributes to reducing the transmission of respiratory tract infections in the community [42].

Physical distancing

Reducing contact with infected individuals is another fundamental and highly effective strategy for limiting the spread of respiratory tract infections [43]. This approach is grounded in the principle of interrupting the transmission chain by minimising exposure to infectious agents, especially during the period when an individual is most contagious [43]. As previously outlined, respiratory tract infections are primarily transmitted through respiratory droplets released when an infected person coughs, sneezes, talks or even breathes [41]. Close contact with such individuals significantly increases the risk of inhaling these droplets or acquiring the pathogens through contaminated hands or surfaces.

Maintaining physical distance from individuals who are visibly ill or may be contagious even if asymptomatic helps reducing the likelihood of direct exposure to infectious droplets [43]. However, it must be noted that social isolation may have drawbacks, as the presence and involvement of a caregiver can significantly influence health outcomes, particularly in vulnerable populations such as children and the elderly [44].

Air quality and ventilation

The importance of indoor air quality and ventilation can be listed among the lessons learned from the coronavirus disease 2019 pandemic, but it is applicable to many respiratory diseases, particularly infections. As published recently by MORAWSKA *et al.* [45], effective ventilation dilutes and removes contaminants, thereby lowering the risk of both acute and chronic respiratory diseases. Therefore, proper ventilation strategies should be included in policies and building design to minimise health risk, as modern buildings tend to prefer artificial ventilation over natural ventilation [46].

Conclusions

In conclusion, nonpharmacological interventions, including respiratory physiotherapy, adequate hydration, nutrition, psychological support and infection prevention measures, offer valuable support in the management of respiratory infections. While these interventions are generally low-risk and well-tolerated, their effectiveness depends on appropriate use within the clinical context and should be tailored to the patient characteristics. When combined thoughtfully, these strategies can ease symptoms, support recovery and help limit the misuse of antibiotics (particularly in viral infections) contributing to more sustainable and patient-centred care.

However, while awareness of the benefits of a holistic approach to the treatment of respiratory infections is increasing, good-quality evidence on the topic remains scarce, and further research is needed to produce evidence-based recommendations.

Key points

- Nonpharmacological strategies are a key component in the management of respiratory infections, although further evidence is needed.
- Improving lifestyle habits, including hydration, nutrition and stress management, can help boost the immune system.
- Respiratory physiotherapy plays a crucial role in the management of respiratory infections, particularly in patients with chronic respiratory diseases.
- Preventive measures, such as handwashing, using masks, and proper room ventilation, can help reduce the spread and the burden of infections.

Self-evaluation questions

1. Define how lifestyle habits, including smoking, alcohol consumption, nutrition and hydration, can impact respiratory infections.
2. Define the role of respiratory physiotherapy in the treatment of respiratory infections.
3. Explain how social and psychological support can be involved in the management of respiratory infections.
4. Explore preventive measures, their role and their effectiveness.

Acknowledgements: The authors used ChatGPT (GPT-5.2 model) and Gemini (2.5 Flash) to rephrase some sentences in order to avoid unnecessary repetition.

Conflict of interest: A. Gramegna declares payment or honoraria for lectures, presentations, speakers' bureaus, manuscript writing or educational events from Chiesi and participation on advisory board for Vertex. F. Blasi declares grants from AstraZeneca, Chiesi and Insmed, consulting fees from Menarini, payment or honoraria for lectures, presentations, speakers' bureaus, manuscript writing or educational events from AstraZeneca, Chiesi, GSK, Guidotti, Grifols, Insmed, Menarini, Novartis, OM Pharma, Pfizer, Sanofi, Viatris, Vertex and Zambon. M. Santambrogio declares consulting fees from Fisher & Paykel, payment or honoraria for lectures, presentations, speakers' bureaus, manuscript writing or educational events from Vertex, support from attending meetings and/or travel from Fisher & Paykel. A. Bulfamante declares consultancy fees from Vertex and Dmf Foodar. The remaining authors report no conflicts of interest related to this publication.

References

- 1 Grief SN. Upper respiratory infections. *Prim Care* 2013; 40: 757–770.
- 2 Albert RH. Diagnosis and treatment of acute bronchitis. *Am Fam Physician* 2010; 82: 1345–1350.
- 3 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–e67.
- 4 Shi T, Arnott A, Semogas I, et al. The etiological role of common respiratory viruses in acute respiratory infections in older adults: a systematic review and meta-analysis. *J Infect Dis* 2020; 222: Suppl. 7, S563–S569.
- 5 Ralston SL, Lieberthal AS, Meissner HC, et al. Clinical practice guideline: the diagnosis, management, and prevention of bronchiolitis. *Pediatrics* 2014; 134: e1474–e1502.
- 6 Sethi S, Murphy TF. Infection in the pathogenesis and course of chronic obstructive pulmonary disease. *N Engl J Med* 2008; 359: 2355–2365.
- 7 Chalmers JD, Smith MP, McHugh BJ, et al. Short- and long-term antibiotic treatment reduces airway and systemic inflammation in non-cystic fibrosis bronchiectasis. *Am J Respir Crit Care Med* 2012; 186: 657–665.
- 8 Zolin A, Adamoli A, Bakkenheim E. ECFSPR Annual Report 2023. 2025. www.ecfs.eu/projects/ecfs-patient-registry/annual-reports
- 9 Loebinger MR, Quint JK, van der Laan R, et al. Risk factors for nontuberculous mycobacterial pulmonary disease: a systematic literature review and meta-analysis. *Chest* 2023; 164: 1115–1124.
- 10 Tiew PY, Mac Aogáin M, Ter SK, et al. Respiratory mycoses in COPD and bronchiectasis. *Mycopathologia* 2021; 186: 623–638.
- 11 Watson A, Wilkinson TMA. Respiratory viral infections in the elderly. *Ther Adv Respir Dis* 2021; 15: 1753466621995050.
- 12 Rumpfelt KE, Englund JA, Kachikis A. The burden, pathogenesis, clinical outcomes, and treatment of common respiratory virus infections during pregnancy. *Womens Health* 2025; 21: 17455057251338501.
- 13 Jiang C, Chen Q, Xie M. Smoking increases the risk of infectious diseases: a narrative review. *Tob Induc Dis* 2020; 18: 60.
- 14 Zhang P, Bagby GJ, Happel KI, et al. Alcohol abuse, immunosuppression, and pulmonary infection. *Curr Drug Abuse Rev* 2008; 1: 56–67.
- 15 Wilschanski M, Munck A, Carrion E, et al. ESPEN-ESPGHAN-ECFS guideline on nutrition care for cystic fibrosis. *Clin Nutr* 2024; 43: 413–445.
- 16 Beijers RJHCG, Steiner MC, Schols AMWJ. The role of diet and nutrition in the management of COPD. *Eur Respir Rev* 2023; 32: 230003.
- 17 Kumar P, Kumar M, Bedi O, et al. Role of vitamins and minerals as immunity boosters in COVID-19. *Inflammopharmacology* 2021; 29: 1001–1016.
- 18 Taylor BE, McClave SA, Martindale RG, et al. Guidelines for the provision and assessment of nutrition support therapy in the adult critically ill patient: Society of Critical Care Medicine (SCCM) and American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.). *Crit Care Med* 2016; 44: 390–438.
- 19 Singh M, Singh M, Jaiswal N, et al. Heated, humidified air for the common cold. *Cochrane Database Syst Rev* 2017; 8: CD001728.
- 20 Hill DB, Button B, Rubinstein M, et al. Physiology and pathophysiology of human airway mucus. *Physiol Rev* 2022; 102: 1757–1836.
- 21 Hasani A, Chapman TH, McCool D, et al. Domiciliary humidification improves lung mucociliary clearance in patients with bronchiectasis. *Chron Respir Dis* 2008; 5: 81–86.
- 22 Rea H, McAuley S, Jayaram L, et al. The clinical utility of long-term humidification therapy in chronic airway disease. *Respir Med* 2010; 104: 525–533.
- 23 Calabrese C, Nolasco S, Annunziata A, et al. Long-term high-flow nasal therapy in patients with bronchiectasis of different severity: a retrospective cohort study. *J Clin Med* 2024; 13: 6146.
- 24 Polverino E, Goeminne PC, McDonnell MJ, et al. European Respiratory Society guidelines for the management of adult bronchiectasis. *Eur Respir J* 2017; 50: 1700629.
- 25 Southern KW, Castellani C, Lammertyn E, et al. Standards of care for CFTR variant-specific therapy (including modulators) for people with cystic fibrosis. *J Cyst Fibros* 2023; 22: 17–30.
- 26 Venkatesan P. GOLD COPD report: 2025 update. *Lancet Respir Med* 2025; 13: e7–e8.
- 27 Castellani C, Duff AJA, Bell SC, et al. ECFS best practice guidelines: the 2018 revision. *J Cyst Fibros* 2018; 17: 153–178.
- 28 Wormald PJ, Cain T, Oates L, et al. A comparative study of three methods of nasal irrigation. *Laryngoscope* 2004; 114: 2224–2227.
- 29 Warnock L, Gates A. Airway clearance techniques compared to no airway clearance techniques for cystic fibrosis. *Cochrane Database Syst Rev* 2023; 4: CD001401.
- 30 Herrero-Cortina B, Lee AL, Oliveira A, et al. European Respiratory Society statement on airway clearance techniques in adults with bronchiectasis. *Eur Respir J* 2023; 62: 2202053.

- 31 Mcllwaine M, Bradley J, Elborn JS, *et al.* Personalising airway clearance in chronic lung disease. *Eur Respir Rev* 2017; 26: 160086.
- 32 Wark P, McDonald VM, Smith S. Nebulised hypertonic saline for cystic fibrosis. *Cochrane Database Syst Rev* 2023; 6: CD001506.
- 33 Phillips J, Lee A, Pope R, *et al.* Effect of airway clearance techniques in patients experiencing an acute exacerbation of bronchiectasis: a systematic review. *Physiother Theory Pract* 2020; 36: 1300–1315.
- 34 Grande AJ, Keogh J, Silva V, *et al.* Exercise versus no exercise for the occurrence, severity, and duration of acute respiratory infections. *Cochrane Database Syst Rev* 2020; 4: CD010596.
- 35 Spruit MA, Singh SJ, Garvey C, *et al.* An official American Thoracic Society/European Respiratory Society statement: key concepts and advances in pulmonary rehabilitation. *Am J Respir Crit Care Med* 2013; 188: e13–e64.
- 36 Chang MS, Kim HJ, Lee JH. The prevalence and implications of depression and anxiety in patients with bronchiectasis: a systematic review and meta-analysis. *ERJ Open Res* 2024; 10: 00248-2024.
- 37 Alkhathlan BS, Barradell AC, Greening NJ, *et al.* Real-time experience of an acute exacerbation of COPD: a qualitative exploration. *Chron Respir Dis* 2025; 22: 14799731251340407.
- 38 Volpato E, Banfi P, Verkleij M. Editorial: the psychological challenges of respiratory disease. *Front Psychol* 2023; 14: 1213963.
- 39 Lunn S, Restrick L, Stern M. Managing respiratory disease. *Chron Respir Dis* 2017; 14: 45–53.
- 40 Mo Y, Pham TM, Lim C, *et al.* The effect of hand hygiene frequency on reducing acute respiratory infections in the community: a meta-analysis. *Epidemiol Infect* 2022; 150: e79.
- 41 Dhand R, Li J. Coughs and sneezes: their role in transmission of respiratory viral infections, including SARS-CoV-2. *Am J Respir Crit Care Med* 2020; 202: 651–659.
- 42 Zayas G, Chiang MC, Wong E, *et al.* Effectiveness of cough etiquette maneuvers in disrupting the chain of transmission of infectious respiratory diseases. *BMC Public Health* 2013; 13: 811.
- 43 Jefferson T, Del Mar CB, Dooley L, *et al.* Physical interventions to interrupt or reduce the spread of respiratory viruses. *Cochrane Database Syst Rev* 2020; 2020: CD006207.
- 44 Matarese M, Pendoni R, Piredda M, *et al.* Caregivers' experiences of contributing to patients' self-care in chronic obstructive pulmonary disease: a thematic synthesis of qualitative studies. *J Adv Nurs* 2021; 77: 4017–4034.
- 45 Morawska L, Li Y, Salthammer T. Lessons from the COVID-19 pandemic for ventilation and indoor air quality. *Science* 2024; 385: 396–401.
- 46 Buonomano A, Forzano C, Giuzio GF, *et al.* New ventilation design criteria for energy sustainability and indoor air quality in a post Covid-19 scenario. *Renew Sustain Energy Rev* 2023; 182: 113378.

Suggested answers

1. Unhealthy lifestyle habits alter structural and immune defense mechanisms, increasing the vulnerability to pathogens.
2. Respiratory physiotherapy has a pivotal role, as it can alleviate symptoms, improve quality of life, decrease exacerbation frequency and slow down disease progression.
3. Respiratory infections, especially in the context of chronic respiratory diseases, are associated with relevant psychosocial burden, which can impact the course of the disease and should therefore be considered as treatable traits.
4. Preventive measures such as handwashing, respiratory etiquette and room ventilation are effective contributors to infection risk reduction.