



FOCUS ON
HEALTH

Physiotherapy, Podiatry and Biokinetics

Self-study CPD activity

Activity Reference Number

D2(25) 2028

Topic

Bronchiectasis

Article(s)

Physiotherapy management of bronchiectasis in adults

Profession(s)

Physiotherapist

Podiatrist

Biokineticist

Supplementary Physiotherapist

Supplementary Podiatrist

Supplementary Biokineticist

Physiotherapy Assistant

Physiotherapy

You can complete any one, or all the parts of this activity

Part 1 is approved for **THREE (3) Clinical** Continuing Education Units (CEU's)

Part 2 is approved for **TWO (2) Clinical** Continuing Education Units (CEU's)

Invited Topical Review

Physiotherapy management of bronchiectasis in adults

Annemarie L Lee ^{a,b}^a Department of Physiotherapy, Monash University, Melbourne, Australia; ^b Institute for Breathing and Sleep, Melbourne, Australia

KEY WORDS

Bronchiectasis
Physical therapy
Pulmonary rehabilitation
Education

[Lee AL (2023) Physiotherapy management of bronchiectasis in adults. *Journal of Physiotherapy* 69:7–14]
© 2022 Australian Physiotherapy Association. Published by Elsevier B.V. This is an open access article under the
CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).



Introduction

Bronchiectasis is characterised by chronic cough with sputum production, dyspnoea and reduced exercise tolerance, all of which contribute to poorer health-related quality of life (HRQOL). Physiotherapy forms an integral part of management, with the goal of addressing symptoms to improve health status and minimise the rate of decline in respiratory function. This review summarises the aetiologies and clinical presentation of bronchiectasis; the corresponding burden on individuals and the healthcare system; key components of bronchiectasis care, focusing on physiotherapy interventions; and future directions for research and practice.

What is bronchiectasis

Bronchiectasis, a chronic respiratory condition, is a clinical syndrome characterised by radiologically abnormal and permanent dilatation of the bronchi, persistent cough, airway inflammation and infection.¹ Diagnosis is confirmed via radiological features evident on high-resolution computed tomography chest scans, which are undertaken when an individual is clinically stable.² Bronchiectasis is caused by a heterogeneous range of clinical disorders; common aetiologies are post-infection (bacterial, viral and mycobacterial), genetic disorders (primary ciliary dyskinesia), humoral immunodeficiencies, autoimmune diseases, inflammatory conditions or idiopathic. The pathophysiology of bronchiectasis is still best understood by the vicious cycle that was first proposed by Cole:³ airway inflammation, primarily dominated by neutrophils, contributes to impaired mucociliary clearance; this impairment leads to mucus hypersecretion and airway obstruction, with an increase in microbial colonisation, which contributes to infection and structural lung damage. Colonisation can arise from a mix of organisms, among which *Pseudomonas aeruginosa*, *Haemophilus influenzae* and *Streptococcus pneumoniae* are the most frequently isolated pathogens.

While the worldwide prevalence of bronchiectasis is not precisely known, international data currently estimate rates between 53 and 566 cases per 100,000 inhabitants, depending on the population

studied.⁴ There has been a consistent increase in recent years across a range of countries and in those of an older age.^{5,6} Given the increasing age of adults with bronchiectasis and that another condition is considered to be the underlying cause in approximately 30% of people, it is unsurprising that individuals with this syndrome have an average of four comorbidities.⁷ Common comorbidities include coexisting respiratory diseases or conditions that arise from the systemic inflammation inherent in bronchiectasis such as vascular diseases, metastatic malignancy, gastro-oesophageal reflux disease, and musculoskeletal dysfunction with osteoporosis and peripheral muscle weakness.

The extent and clinical course of bronchiectasis is variable; some individuals with mild symptoms at diagnosis or localised disease may report a stable trajectory, while those with severe symptoms at the outset may present with diffuse disease and experience a rapid progressive decline. Within the natural history of bronchiectasis, acute exacerbations, defined as worsening of usual respiratory symptoms and requiring a change in treatment,⁸ are significant events that influence an individual's clinical presentation, condition trajectory and overall prognosis.

Burden of bronchiectasis

Chronic cough is the most frequently experienced symptom, affecting up to 96% of adults with bronchiectasis. Sputum expectoration, shortness of breath, haemoptysis, chest pain and, to a lesser extent, fatigue have also been reported.⁹ Other clinical characteristics include extrapulmonary manifestations of peripheral muscle weakness, presenting as reduced functional exercise capacity and physical activity,¹⁰ and anxiety and depression.¹¹ The severity of symptoms is often synonymous with the severity of disease and co-existing conditions. Collectively, respiratory and systemic features, including those derived from comorbid conditions, contribute to a heightened treatment burden, poorer physical/social functioning, poorer role performance and reduced perceptions of health.¹² From the patient perspective, HRQOL is further impaired by social embarrassment and stigma due to chronic cough and sputum expectoration, limitations

on daily activities and psychological symptoms.¹³ Although not well understood, intangible costs related to work productivity impairment due to absenteeism and presenteeism of those with bronchiectasis and the subsequent burden on caregivers and family as a result of these indirect effects have been observed.¹⁴

Acute exacerbations are responsible for disease progression and deterioration in lung function. The number of exacerbations per year independently predicts future mortality, with the risk of mortality doubled in frequent exacerbators.¹⁵ Those of the frequent exacerbator phenotype have a greater likelihood of hospitalisation and poorer HRQOL.¹⁶ Although a causal relationship has not been demonstrated, the co-existence of chronic obstructive pulmonary disease (COPD) or asthma in 20 to 60% of individuals with bronchiectasis is linked to a higher 5-year mortality rate (55% compared with 20% among those without COPD or asthma).¹⁷

Within the primary and secondary healthcare settings, direct costs to the health system are significant. A systematic review found that those with bronchiectasis have a longer length of hospital stay (4.5 versus 2.5 days), a greater number of admissions (0.6 versus 0.4 per year), more outpatient consultations (20 versus 14), more emergency room visits and more days of medication use compared with those without bronchiectasis.¹⁴ Costs in the primary and secondary care settings in Spain have been reported at €4,672, which increased to €9,999 in those with a high mortality risk, while annual costs ranged from US\$13,244 to US\$67,764 in the USA.¹⁴ This is largely driven by higher annual hospitalisation rates and medication (respiratory and those prescribed to manage comorbidities). Those colonised with *Pseudomonas aeruginosa* have a 6.5-fold increase in hospital admissions.¹⁸ Costs have not been quantified for the time required for treatment (including physiotherapy), diagnostic tests, monitoring, nutritional interventions, and requirements for social care, including adaptations to the home for those with severe disease, but such costs are likely to be considerable.

Management of bronchiectasis

The main goals of treatment for bronchiectasis are to control and alleviate symptoms, reduce the incidence of acute exacerbations and prevent disease progression. Following the game-changing studies of macrolides with reduced frequency of acute exacerbations, robust evidence supports their use.^{19,20} Other medical approaches comprise anti-inflammatory agents, inhaled antibiotics and bronchodilators, corticosteroid and immune-modulating therapies.^{2,19,20} Physiotherapy is equally important in bronchiectasis management; a summary of interventions together with the level of evidence that underpins their use is provided in [Figure 1](#).

Airway clearance techniques

Airway clearance techniques are recommended as part of management of people with bronchiectasis, with techniques customised and modified as required, particularly during an acute exacerbation.¹⁹ Broad categories of techniques include positional options (gravity-assisted drainage), those which modulate expiratory flow (active cycle of breathing technique, autogenic drainage and forced expiratory technique) and positive pressure devices (both oscillatory and non-oscillatory devices). Techniques are applied across the disease spectrum, with therapists modifying approaches to accommodate comorbidities as necessary.²¹ The physiological rationale is that these techniques augment sputum clearance via a number of mechanisms: improvement in collateral ventilation and independence; increase in expiratory airflow velocity; reduction in airway resistance; use of gravity; changes in airway pressure; and generation of airway oscillations. A recent review of Australian practice found that up to 58% of adults with bronchiectasis regularly used airway clearance techniques,²² and the proportion of clinicians prescribing techniques increased to 89% during an acute exacerbation.²¹

When compared with no treatment, a Cochrane review showed that airway clearance techniques were associated with short-term improvement in sputum expectoration (MD 8.4 ml, 95% CI 3.4 to 13.4) and health status (MD -14.8 points, 95% CI -18.0 to -11.6), but had no clear effect on acute exacerbation rate (RR 0.71, 95% CI 0.23 to 2.25).²³ Acknowledging the different mechanisms of action between techniques, a more recent Cochrane review showed that positive expiratory pressure (PEP) therapy had similar effects on HRQOL, symptoms, sputum expectoration and lung volumes compared with other techniques for clinically stable patients.²⁴ In those with an acute exacerbation of bronchiectasis, six studies of 120 patients highlighted the safety of a range of airway clearance techniques, with suggestions that the active cycle of breathing technique may offer more clinical benefit compared with gravity-assisted drainage and manual techniques.²⁵ The results of these reviews were heavily influenced by studies of a short (single sessions to maximum of 1 week) or medium duration (4 weeks to 3 months) for selected outcomes, and a mix of techniques and outcomes, which limited the pooling of data, irrespective of clinical state.

Since these reviews, additional short-term, randomised controlled trials comparing techniques have emerged.^{26–28} The effects of therapist-made Bottle PEP therapy found that a single treatment session led to equivalent sputum weight during treatment compared with the active cycle of breathing technique.²⁷ These findings are encouraging, given that this is a simple and inexpensive method of applying oscillating PEP therapy. The longer-term effect of techniques modulating expiratory flow is outlined by the pooled analysis

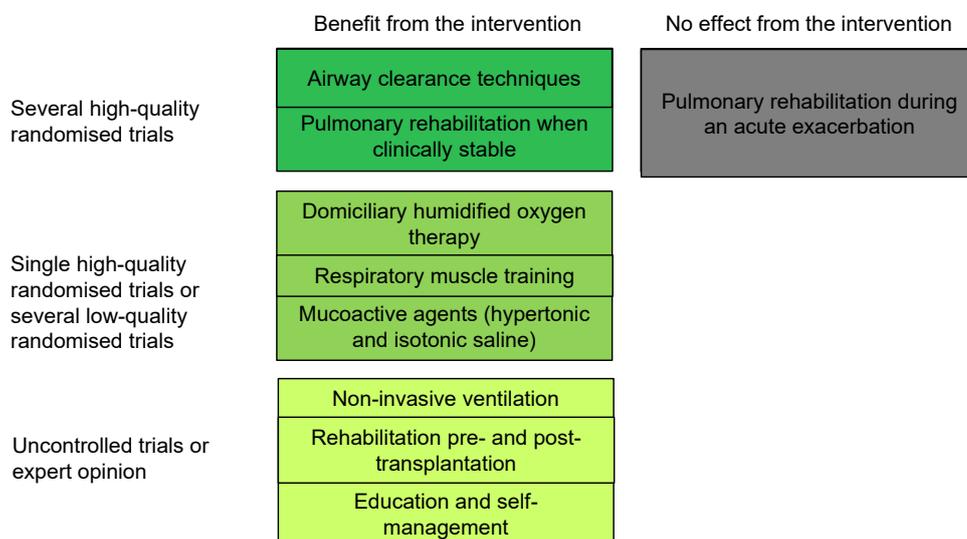


Figure 1. Interventions for the management of bronchiectasis with associated levels of evidence.

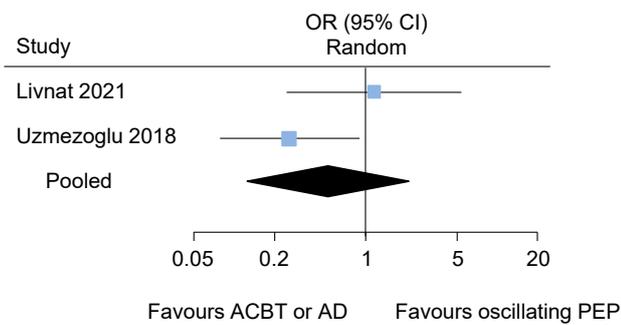


Figure 2. Increase in self-reported sputum expectoration comparing oscillating PEP therapy and techniques modulating expiratory flow for 4 weeks. Data are odds ratios. ACBT = active cycle of breathing technique, AD = autogenic drainage, PEP = positive expiratory pressure.

demonstrating similar proportions of individuals reporting an increase in self-reported sputum expectoration, irrespective of technique, following 4 weeks of daily oscillating PEP therapy versus autogenic drainage²⁶ or twice daily oscillating PEP therapy versus active cycle of breathing technique and gravity-assisted drainage²⁸ (Figure 2; see Figure 3 on the eAddenda for a detailed forest plot). The impact on generic and disease-specific HRQOL measures were also equivalent between techniques. Together with previous studies, these trial findings emphasise that no single airway clearance technique results in superior physiological or patient-reported outcomes in the short term.

There is a large, long-term trial of airway clearance techniques that has implications for practice.²⁹ A randomised controlled trial with 44 participants with stable bronchiectasis, whose disease severity ranged from mild to severe, found a reduction in the number of acute exacerbations, improvement in disease-specific and cough-related QOL and increase in sputum expectoration over a 12-month period for those receiving slow expiration with an open glottis in a lateral posture twice daily compared with upper limb stretches. As the only study to date that has examined the effects of airway clearance techniques over a period of > 3 months, this provides confidence that undertaking a form of airway clearance therapy in the long term leads to health benefits, including those linked to morbidity and mortality compared with no treatment.

To ensure effective implementation in the long term, adherence to the airway clearance techniques is critical. Adults with bronchiectasis have an adherence rate of 41%; those with better physical function, with a greater burden of treatment and more severe respiratory symptoms are more likely to be adherent.³⁰ Predictors of compliance are older age and a strong belief in treatment necessity.³¹ Capturing the patient's and clinician's voice, recent qualitative studies have shown that barriers to airway clearance techniques include lack of perceived benefit, poor motivation, time commitment and lack of resources, while enablers are use of a tailored, personalised approach, perceived health and QOL benefit, inclusion of self-management strategies and working with the interdisciplinary team.^{32,33}

In summary, current evidence for airway clearance techniques in bronchiectasis supports that undertaking a form of therapy yields some clinical benefit in the short and long term, but there is not necessarily a single, optimal or superior technique. There is significant heterogeneity in disease severity, technique prescription, treatment duration and outcomes between reported studies. Data for exacerbations and HRQOL are scant, with few long-term studies and a lack of consensus of key outcomes for airway clearance trials.³⁴ Demographic and clinical factors appear to serve as enablers or barriers to adherence in the adult population; this information may be applied in the clinical setting to guide practice.

Mucoactive agents

Mucoactive therapy has been recommended for people with bronchiectasis in cases where airway clearance techniques are ineffective²⁰ or

for those with recurrent exacerbations.¹⁹ This form of pharmacological therapy aims to improve mucociliary clearance and promote sputum expectoration by reducing the viscosity of secretions and improving sputum hydration. Mucoactive agents prescribed in people with bronchiectasis include nebulised hypertonic (concentrations ranging from 3 to 10%) and isotonic saline (concentration of 0.9%), with recent data outlining that 14% and 4% of Australians with bronchiectasis use hypertonic or isotonic saline, respectively, on a regular basis.³⁵

A previous systematic review comparing hypertonic with isotonic saline in adults with bronchiectasis reported similar improvement in dynamic lung function measurements (forced expiratory volume in 1 second (SMD 0.34, 95% CI -0.06 to 0.75) and forced vital capacity (SMD 0.40, 95% CI -0.01 to 0.80) and a mixed impact on HRQOL following 3 months of treatment, or no difference between techniques after 12 months of treatment.³⁶ Similar effects on selected HRQOL tools were noted in a recent study of 22 people with primary ciliary dyskinesia comparing twice daily hypertonic saline (7%) with isotonic saline (0.9%) over 4 months.³⁷ The findings on HRQOL between studies highlight the importance of sufficient power to detect changes in selected outcomes and the potential benefit in using a bronchiectasis-specific QOL tool to assess clinical effect.

Practically, physiotherapists prescribe isotonic saline or propose a recommendation for hypertonic saline as adjuncts to airway clearance techniques in this population and within these prescriptions, guidance for treatment order is included. While it is common for hypertonic saline to be administered prior to or during airway clearance therapy (practice informed by studies in cystic fibrosis³⁸), isotonic saline is more frequently delivered in conjunction with airway clearance techniques; a combined approach reduces treatment burden.³⁹ Physiotherapists also provide guidance to ensure optimal medication delivery, including the type of nebuliser and breathing technique.

Pulmonary rehabilitation and physical activity

Pulmonary rehabilitation guidelines and bronchiectasis management guidelines recommend the inclusion of adults with bronchiectasis within these programs as part of overall care.^{19,20,40} Pulmonary rehabilitation programs for adults with bronchiectasis are conducted in a mix of settings, including hospital or community outpatient programs, home-based or telerehabilitation, with the exercise structure focused on moderate-to-high intensity endurance and resistance exercise prescription, for a typical duration of 6 to 8 weeks. Co-interventions range across education, self-management, airway clearance techniques and respiratory muscle training. A recent Cochrane review of six studies demonstrated that in clinically stable individuals, rehabilitation with or without co-interventions improved functional exercise tolerance reflected in the incremental shuttle walk distance (MD 87 m, 95% CI 43 to 132) and disease-specific HRQOL (MD -9.6 points, -11.7 to -3.6) compared with usual care.⁴¹ While the magnitude of improvements were clinically significant, they were not sustained in the long term. This review confirms that this intervention, which was originally designed for and applied to those with COPD, offers a similar degree of benefit in bronchiectasis. This observation has been confirmed in a propensity-matched observational study, with similar completion rates and improvement in clinical outcomes observed in 426 patients (213 with bronchiectasis, 213 with COPD).⁴²

The emergence of alternative rehabilitation models examines whether home-based programs offer similar results to those conducted within the hospital or community environment. Two recent trials studied home-based pulmonary rehabilitation for people with bronchiectasis, with training consisting of walking or cycling or step training combined with resistance exercise.^{43,44} The pooled effects demonstrated similar improvement in functional exercise capacity for both home-based and hospital outpatient-based models of care (Figure 4; see Figure 5 on the eAddenda for a detailed forest plot). Following the escalation in telerehabilitation, a randomised controlled equivalence trial demonstrated a similar degree of improvement in functional exercise capacity and HRQOL domains in

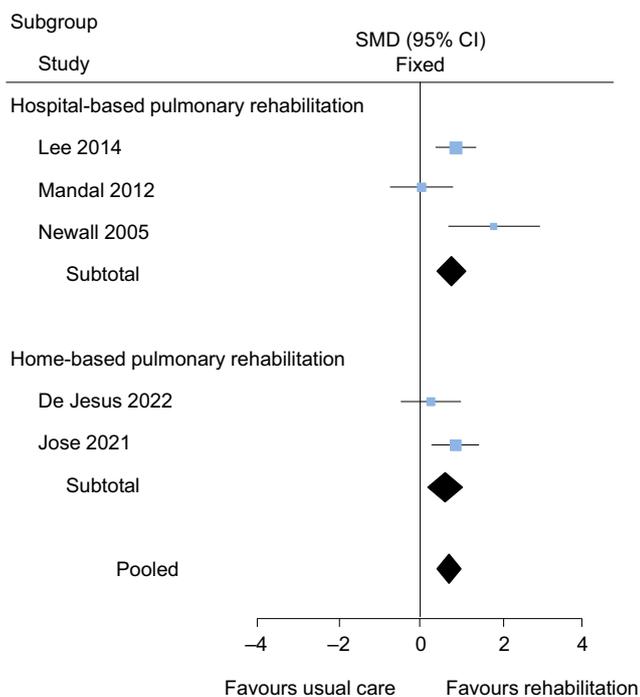


Figure 4. Differences in walking distance following pulmonary rehabilitation versus usual care in hospital-outpatient pulmonary rehabilitation and home-based pulmonary rehabilitation. Data are standardised mean difference (either 6-minute walk distance or incremental shuttle walk distance).

those undertaking telerehabilitation compared with centre-based rehabilitation in a subgroup of individuals with bronchiectasis.⁴⁵ Although trials are few, the findings to date outline that alternative ways of delivering pulmonary rehabilitation can be safely delivered, appear clinically beneficial and may overcome access issues.

These positive effects were less evident when applied to individuals following an acute exacerbation of bronchiectasis. Following 14 days of antibiotic treatment, 48 patients were randomised to either outpatient exercise rehabilitation and education or usual care for 6 weeks,⁴⁶ with no clear between-group differences in functional exercise capacity, patient-reported outcomes or time to next exacerbation. The findings contrast with studies of people with COPD, in whom pulmonary rehabilitation following discharge for an acute exacerbation led to selected clinical improvement.⁴⁷ The lack of benefit may be attributable to natural recovery in this population. Further examination related to the timing of prescribing this intervention in this clinical state is required.

Box 1. Education topics for people with bronchiectasis. From Lee et al,⁵⁰ Burge et al⁴⁸ and Hester et al.⁶⁹

- Understanding the aetiology of the condition and prognosis, including uncertainty
- Knowledge about self-management, including strategies for early recognition of exacerbations and developing support and coping mechanisms
- Becoming an active partner in disease management
- Understanding of the physical, psychological and social impacts of living with the condition
- Medication and rescue packs
- Lifestyle factors of diet and sleep
- Knowledge for carers
- Airway clearance therapy - alternative options for techniques, frequency of review and advice on cleaning of devices
- Physical activity beyond pulmonary rehabilitation
- Treatment for extra-pulmonary conditions
- Management anxiety, depression and symptom stigma
- End-of-life care and advance directives

While all programs provide adjunct management, consisting of education and/or initial instruction or review of airway clearance therapy, there is no consistency between studies. It is therefore difficult to determine the overall contribution of these co-treatments to the clinical outcomes. Ideally, prior to commencing a rehabilitation program, airway clearance techniques are already prescribed. To date, commonly included education topics have varied from airway clearance therapy, benefits of exercise, breathing techniques, underlying lung pathology, inhaled medication, pacing and energy conservation, nutrition, self-management, and exercise maintenance options.⁴¹ Recent updates of topics desired by patients in this setting (Box 1)⁴⁸⁻⁵⁰ could be considered in future iterations of the education component of pulmonary rehabilitation.

Despite the benefits of pulmonary rehabilitation, attendance rates are low (22%), although it is indicated in 67% of the population.³⁵ For some adults with an adequate, individually-tailored physical activity routine with which they are engaged, a structured program may not be required. While physical activity levels are lower compared with healthy aged-matched peers,¹⁰ physical activity interventions in this population beyond pulmonary rehabilitation have not been examined. Patient-identified barriers to exercise are embarrassment about symptoms, breathlessness, fear of exacerbating symptoms or causing an exacerbation, and insufficient time.⁵¹ Not unexpectedly, enjoyable and motivating activities that are undertaken with a support network promote greater engagement. These factors warrant consideration to improve uptake and completion of pulmonary rehabilitation or engagement with physical activity, with the necessary adaptations to accommodate the needs of individuals and comorbidities central to success.

Oxygen therapy

Hypoxaemia may be present in people with bronchiectasis, particularly during an acute exacerbation with reduced ventilation or airflow obstruction and in those with severe disease and chronic gas exchange abnormalities. In the absence of specific guidelines for bronchiectasis, the recommendations for treating hypoxaemia are derived from position statements and guidelines for acute oxygen therapy and domiciliary oxygen therapy.^{52,53} These recommendations guide empirical and pragmatic approaches in clinical practice to treat acute and chronic hypoxaemia. Like other chronic lung diseases, physiotherapists optimise oxygen therapy in the acute or rehabilitation environment to ensure adequate dosage and the most suitable mode of oxygen delivery.

One of the more recent systems used is high-flow nasal therapy (HFNT), a gas delivery system capable of providing heated and humidified air or supplemental oxygen via a heated pass-over humidifier and nasal cannulae. Options for airflow commonly range from 20 to 60 l/min, while oxygen can be titrated to 60 to 100%. The rationale is that an increase in airway surface liquid volume under conditions of 37°C and 100% relative humidity enhances mucociliary clearance. Other physiological effects are a reduction in anatomical dead space, enhanced carbon dioxide washout, reduced work of breathing and generation of positive end-expiratory pressure, which reduces dyspnoea and improves oxygenation.⁵⁴ A short-term study highlighted that 3 hours of treatment per day with HFNT over 7 days improved mucociliary transport in adults with bronchiectasis,⁵⁵ suggesting an adjunct role of humidified oxygen therapy in improving sputum clearance. A longer term, randomised controlled study of 45 people with bronchiectasis who produced daily sputum (> 5 ml) received domiciliary humidified air at 20 to 25 l/min via HFNT for a period of ≥ 2 hours/day for a 12-month period;⁵⁴ fewer exacerbations and a better HRQOL were noted in those receiving this therapy compared with usual care.⁵⁶ These preliminary findings offer encouragement towards the prescription of humidified oxygen therapy, although further studies across a broader range of disease severity are required to clarify the benefits.

Evidence is very limited regarding HFNT in those with acute exacerbations. An observational study of 15 patients with acute respiratory failure secondary to an exacerbation of COPD with concurrent bronchiectasis applied HFNT and supplemental oxygen at 50 l/min,

with the fraction of inspired oxygen titrated to maintain percutaneous saturations of 92%.⁵⁷ Improvements in respiratory rate, gas exchange parameters, symptoms and ease of expectoration were reported after 24 hours of treatment. With the contribution of bronchiectasis to the underlying exacerbation being unclear, further trials are necessary to determine the clinical effect of this practice.

Non-invasive ventilation

Non-invasive ventilation is applied to treat acute or chronic type II respiratory failure in those with bronchiectasis. Physiologically, non-invasive ventilation corrects acid-base balance, unloads respiratory muscles and improves symptoms. For those with acute respiratory failure secondary to an acute exacerbation of bronchiectasis, feasibility studies have demonstrated improvement in selected gas exchange parameters and respiratory symptoms, with suggestions for a reduced need for intubation and duration of stay in intensive care.^{58,59} Within their scope of practice, physiotherapists play a role in the provision of this treatment, including the practicalities of identifying suitable candidates, establishing treatment and adjusting parameters to ensure patient comfort and clinical efficacy.⁶⁰ This role is likely to extend to the provision of airway clearance therapy to maximise secretion clearance.

For those with chronic respiratory failure, domiciliary nasal non-invasive ventilation has been associated with stabilisation of blood gas measurements and reduction in hospitalisation duration over a 12-month period and improvement in QOL.^{61,62} The role of the physiotherapist in domiciliary non-invasive ventilation services is less clear and may be dependent on the physiotherapists' clinical skill and confidence in this environment.

Respiratory muscle training

Respiratory muscle weakness has been observed in people with bronchiectasis;⁶³ this feature has been linked to dyspnoea and impaired efficiency of coughing, which may limit secretion clearance. In the event of respiratory muscle weakness contributing to respiratory symptoms in a spontaneously breathing patient with bronchiectasis, inspiratory muscle training is recommended.⁶⁴ A mix of approaches for this mode of intervention, including pressure threshold training of 30 to 70% maximal inspiratory pressures and airway clearance techniques (PEP therapy) were recently examined in a systematic review.⁶⁵ Pooled results revealed an improvement in maximal inspiratory pressures (MD 6.08, 95% CI 138 to 10.77), but no change in maximal expiratory pressures (MD 2.04, 95% CI -3.33 to 7.31). Importantly, the effect of respiratory muscle training on patient-centred outcomes is mixed, with greater benefits evident in functional exercise tolerance and HRQOL with high-intensity compared with low- to medium-intensity training protocols.⁶⁶ A more recent study found similar improvements in maximal inspiratory pressures, while interviews with individuals revealed a perceived improvement in physical ability and health due to inspiratory muscle training.⁶⁷ When combined with exercise training, while there is no initial superiority in adding respiratory muscle training immediately following treatment, the benefits of an exercise program on exercise capacity were sustained at 3 months after the program's conclusion.⁶⁸ While these studies hint at physiological benefits for respiratory muscle training, there is a lack of translational effect illustrating the impact on activities limited by symptoms or synonymous with exercise intolerance. The benefit in using this mode of training may depend on the degree of hyperinflation, degree of weakness and the optimal prescription, which has not yet been identified.

Education and self-management

Patient education is a fundamental part of management, with information and knowledge delivered in a variety of formats, including pulmonary rehabilitation, clinical consultations, patient webinars/seminars or in the inpatient setting. In addition to receiving

information within these settings, patients desire credible and trustworthy sources of information that are accessible outside the clinical environment,⁶⁹ which include digital websites. When designed in partnership with consumers, such websites have a usefulness rating of 93% and offer an increased understanding of their disease and treatment options—lending support for a 'patient as partner' role in developing such resources.⁶⁹

The basis of self-management in bronchiectasis is derived from other respiratory conditions and is designed to assist patients in understanding their condition, treatments and their benefits. A systematic review and realist synthesis of self-management in adults with bronchiectasis included data from six studies consisting of 288 patients,⁷⁰ and highlighted three types of self-management programs: education and action planning; education and airway clearance therapy; and education, exercise and airway clearance therapy. Components within each program are outlined in Table 1. These approaches to self-management applied in a mix of study designs have led to short-term improvements in self-efficacy and HRQOL, while long-term outcomes are unknown.⁷⁰ The success of self-management comes from recognising that there is no 'one size fits all', with individualised, flexible and responsive self-management plans needed by those living with bronchiectasis.⁴⁹ The priorities of self-management program should be guided by an individual's current status and knowledge for maximum gain, for example: education about the disease is less useful for a well-informed patient, but a focus on dealing with the psychosocial factors and stigma of bronchiectasis may be a higher priority.

Management of comorbidities

For people with bronchiectasis, comorbid conditions (including anxiety and depression, incontinence, musculoskeletal pain and rhinosinusitis) are potentially amenable to physiotherapy. While exercise training alone had no effect on anxiety or depression,⁷¹ an observational study showed that those with at least mild anxiety or depression improved in their psychological symptoms following pulmonary rehabilitation beyond the minimum important difference.⁷² The inclusion of an education session on psychological well-being in addition to endurance and strength exercise training is a necessity for improvement.

Urinary incontinence affects 45 to 55% of adults with bronchiectasis, with some reporting symptoms for a duration of 5 to 10 years, with detrimental effects on HRQOL.^{73,74} While the efficacy of treatment in bronchiectasis is unproven, various treatment options consisting of urinary incontinence management plans with pelvic floor muscle strengthening, urge suppression, bladder retraining and toilet scheduling have been prescribed.

While musculoskeletal complications have been reported in those with bronchiectasis, only one study has examined the presence of pain.⁷⁵ Pain locations were chest, middle and low back pain (due to coughing) and neck pain. Poor posture was evident, with an increased frequency of postural malalignment (scoliosis and kyphosis) in those with bronchiectasis compared with healthy controls. At a minimum, postural review and prescription of musculoskeletal interventions designed to address the contributing factors to poor posture and pain by physiotherapists are worthy of further study.

In some individuals with bronchiectasis, a united airways' disease syndrome is apparent with a concurrent diagnosis of rhinosinusitis; it can affect approximately 62% of adult cases and has been linked to poorer HRQOL.⁷⁶ There is paucity of evidence about treatment, which has included nasal saline irrigation, antibiotics, topical or systemic steroids, mucolytics, decongestants, antihistamines and surgery.⁷⁷ It is recommended that physiotherapists managing individuals with these symptoms liaise closely with respiratory physicians and ear, nose and throat specialists to optimise treatment where possible.

Surgery and lung transplantation

Surgical management for those with bronchiectasis is preserved for those with localised disease, with cohort studies demonstrating

Table 1
Self-management program content and outcomes applied in bronchiectasis. Adapted from Tsang et al.⁷⁰

Self-management programs	Program components and content	Outcomes
Education and action planning	<ul style="list-style-type: none"> Interactive sessions by healthcare professionals with visual and auditory learning resources (including handouts, posters and videos). Education on provision of airway clearance therapy Educational topics: signs and symptoms, treatment goals, problem-solving and general health promotion (nutrition) Participants completed worksheets outlining usual symptoms, daily management of symptoms and triggers for exacerbation Weekly action planning and goal setting Action plans served as treatment seeking support tool to set weekly goals 	<ul style="list-style-type: none"> Improved patient knowledge about symptoms and ability to recognise exacerbations Improved self-efficacy and health-related quality of life
Education and airway clearance techniques	<ul style="list-style-type: none"> Awareness of psychosocial factors (relationships with people and levels of anxiety and depression) Provision of educational materials to encourage independence in further aspects of their care Knowledge regarding how to deal with the social and psychological aspects of bronchiectasis Education regarding differentiation in symptoms between stable and exacerbation phase Role of family members in providing emotional support and advice 	<ul style="list-style-type: none"> Improvement in self-efficacy and health-related quality of life
Education, exercise and airway clearance techniques	<ul style="list-style-type: none"> Provision of structured program of exercise, education and psychosocial support, instructing in problem-solving skills, behavioural management and decision-making Individual tailoring of exercise program based on patient tolerance to accommodate disease severity Instruction in breathing techniques (pursed lips breathing, exhalation on effort and forward leaning position) and examples of airway clearance techniques 	<ul style="list-style-type: none"> Improved health-related quality of life and exercise capacity

improvement in HRQOL following surgery.⁷⁸ The focus of physiotherapy interventions in this clinical scenario involves education regarding postoperative management, respiratory care and early mobilisation to facilitate discharge planning.⁷⁹

While surgery involving removal of a portion of the lung is rarely performed, lung transplantation is undertaken for life-threatening, advanced disease. While only making up a small portion of lung transplants, physiotherapists form a pivotal role in optimising management of those with bronchiectasis awaiting a lung transplant and following the procedure. Physiotherapists prescribe pre-transplant exercise programs with a mix of endurance and resistance training, while maintaining optimal airway clearance therapy. Although based on uncontrolled studies, a systematic review demonstrated that this intervention package improved exercise capacity, while effects on HRQOL were mixed.⁸⁰ In addition, physiotherapists are involved as part of the multidisciplinary team in providing education and support to address the stress and expectations of the waiting period for transplant, address energy conservation and manage infection control for some individuals.⁸¹ Post-transplant rehabilitation programs have a similar focus to pre-transplantation, with education and exercise training across a variable duration.⁸⁰ Despite the absence of comparator groups or specific data for those with bronchiectasis, benefits from clinical trials of mixed diagnoses have demonstrated improvements in clinical outcomes.⁸⁰ To maintain improvements, recommendations for ongoing exercise, with identification of enjoyable physical activities is important in long-term management.

Future directions for research and practice

Bronchiectasis is no longer considered an orphan disease and the growth of international registries in recent years has energised opportunities for future research. Most trials of airway clearance therapy have focused on single treatment techniques and short-term outcomes; given combinations of techniques are frequently applied in clinical practice,³⁹ there is a need for pragmatic studies of individuals diagnosed with comorbidities examining the clinical effect of combined approaches in a stable clinical state and during an acute exacerbation. To date, all studies have applied models of physiotherapy treatment that were delivered in person. Given the challenges to accessing physiotherapy,⁸² exploration of telephysiotherapy that includes delivery of airway clearance therapy should be explored. Of importance in all studies is consumer input into study design and outcomes for evaluation. The recent recognition of the need for a core set of outcomes in physiotherapy trials and their subsequent identification⁸³ will further inform which patient-reported and patient-experience outcomes should be incorporated.

In the meantime, use of recently developed bronchiectasis-specific tools (Quality of Life-Bronchiectasis and Bronchiectasis Health Questionnaire)⁸⁴ are applicable. Clarity on the effects of hypertonic and isotonic saline inhalation and humidified HFNT alone or in conjunction with airway clearance therapy would further inform clinical practice. A growth in studies of longer duration (12 months) will enable more robust interpretation of the effects of airway clearance techniques on exacerbation rates, hospitalisations, HRQOL, and direct and indirect measures of cost-effectiveness, which are all outcomes reflecting morbidity and impacting on mortality and the healthcare system.

While pulmonary rehabilitation in a stable clinical state causes short-term benefit, it is unclear how to retain these improvements. Greater examination of the role of exercise training and mobilisation in the inpatient setting and of pulmonary rehabilitation following hospitalisation for an acute exacerbation is needed to guide clinical practice. Home-based rehabilitation and telerehabilitation offer improvements, but how to accurately assess exercise capacity and peripheral muscle strength within these settings to maximise access requires attention. Identification of common physical activity interventions undertaken by this population is the first step towards establishing their impact, as not all individuals will engage with pulmonary rehabilitation. Understanding patient factors influencing adherence to and engagement with physical activity and exercise interventions will enable greater personalised tailoring of therapies.

Clarity on the role of education and self-management in bronchiectasis is required, including content and availability of resources, modes of delivery, evaluation of impact and translation into daily practice to facilitate behavioural change. Given the mix of comorbidities in bronchiectasis that may be amenable to physiotherapy interventions, research should gain a greater understanding of the breadth and clinical impact of these co-existing conditions, establish reliable and valid measurement tools, and explore treatment options within the scope of physiotherapy practice. Finally, continuation of translation of findings into practice is critical to implementing evidence-based physiotherapy care for adults with bronchiectasis.

eAddenda: Figures 3 and 5 can be found online at <https://doi.org/10.1016/j.jphys.2022.11.013>

Ethics approval: Not applicable.

Competing interests: Nil.

Source(s) of support: Nil.

Acknowledgements: Nil.

Provenance: Invited. Peer reviewed.

Correspondence: Annemarie L Lee, Department of Physiotherapy, Monash University, Melbourne, Australia. Email: Annemarie.Lee@monash.edu

References

- Chang AB, Fortescue R, Grimwood K, Alexopoulou E, Bell L, Boyd J, et al. European Respiratory Society guidelines for the management of children and adolescents with bronchiectasis. *Eur Respir J*. 2021;58:2002990.
- Hill AT, Sullivan AL, Chalmers JD, De Soyza A, Elborn JS, Floto RA, et al. British Thoracic Society guideline for bronchiectasis in adults. *Thorax*. 2019;74(Suppl 1):1–69.
- Cole PJ. Inflammation: a two-edged sword—the model of bronchiectasis. *Eur J Respir Dis Suppl*. 1986;147:6–15.
- Contarini M, Finch S, Chalmers JC. Bronchiectasis: a case-based approach to investigation and management. *Eur Respir Rev*. 2018;27:180016.
- Seitz AE, Olivier KN, Adjemian J, Holland SM, Prevots DR. Trends in bronchiectasis among medicare beneficiaries in the United States, 2000 to 2007. *Chest*. 2012;142:432–439.
- Quint JK, Millett ERC, Joshi M, Navaratnam V, Thomas SL, Hurst JR, et al. Changes in the incidence, prevalence and mortality of bronchiectasis in the UK from 2004 to 2013: a population-based cohort study. *Eur Respir J*. 2016;47:186–193.
- McDonnell MJ, Aliberti S, Goeminne PC, Restrepo MI, Finch S, Pesci A, et al. Comorbidities and the risk of mortality in patients with bronchiectasis: an international multicentre cohort study. *Lancet Respir Med*. 2016;4:969–979.
- Hill AT, Haworth CS, Aliberti S, Barker A, Blasi F, Boersma W, et al. Pulmonary exacerbation in adults with bronchiectasis: a consensus definition for clinical research. *Eur Respir J*. 2017;49:1700051.
- Quint JK, Smith MP. Paediatric and adult bronchiectasis: diagnosis, disease burden and prognosis. *Respirology*. 2019;24:413–422.
- De Camargo AA, Boldorini JC, Holland AE, de Castro RA, de Cordoba Lanza F, Athanazio RA, et al. Determinants of peripheral muscle strength and activity in daily life in people with bronchiectasis. *Phys Ther*. 2018;98:153–161.
- Oliveira C, Oliveira G, Gaspar I, Dorado A, Cruz I, Soriguer F, et al. Depression and anxiety symptoms in bronchiectasis: associations with health-related quality of life. *Qual Life Res*. 2013;22:597–605.
- Ringshausen FC, Sokol P, Barten G, De Roux A, Diel R, Konwert S, et al. Quality of life is associated with increased symptom burden and markers of disease severity: data from the German Bronchiectasis Registry PROGNOSIS. *Eur Respir J*. 2018;52:PA2670.
- Dudgeon EK, Crichton M, Chalmers JD. “The missing ingredient”: the patient perspective of health related quality of life in bronchiectasis: a qualitative study. *BMC Pulm Med*. 2018;18:81.
- Goeminne PC, Hernandez F, Diel R, Filonenko A, Hughes R, Juelich F, et al. The economic burden of bronchiectasis: known and unknown – a systematic review. *BMC Pulm Med*. 2019;19:3388.
- Chalmers JD, Goeminne PC, Aliberti S, McDonnell MJ, Lonni S, Davidson J, et al. The bronchiectasis severity index. An International derivation and validation study. *Am J Respir Crit Care Med*. 2014;189:576–585.
- Chalmers JD, Aliberti S, Filonenko A, Shteinberg M, Goeminne PC, Hill AT, et al. Characterisation of the “Frequent Exacerbator Phenotype” in bronchiectasis. *Am J Respir Crit Care Med*. 2018;197:1410–1420.
- Polverino E, Dimakou K, Hurst J, Martinez-Garcia MA, Miravittles M, Paggiaro P, et al. The overlap between bronchiectasis and chronic airway disease: state of the art and future directions. *Eur Respir J*. 2018;52:1800328.
- Finch S, McDonnell MJ, Abo-Leyah H, Aliberti S, Chalmers JD. A comprehensive analysis of the impact of Pseudomonas aeruginosa colonisation on prognosis in adult bronchiectasis. *Ann Am Thorac Soc*. 2015;12:1602–1611.
- Chang AB, Bell SC, Torzillo PJ, King PT, Maguire G, Byrnes CA, et al. Chronic suppurative lung disease and bronchiectasis in children and adults in Australia and New Zealand. Thoracic Society of Australia and New Zealand guidelines. *Med J Aust*. 2015;202:21–23.
- Polverino E, Goeminne PC, O'Donnell MJ, Aliberti S, Marshall SE, Loebinger MR, et al. European Respiratory Society guidelines for the management of adult bronchiectasis. *Eur Respir J*. 2017;50:1700629.
- Phillips J, Lee AL, Pope R, Hing W. Physiotherapists' use of airway clearance techniques during an acute exacerbation of bronchiectasis: a survey study. *Arch Physiother*. 2021;11:3.
- Webb EM, Holland AE, Chang AB, Burr L, Holmes-Liew C-L, Jayaram L, et al. Physiotherapy practice for adults with bronchiectasis: Australian bronchiectasis registry data. *Respirology*. 2022;27:TO034.
- Lee AL, Burge AT, Holland AE. Airway clearance techniques in bronchiectasis. *Cochrane Database Syst Rev*. 2015;11:CD008351.
- Lee AL, Burge AT, Holland AE. Positive expiratory pressure therapy versus other airway clearance techniques in bronchiectasis. *Cochrane Database Syst Rev*. 2017;9:CD011699.
- Phillips J, Lee AL, Pope R, Hing W. Effect of airway clearance techniques in patients experiencing an acute exacerbation of bronchiectasis: a systematic review. *Physiother Theory Pract*. 2019;36:1300–1315.
- Livnat G, Yaari N, Stein N, Bentur L, Hanna M, Harel M, et al. 4-week daily airway clearance using oscillating positive-end expiratory pressure versus autogenic drainage in bronchiectasis patients: a randomised controlled trial. *Eur Respir J Open Res*. 2021;7:00426–2021.
- Santos MD, Milross MA, McKenzie DK, Alison JA. Bubble-positive expiratory pressure device and sputum clearance in bronchiectasis: a randomised cross-over study. *Physiother Res Int*. 2019;25:e1836.
- zmezoglu B, Altayi G, Özdemir L, Tuna H, Süt N. The efficacy of flutter and active cycle of breathing techniques in patients with bronchiectasis: a prospective, randomised, comparative study. *Turk Thorac J*. 2018;19:103–109.
- Muñoz G, de Gracia J, Buxó M, Alvarex A, Vendrell M. Long-term benefits of airway clearance in bronchiectasis: a randomised placebo-controlled trial. *Eur Respir J*. 2018;51:1701926.
- McCullough AR, Tunney MM, Quittner AL, Elborn JS, Bradley JM, Hughes CM, et al. Treatment adherence and health outcomes in patients with bronchiectasis. *BMC Pulm Med*. 2014;14:107.
- McCullough AR, Tunney MM, Elborn JS, Bradley JM, Hughes CM. Predictors of adherence to treatment in bronchiectasis. *Respir Med*. 2015;109:838–845.
- Franks LJ, Walsh JR, Hall K, Adsett JA, Morris NR. Patient perspectives of airway clearance techniques in bronchiectasis. *Physiother Theory Pract*. Published online ahead of print, Sept 20 2022; <https://doi.org/10.1080/09593985.2022.2126741>.
- Lawton K, Royals K, Carson-Chahhoud K, Smith B, Veale A. Management: a health professional perspective. *Respirology*. 2019;24(Suppl 1):101.
- Welsh EJ, Evans DJ, Fowler SJ, Spencer S. Interventions for bronchiectasis: an overview of Cochrane systematic reviews. *Cochrane Database Syst Rev*. 2015;7:CD010337.
- Visser SK, Bye PTP, Fox GJ, Burr LD, Chang AB, Holmes-Liew C-L, et al. Management of Australian adults with bronchiectasis in tertiary care: evidence-based or access-driven? *Lung*. 2019;197:803–810.
- Tarrant BJ, Le Maitre C, Romero L, Steward R, Button BM, Thompson BR, et al. Mucoactive agents for chronic, non-cystic fibrosis lung disease: a systematic review and meta-analysis. *Respirology*. 2017;22:1084–1092.
- Paff T, Daniels JMA, Weersink EJ, Lutter R, Noordegraaf AV, Haarman EG. A randomised controlled trial on the effect of inhaled hypertonic saline on quality of life in primary ciliary dyskinesia. *Eur Respir J*. 2017;49:1601770.
- Elkins M, Dentice R. Timing of hypertonic saline inhalation for cystic fibrosis. *Cochrane Database Syst Rev*. 2020;2:CD008816.
- Lee AL, Baenziger S, Louey A, Jennings S, Solin P, Hoy R. A review of physiotherapy practice for people with bronchiectasis. *Eur Respir J Open Res*. 2020;7. <https://doi.org/10.1183/23120541.00569-2020>.
- Alison JA, McKeough ZJ, Johnston K, McNamara RJ, Spencer LM, Jenkins SC, et al. Australian and New Zealand pulmonary rehabilitation guidelines. *Respirology*. 2017;22:800–819.
- Lee AL, Gordon C, Osadnik CR. Exercise training for people with bronchiectasis. *Cochrane Database Syst Rev*. 2021;3:CD 013110.
- Patel S, Cole AD, Nolan CM, Barker RE, Jones SE, Kon S, et al. Pulmonary rehabilitation in bronchiectasis: a propensity-matched study. *Eur Respir J*. 2019;53:1801264.
- de Jesús S, Pacheco VA, Morales AV, Rodriguez AMM, Garcia RR, Arnedillo-Muñoz A. Exercise capacity and physical activity in non-cystic fibrosis bronchiectasis after a pulmonary rehabilitation home-based programme: a randomised controlled trial. *Int J Environ Res Public Health*. 2022;19:11039.
- José A, Holland AE, Selman JPR, de Camargo CO, Fonseca DS, Athanazio RA, et al. Home-based pulmonary rehabilitation in people with bronchiectasis: a randomised controlled trial. *Eur Respir J Open Res*. 2021;7:00021–2021.
- Cox NS, McDonald CF, Mahal A, Alison JA, Wootton R, Hill CJ, et al. Tele-rehabilitation for chronic respiratory disease: a randomised controlled equivalence trial. *Thorax*. 2022;77:643–651.
- Chalmers JD, Crichton M, Brady G, Finch S, Lonergan M, Fardon TC. Pulmonary rehabilitation after exacerbation of bronchiectasis: a pilot randomised controlled trial. *BMC Pulm Med*. 2019;17:85.
- Puhan M, Scharplatz M, Troosters T, Haydn Walters E, Steurer J. Pulmonary rehabilitation following exacerbations of chronic obstructive pulmonary disease. *Cochrane Database Syst Rev*. 2016;2016:CD0053005.
- Burge AT, Lee A, Nicholes M, Purcell S, Miller B, Norris N, et al. Advance care planning education in pulmonary rehabilitation: a qualitative study exploring participant perspectives. *Palliat Med*. 2013;27:508–515.
- Kelly CA, Tsang A, Lynes D, Spencer S. ‘It’s not one size fits all’: a qualitative study of patients’ and healthcare professionals’ views of self-management for bronchiectasis. *BMJ Open Respir Res*. 2021;8:e000862.
- Lee AL, Smith R, Burr L, Chang AB, Holmes-Liew C-L, King P, et al. “Teach me how to look after myself”: What people with bronchiectasis want from education in a pulmonary rehabilitation setting. *Clin Respir J*. Published online ahead of print, Nov 7 2022; <https://doi.org/10.1111/crj.13563>.
- Royle H, Kelly C. “The likes of me running and walking? No change”: Exploring the perceptions of adult patients with bronchiectasis towards exercise. *Chron Illn*. Published online ahead of print, May 23 2022; <https://doi.org/10.1177/17423953221108223>.
- Barrett A, Beasley R, Buchan C, Chien J, Farah CS, King G, et al. Thoracic Society of Australia and New Zealand position statement on acute oxygen use in adults: ‘Swimming between the flags’. *Respirology*. 2022;27:262–276.
- McDonald CF, Whyte K, Jenkins S, Serginson J, Frith P. Clinical practice guideline on adult domiciliary oxygen therapy: executive summary from the Thoracic Society of Australia and New Zealand. *Respirology*. 2016;21:76–78.
- Rea H, McAuley S, Jayaram L, Garrett J, Hockey H, Storey L, et al. The clinical utility of long-term humidification therapy in chronic airway disease. *Respir Med*. 2010;104:525–533.
- Hasani A, Chapman TH, McCool D, Smith RE, Dilworth JP, Agnew JE. Domiciliary humidification improves lung mucociliary clearance in patients with bronchiectasis. *Chron Respir Dis*. 2008;5:81–86.
- Good WR, Garrett J, Hockey HUP, Jayaram L, Wong C, Rea H. The role of high-flow nasal therapy in bronchiectasis: a post hoc analysis. *Eur Respir J Open Res*. 2021;7:00711–2020.
- Crimi C, Noto A, Cortegiani A, Campisi R, Heffler E, Gregoretti C, et al. High flow nasal therapy use in patients with acute exacerbation of COPD and bronchiectasis: a feasibility study. *J COPD*. 2020;17:184–190.
- Phua J, Ang YL, See KC, Mukhopadhyay A, Santiago EA, Dela Pena EG, et al. Noninvasive and invasive ventilation in acute respiratory failure associated with bronchiectasis. *Intensive Care Med*. 2010;36:638–647.
- Sadigov A, Bakhshaliyeva K, Ibrahimov T, Ismailzadeh J. Noninvasive ventilation in acute respiratory failure caused by non-cystic fibrosis bronchiectasis and chronic obstructive pulmonary disease. *Eur Respir J*. 2015;46:PA4808.
- Piper AJ, Moran FM. Non-invasive ventilation and the physiotherapist: current state and future trends. *Phys Ther Rev*. 2006;11:37–43.
- Simonds AK, Elliott MW. Outcome of domiciliary nasal intermittent positive pressure ventilation in restrictive and obstructive disorders. *Thorax*. 1995;50:604–609.

62. Gacouin A, Desrues B, Léna H, Quinquenel ML, Dassonville J, Dalaval P. Long-term nasal intermittent positive pressure ventilation (NIPPV) in sixteen consecutive patients with bronchiectasis: a retrospective study. *Eur Respir J*. 1996;9:1246–1250.
63. Moran FM, Piper AJ, Elborn JS, Bradley JM. Respiratory muscle pressures in non-CF bronchiectasis: repeatability and reliability. *Chron Respir Dis*. 2010;7:165–171.
64. Bott J, Blumenthal S, Buxont M, Ellum S, Falconer C, Garrod R, et al. Guidelines for the physiotherapy management of the adult, medical, spontaneously breathing patient. *Thorax*. 2009;64(Suppl 1):i1–i51.
65. Martin-Valero R, Jimenez-Cebrian AM, Moral-Munoz JA, de-la-Casa-Almeida M, Rodriguez-Huguet M, Casuso-Holgado MJ. The efficacy of therapeutic respiratory muscle training interventions in people with bronchiectasis: a systematic review and meta-analysis. *J Clin Med*. 2020;9:1017.
66. Ozalp O, Inal-Ince D, Cakmak A, Calik-Kutukcu E, Saglam M, Savci S, et al. High-intensity inspiratory muscle training in bronchiectasis: a randomised controlled trial. *Respirology*. 2019;24:246–253.
67. McCreery JL, Mackintosh KA, Mills-Bennett R, McNarry MA. The effect of a high-intensity PrO2Fit inspiratory muscle training intervention on physiological and psychological health in adults with bronchiectasis: a mixed-methods study. *Int J Environ Res Public Health*. 2021;18:3051.
68. Newall C, Stockley RA, Hill SL. Exercise training and inspiratory muscle training in patients with bronchiectasis. *Thorax*. 2005;60:943–948.
69. Hester KLM, Newton J, Rapley T, Ryan V, De Soyza A. Information and education provision in bronchiectasis: co-development and evaluation of a novel patient-driven resource in a digital era. *Eur Respir J*. 2018;51:1702402.
70. Tsang A, Lynes D, McKenzie H, Spencer S, Kelly C. Self-management programmes for adult patients with bronchiectasis: a systematic review and realist synthesis. *Disabil Rehabil*. 2021;44(23):6939–6948.
71. Lee AL, Hill CJ, Cecins N, Jenkins S, McDonald CF, Burge AT, et al. The short and long term effects of exercise training in non-cystic fibrosis bronchiectasis—a randomised controlled trial. *Respir Res*. 2014;15:44.
72. Wynne SC, Patel S, Barker RE, Jones SE, Walsh JA, Kon S, et al. Anxiety and depression in bronchiectasis: Response to pulmonary rehabilitation and minimal clinically important difference of the Hospital Anxiety and Depression Scale. *Chron Respir Dis*. 2020;17:1–9.
73. Duignan N, McDonnell MJ, Mokoka MC, Rutherford RM. High prevalence of stress urinary incontinence in adult patients with bronchiectasis. *Ir Med J*. 2016;109:440.
74. Prys-Pricard CO, Niven R. Urinary incontinence in patients with bronchiectasis. *Eur Respir J*. 2006;27:866–867.
75. Vardar-Yagli N, Seglam M, Calik-Kutukcu E, Inal-Ince D, Arikan H, Coplu L. Increased pain sensitivity, postural abnormalities, and functional balance impairment in obstructive lung disease compared to healthy subjects. *Heart Lung*. 2019;48:351–355.
76. Handley E, Nicolson CHH, Hew M, Lee AL. Prevalence and clinical implications of chronic rhinosinusitis in people with bronchiectasis: a systematic review. *J Allergy Clin Immunol Pract*. 2019;7:2004–2012.
77. Brunner JP, Riley CA, McCoul ED. A systematic review of the treatment of chronic rhinosinusitis in adults with primary ciliary dyskinesia. *Sinusitis*. 2017;2:1–7.
78. Vallilo CC, Terra RM, De Albuquerque ALP, Suesada MM, Mariani AW, Salge JM, et al. Lung resection improves the quality of life of patients with symptomatic bronchiectasis. *Ann Thorac Surg*. 2014;98:1034–1041.
79. Baddeley RA. Physiotherapy for enhanced recovery in thoracic surgery. *J Thorac Dis*. 2016;8(Suppl 1):S107–S110.
80. Hume E, Ward L, Wilkinson M, Manfield J, Clark S, Vogiatzis I. Exercise training for lung transplant candidates and recipients: a systematic review. *Eur Respir Rev*. 2020;29:200053.
81. Wickerson L, Rozenberg D, Janaudis-Ferreira T, Deliva R, Lo V, Beauchamp G, et al. Physical rehabilitation for lung transplant candidates and recipients: an evidence-informed clinical approach. *World J Transplant*. 2016;6:517–531.
82. Cooper L, Johnston K, Williams M. Airway clearance services (ACSS) in Australia for adults with chronic lung conditions: scoping review of publicly available web-based information. *BMC Health Ser Res*. 2019;19:808.
83. Hamzeh H, Spencer S, Kelly C. Development of a core outcome set and outcome measurement set for physiotherapy trials in adults with bronchiectasis (COS-PHyBE study): a protocol. *PLoS One*. 2022;17:e0263695.
84. McLeese RH, Spinou A, Alfahl Z, Tsagris M, Elborn JS, Chalmers JD, et al. Psychometrics of health-related quality of life questionnaires in bronchiectasis: a systematic review and meta-analysis. *Eur Respir J*. 2021;2021(58):2100025.

QUESTIONNAIRE

D2(25) Part 1 of 2

Physiotherapy management of bronchiectasis in adults

INSTRUCTIONS

- Read through the article and answer the multiple-choice questions provided below.
- **Some questions may have more than one correct answer;** in which case you must mark **all** the correct answers.

Introduction

Question 1: What is the primary goal of physiotherapy in the management of bronchiectasis?

- A. To significantly increase exercise tolerance
- B. To address symptoms on a “as needed” basis
- C. To address symptoms in such a way that the use of medication is avoided
- D. Addressing symptoms to improve health status and minimise the rate of decline in respiratory function

What is bronchiectasis

Question 2: What is bronchiectasis primarily characterised by?

- A. Airway inflammation and infection
- B. Radiologically abnormal and permanent dilatation of the bronchi
- C. Temporary inflammation of the airways
- D. Persistent cough

Question 3: Fill in the missing words:

“The pathophysiology of bronchiectasis is still best understood by the vicious cycle that was first proposed by Cole: airway inflammation, primarily dominated by neutrophils, contributes to impaired mucociliary clearance; this impairment leads to mucus hypersecretion and airway obstruction, with an increase in microbial colonisation, which contributes to infection and structural lung damage”.

- A. Impaired / hypersecretion / infection
- B. Increased / hyposecretion / apnoea
- C. Inhibited / secretion / bacterial overload

Question 4: Which of the following is **NOT** a common aetiology of bronchiectasis?

- A. Genetic disorders
- B. Autoimmune diseases
- C. Post infection (fungal)
- D. Idiopathic causes

Question 5: Which pathogen is frequently isolated in bronchiectasis?

- A. *Escherichia coli*
- B. *Pseudomonas aeruginosa*
- C. *Streptococcus pyogenes*
- D. *Mycobacterium tuberculosis*

Burden of bronchiectasis

Question 6: What is the most frequently experienced symptom in adults with bronchiectasis?

- A. Sputum expectoration
- B. Anxiety
- C. Acute cough episodes lasting longer than 15 minutes per episode
- D. Chronic cough

Question 7: Is the following statement **TRUE** or **FALSE**?

“Although a causal relationship has not been demonstrated, the co-existence of chronic obstructive pulmonary disease (COPD) or asthma in 20 to 60% of individuals with bronchiectasis is linked to a higher 5-year mortality rate (55% compared with 20% among those without COPD or asthma)”.

- A. TRUE
- B. FALSE

Question 8: What factor significantly predicts future mortality in bronchiectasis patients?

- A. Age at diagnosis
- B. Number of acute exacerbations per year
- C. Type of pathogen causing infection
- D. Presence or absence of acute cough

Management of bronchiectasis

Question 9: Which ONE of the following is considered a main goal of bronchiectasis treatment?

- A. Minimise acute cough episodes
- B. Decrease hospitalisation rates
- C. Control and alleviation of symptoms
- D. Reduction in the need for physiotherapy

Question 10: A game-changing study of what antibiotic class reduces the frequency of acute exacerbations?

- A. Macrolides
- B. Aminoglycosides
- C. Sulphonamides
- D. None of the above

Question 11: Double-blind, placebo-controlled trials have shown benefit from which of the following interventions?

- A. Mucoactive agents
- B. Respiratory muscle training
- C. Airway clearance techniques
- D. Pulmonary rehabilitation during an acute exacerbation

Airway clearance techniques

Question 12: Which method is **NOT** typically used in airway clearance techniques?

- A. Gravity-assisted drainage
- B. Positive pressure devices
- C. Electrical stimulation
- D. Active cycle of breathing technique
- E. Autogenic drainage

Question 13: Is the following statement **TRUE** or **FALSE**?

“When compared with no treatment, a Cochrane review showed that airway clearance techniques were associated with short-term improvement in sputum expectoration (MD 8.4 ml, 95% CI 3.4 to 13.4) and health status (MD – 14.8 points, 95% CI –18.0 to –11.6), but had no clear effect on acute exacerbation rate (RR 0.71, 95% CI 0.23 to 2.25)”.

- A. TRUE
- B. FALSE

Question 14: Which intervention has shown a significant reduction in the number of acute exacerbations, improvement in disease-specific and cough related QOL and increase in sputum expectoration over a 12-month period?

- A. Slow expiration with an open glottis in a lateral posture
- B. High-frequency chest wall oscillation
- C. Hypertonic saline inhalation
- D. Nebulised macrolide antibiotics

Question 15: What is the estimated adherence rate to airway clearance techniques in adults with bronchiectasis?

- A. 20%
- B. 41%
- C. 60%
- D. 80%

THE END

QUESTIONNAIRE

D2(25) Part 2 of 2

Physiotherapy management of bronchiectasis in adults

INSTRUCTIONS

- Read through the article and answer the multiple-choice questions provided below.
- **Some questions may have more than one correct answer;** in which case you must mark **all** the correct answers.

Question 1: What is one of the barriers to adherence to airway clearance techniques identified in the article?

- A. Lack of perceived benefit
- B. High cost of therapy
- C. Availability of equipment
- D. Treatment modality being used

Question 2: Current evidence for airway clearance techniques in bronchiectasis

- A. Supports that undertaking a form of therapy yields some clinical benefit in the short- and long-term
- B. Clearly identifies superior techniques
- C. Shows significant heterogeneity in disease severity, technique prescription, treatment duration and outcomes between studies
- D. All of the above

Question 3: Is it **TRUE** that the effects of therapist-made Bottle PEP therapy found that a single treatment session led to equivalent sputum weight during treatment compared with the active cycle of breathing technique?

- A. YES
- B. NO

Mucoactive agents

Question 4: Mucoactive therapy

- A. Has been recommended for people with bronchiectasis in cases where airway clearance techniques are ineffective
- B. Aims to improve mucociliary clearance and promote sputum expectoration
- C. Include nebulized hypertonic and isotonic saline
- D. None of the above

Oxygen therapy

Question 5: Which type of therapy is suggested for patients with chronic gas exchange abnormalities in bronchiectasis?

- A. Acute and domiciliary oxygen therapy
- B. High-frequency oscillation therapy
- C. Physiotherapy-based breathing techniques
- D. Corticosteroid therapy

Question 6: Is the following statement **TRUE** or **FALSE**?

“A longer term, randomised controlled study of 45 people with bronchiectasis who produced daily sputum (. 5 ml) received domiciliary humidified air at 20 to 25 l/min via HFNT for a period of more than 2 hours/day for a 12-month period; fewer exacerbations and a better HRQOL were noted in those receiving this therapy compared with usual care”.

- A. TRUE
- B. FALSE

Respiratory muscle training

Question 7: Which type of physiotherapy intervention is typically involved in managing respiratory muscle weakness contributing to respiratory symptoms in bronchiectasis patients?

- A. Inspiratory muscle training
- B. Isotonic saline nebulisation
- C. Expiratory muscle training
- D. Pulmonary rehabilitation only

Management of comorbidities

Question 8: For people with bronchiectasis

- A. Comorbid conditions include anxiety and depression, incontinence and musculoskeletal pain
- B. Urinary incontinence affects 10% - 15% of adults
- C. Pain locations were chest, middle- and low back pain and neck pain
- D. Poor posture was not evident
- E. A united airways' disease syndrome was generally apparent

Question 9: Which comorbidity commonly coexists with bronchiectasis and can affect up to 62% of adult cases?

- A. Chronic obstructive pulmonary disease (COPD)
- B. Rhinosinusitis
- C. Pulmonary fibrosis
- D. Asthma

Question 10: What is **NOT** the focus of physiotherapy interventions in the clinical scenario of surgery or lung transplantation for bronchiectasis?

- A. Postoperative management
- B. Respiratory care
- C. Early mobilisation
- D. Long-term use of antibiotics

THE END



FOCUS ON HEALTH

www.foh-cpd.co.za

Cell: 074 230 3874

Tel: 012 653 0133 / 2373 / 2394

Mon-Fri: 08:00-16:00

400 Theuns van Niekerk Street

Wierda Park

0157

PO Box 71

Wierda Park

0149

MEMBER INFO

(Complete sections marked with an asterisk *)

***FOH number**

***HPCSA number**

ID number

Personal detail changes

I hereby declare that the completion of this document is my own effort without any assistance.

SIGNED:

DATE:

This activity is accredited for **FIVE (5) CLINICAL CEU'S**. You have to achieve 70% to pass this activity.

ANSWER SHEET

D2(25)

Physiotherapy management of bronchiectasis in adults

*Time spent on activity	hour					min					PART 1					PART 2				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E					
1						9						1								
2						10						2								
3						11						3								
4						12						4								
5						13						5								
6						14						6								
7						15						7								
8												8								
												9								
												10								

How relevant was the content of this activity to your scope of practice?			
			
Not at all	Somewhat	Mostly	Extremely

RETURN ANSWER SHEET TO

Online members, complete your answer sheet online

CPD PORTAL: <http://foh-cpd.co.za/cpd-online/cpd-user> (Username: FOH number & Password: ID)

(Results are available immediately)

Email or hard copy members, complete your answer sheet online or return it to:

WHATSAPP: 074 230 3874 EMAIL: info@foh-cpd.co.za

(Results will be sent via email)

You will receive a confirmation of receipt SMS within 12-24hours, if not received please send again.

Have a suggestion or comment?

Send it to us on EMAIL or WHATSAPP