Koninklijk Nederlands
Genootschap voor Fysiotherapie

Royal Dutch Society for Physical Therapy

Vereniging van Oefentherapeuten

KNGF Guideline
on COPD

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Practice Guideline

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The KNGF aims to create the conditions in which high-quality physiotherapeutic care can be provided that is accessible to the entire Dutch population, whilst recognising the professional expertise of the physical therapist. The KNGF represents the professional, social and economic interests of over 19,000 registered physical therapists.

All sections of the guideline, including the summary, are available at http://www.kngf.nl/kennisplatform.

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CAHAG = COPD & Astma Huisartsen Advies Groep (COPD and Asthma General Practitioners Advisory Panel); EN = Ergotherapie Nederland (Dutch Association of Occupational Therapists); KNGF = Koninklijk Nederlands Genootschap voor Fysiotherapie (Royal Dutch Society for Physical Therapy); NHG = Nederlands Huisartsen Genootschap (Dutch Society of General Practitioners); NVALT = Nederlandse Vereniging van Artsen voor Longziekten en Tuberculose (Dutch Association of Physicians in Chest Medicine and Tuberculosis); NIP = Nederlands Instituut van Psychologen (Dutch Institute of Psychologists); NVD = Nederlandse Vereniging van Diëtisten (Dutch Society of Dieticians); NVFG = Nederlandse Vereniging voor Fysiotherapie in de Geriatrie (Dutch Association for Physical Therapy in Geriatrics); NVZF = Nederlandse Vereniging voor Ziekenhuis Fysiotherapie (Dutch Society for Hospital Physical Therapy); VHVL = Vereniging voor Hart-, Vaat- en Longfysiotherapie (Association of Cardiovascular and Pulmonary Rehabilitation); NVFS = Nederlandse Vereniging voor Fysiotherapie in de Sportgezondheidszorg (Dutch Society for Physical Therapy in Sports Medicine); V&VN = Verpleegkundigen & Verzorgenden Nederland (Dutch Organisation for Nurses and Carers); VvOCM = Vereniging van Oefentherapeuten Cesar en Mensendieck (Association of Exercise Therapists Cesar and Mensendieck); ZIN = Zorginstituut Nederland (Healthcare Institute of the Netherlands); ZN = Zorgverzekeraars Nederland (Dutch Healthcare Insurance Companies). n.p. = not practising.

Contents

Explanation

A General information

A.1 Introduction

Reason for guideline revision

Since the publication of the 'KNGF-Guideline for physical therapy in patients with chronic obstructive pulmonary disease' (COPD) in 2008 and the VvOCM Guideline on COPD in 2004, new insights have been obtained with regard to diagnosing and treating patients with COPD. For example, it has been clearly demonstrated that the degree of airflow limitation provides insufficient insight into the physical capacity, physical activity, perceived symptom burden and quality of life. Additionally, it has become clearer that physiotherapy and exercise therapy Cesar/Mensendieck (C/M) are very beneficial during and immediately following an exacerbation as well. In order to offer COPD patients the right therapeutic intervention(s) for the right goals – at the right place within the healthcare process – and to decrease practical variations, a revision of the existing guidelines for physiotherapy and exercise therapy C/M for COPD patients was needed. This revision was also a part of the agreements stemming from the System Advice (see explanation), whereby physiotherapy and exercise therapy C/M for COPD, among others, could again be included in basic healthcare insurance. The close correlation between physiotherapy and exercise therapy C/M was the impetus for the KNGF and VvOCM to merge the KNGF Guideline from 2008 and the VvOCM Guideline from 2004 into one joint guideline.

Goal of the guideline

The aim of this guideline is to provide a handbook for the daily practice of physical therapists and exercise therapists in diagnosing and treating COPD patients. By systematically evaluating scientific research and considering patient preferences and professional expertise, the KNGF Guideline on COPD supports therapists and patients in the clinical decision-making process and also offers transparency for other healthcare providers and involved parties. By formulating patient profiles (and the resulting diagnosis and treatment algorithm), this evidence-based guideline aims to enable customised care.
Recommendations in a guideline are not laws or mandatory rules. In principle, therapists should adhere to the provisions of the guideline, but substantiated deviation is legitimate and even necessary if this is commensurate with the individual patient's situation and wishes.

Target group

Patient group. This guideline is intended for the treatment of patients who have been diagnosed with COPD by a physician. Treatment of patients with other pulmonary diseases, such as asthma, interstitial or restrictive pulmonary diseases, is not a part of this guideline. The guideline does, however, concern almost all patient categories: patients with stable COPD, patients experiencing or recovering from an exacerbation and patients with mild, moderate or severe symptom burden. The guideline is aimed at patients with all degrees of airflow limitation (GOLD I-IV) as well as at patients with co-morbidity or in the palliative phase.

Intended users of the guideline. This guideline is primarily aimed at physical therapists and exercise therapists C/M who treat patients with health problems stemming from COPD, regardless of the setting (a primary care practice, hospital or rehabilitation facility; monodisciplinary or multidisciplinary setting).
This guideline contains recommendations that require specific knowledge and skills, for example:

- interpretation of medical test data, such as from the maximal exercise test and spirometry;
- exercise training in various types of patients (e.g. with oxygen supplementation, (non-) invasive ventilation or low oxygen saturation);
- various interventions for the respiratory system, such as respiratory muscle training and mucus clearance interventions;
- treatment of patients with complex co-morbidity, such as cardiovascular problems;
- treatment of patients during or immediately after an exacerbation;
- treatment of patients in the palliative phase.

Knowledge and skills can be acquired and updated by participating in continuing education and further training, amassing practical experience, reading professional literature and/or attending lectures. The statement 'bekwaam is bevoegd' ('competent is authorised') applies here.

The guideline is also relevant for other healthcare providers who are involved in monitoring and treating COPD patients, such as general practitioners, pulmonologists, (pulmonary) nurses, pulmonary nursing specialists, psychologists, occupational therapists and dieticians, as well as for patients, policy-makers and other organisations involved in the care of COPD patients. The guideline provides a clear picture of what is expected of therapists and of the information therapists need in order to work together with other involved healthcare providers.

Reading guide

The information in the guideline is divided into three sections (Section A: 'General', Section B: 'Diagnostic process' and Section C: 'Therapeutic process'). The general information in Section A contains the general introduction, background information about COPD and information about the way in which COPD care is organised. The Diagnostic process and Therapeutic process sections describe the respective methodologies.
The various topics within a section make up separate, stand-alone modules. In each module, the information is subsequently divided into three in-depth levels (the Practice Guideline, the Explanation and the Justification). The respective topic is then further elaborated on with each level. The practical tips are included in the Practice Guideline (the first level). The information about the topic being addressed and the consideration of the most important arguments that lead to the recommendation or description are contained in the notes included in the Explanation (the second level). The Justification (the third level) provides details about how this information was collected (including the search strategy, summary of results, evaluation of the quality of evidence and description of considerations), the process with which this deliberation came about and the references of the (scientific) literature used.

Where this document refers to 'he', this can also mean 'she'. Where this document refers to 'therapist', this can mean either 'physical therapist' or 'exercise therapist C/M'. Where this document refers to 'therapy', this can mean either 'physiotherapy' or 'exercise therapy C/M'.

Methodology

This guideline was developed in accordance with the KNGF Guideline Methodology 2019. The way this methodology was applied and the manner in which interested parties were involved in the development are described in the Justification of this module.

Definitions and terms

The Explanation of this module describes the most important definitions and terms used in this guideline.

A.2 COPD background

A.2.1 Pathophysiology

COPD is a common, often preventable and treatable (incurable) disease characterised by persistent respiratory problems (symptoms) and chronic airflow limitation resulting from airway and/or alveolar anomalies, usually caused by significant exposure to harmful particles and gasses.

A.2.2 Clinical presentation

The clinical presentation is characterised by permanent airflow limitation and respiratory symptoms, such as dyspnoea during exercise (and possibly also at rest afterwards) and possibly chronic cough with or without sputum production. In addition to physical aspects, emotional, psychological and/or social aspects are also important when identifying the symptom burden and determining therapy.

A.2.3 Etiological and prognostic factors

Smoking is the most important etiological factor for the development of COPD. Other etiological factors are atmospheric pollution, socioeconomic status, environmental factors in the early life stage and genetic factors. The course of COPD can be negatively impacted by the following

prognostic factors: continuing to smoke, exacerbations, respiratory failure, bad nutritional status and co-morbidity. In order to positively impact the course of COPD, quitting smoking is the most important prognostic factor.

A.2.4 Epidemiology and societal impact

Approximately 600,000 people have COPD in the Netherlands, with approximately 10,000 people with chronic bronchitis and 27,000 people with emphysema being added to this figure every year. Based on demographic developments, the absolute number of COPD patients will increase by 36% between 2015 and 2040. COPD is currently the fifth most common cause of death in the Netherlands. The healthcare costs for COPD are about EUR 1 billion annually (in 2015) in the Netherlands.

A.3 Organisation of care

A.3.1 The therapist's role

The therapist's role consists of the following:

- assessing and analysing COPD-related health problems in the area of physical functioning;
- compiling the treatment plan and treatment goals related to the therapeutic treatable traits (see A.3.3 'Treatable traits for physiotherapy and exercise therapy C/M');
- supervising and monitoring the therapy;
- referring patients if the patient is found to have health-related problems that the therapist cannot treat in his/her role;
- actively encouraging patients to be pro-active and encouraging patients to become/remain sufficiently physically active after conclusion of the therapy.

A.3.2 Organisation of multidisciplinary collaboration

Multidisciplinary collaboration between various healthcare professionals contributes to the possible success of the COPD treatment plan. One of the ways multidisciplinary collaboration takes place is collaboration within a COPD network or sequenced healthcare. COPD patients can be treated in a primary, secondary or tertiary care setting. Treatment in a primary care setting takes place in the patient's immediate surroundings.
Treatment in a secondary or tertiary care setting takes place in a hospital or a pulmonary rehabilitation facility.

A.3.3 Treatable traits for physiotherapy and exercise therapy C/M

Depending on the diagnosed limitations, physiotherapy and exercise therapy C/M for COPD patients is focused on one or more of the following three treatable traits:

- the physical capacity;
- the physical activity;
- the respiratory system.

A.3.4 Information exchange with referring physicians

The referral must list the following (recently measured) information:

- airflow limitation (FEV1);
- degree of dyspnoea (Medical Research Council [MRC] or modified Medical Research Council [mMRC]);
- symptom burden (score on the Clinical COPD Questionnaire [CCQ] or the COPD Assessment Test [CAT]);
- number of exacerbations experienced in the last 12 months;
- number of lung-related hospitalisations in the last 12 months;
- problem/reason for referral;
- relevant co-morbidity;
- current medications;
- results of relevant medical diagnostic tests.

If the patient uses medical oxygen, the referral must contain information about the dosage (continuous and/or exercise-dependent plus the settings for the flow rate in l/min).

Recommendations

Contact the referring physician if the necessary information is not listed on the referral.

Send a report to the referring physician and the care coordinator (if applicable) if therapy is not initiated, there are relevant interim changes or interim evaluations, the treatment is concluded and for every periodic follow-up session.

Compile reports and final reports in accordance with the valid NHG-KNGF Guideline on Structured Information Exchange between General Practitioners and Physical Therapists, the KNGF Guideline on Physiotherapeutic File-keeping and the VvOCM Guideline on Reporting.

After obtaining the patient's consent, send reports to both the referring physician and the care coordinator (if applicable). Optionally, a copy of the reports can be sent to other healthcare providers who are involved in the multidisciplinary treatment.

B Diagnostic process

This section of the Practice Guideline contains the recommendations concerning the diagnostic process for COPD patients.

B.1 Medical history taking

When taking the medical history, ask for relevant information using the aspects described in the overview below. If necessary, ask the referring physician for additional referral information which can be included in the results of the anamnesis.

Differentiate between two medical history aspects:
- treatable traits for therapeutic actions ('respiratory system', 'physical capacity', and 'physical activity' (see A.3.3 'Treatable traits for physiotherapy and exercise therapy C/M');
- the context in which the patient receives the therapeutic treatment.

Together with the need for assistance, both the treatable traits as well as the context-related factors are decisive for the COPD patient's physical examination and therapeutic treatment. Relevant information with regard to taking the medical history is described in the following overview.

Information from the medical history taking

Related to the therapeutic treatable traits:
- the patient's need for assistance;
- symptoms of fatigue at rest and during exercise, the current state and the course of the symptoms (CIS8R^{opt} and/or Borg Scale fatigue^{opt});
- symptoms of dyspnoea at rest and during exercise, the current state and the course of the symptoms (mMRC^{opt} and/or Borg Scale for Dyspnoea^{opt});
- signs of a disrupted respiratory system, such as coughing and the possibility of mucus clearance (item-CAT^{recomm});
- signs of decreased physical capacity;
- signs of decreased physical activity;
- signs of decreased balance/risk of falling (TUG^{opt}).

Information about the context:
- other symptoms not directly related to COPD, such as pain (NPRS[opt]), sleep problems or incontinence;
- presence of an exacerbation, number of exacerbations in the past year and severity of the exacerbations (with or without hospitalisation);
- existing co-morbidity and related experienced limitations in activities and participation;
- current medications;
- use of other aids, such as medical oxygen;
- contact with other healthcare providers;
- experienced health status/symptom burden (CCQ[recomm] or CAT[recomm]);
- knowledge of COPD and disease insight;
- self-reliance, self-management and empowerment with regard to (dealing with) physical functioning;
- feelings/symptoms of anxiety or depression (HADS[opt]);
- nutritional status (MUST[opt] and/or SARC-F[opt]);
- willingness, motivation and management strategies (self-efficacy, coping);
- risk and prognostic factors that impact the onset or exacerbation of symptoms (including smoking or exposure to hazardous gasses);
- employment status;
- hobbies;
- home environment, including the functioning of directly involved persons and/or caregivers;
- inhibiting or facilitating factors for physical activity.

Parameters can be defined with the help of a recommended ([recomm]) or optional ([opt]) measurement instrument (see B.3.1 'Recommended and optional measurement instruments'). CAT = COPD Assessment Test; CCQ = Clinical COPD Questionnaire; CIS8R = Checklist Individual Strength; HADS = Hospital Anxiety and Depression Scale; mMRC = modified Medical Research Council Dyspnoea Scale; NPRS = Numeric Pain Rating Scale; MUST = Malnutrition Universal Screening Tool; PSG = Patient-Specific Goal-setting method; Timed Up & Go test.

B.2 Physical examination

During the physical examination, relevant information should be collected by means of an assessment at rest, a functional assessment and the basic examination. If relevant, consult with the referring physician to ask for additional test data, such as results of the maximal exercise test. Relevant information concerning the physical examination is described in the following overview.

Examples of relevant aspects from the physical exam

Assessment at rest:
- posture, signs of dyspnoea and/or fatigue, cyanosis, muscular atrophy, hypertonia of (auxiliary) respiratory muscles and/or peripheral oedema;
- assessment of the shape of the thorax (static hyperinflation, deformities).

Functional assessment:
- obtainment of a clinical impression during (functional) movements (posture, balance dyspnoea and/or fatigue, use of a walking aid);
- assessment of the manner of breathing (respiratory rate, respiratory movement pattern, paradoxical thoracoabdominal movement at rest and during exercise, activity and hypertonia of (auxiliary) respiratory muscles;
- assessment of the manner of coughing and forced expiration to facilitate mucus clearance.

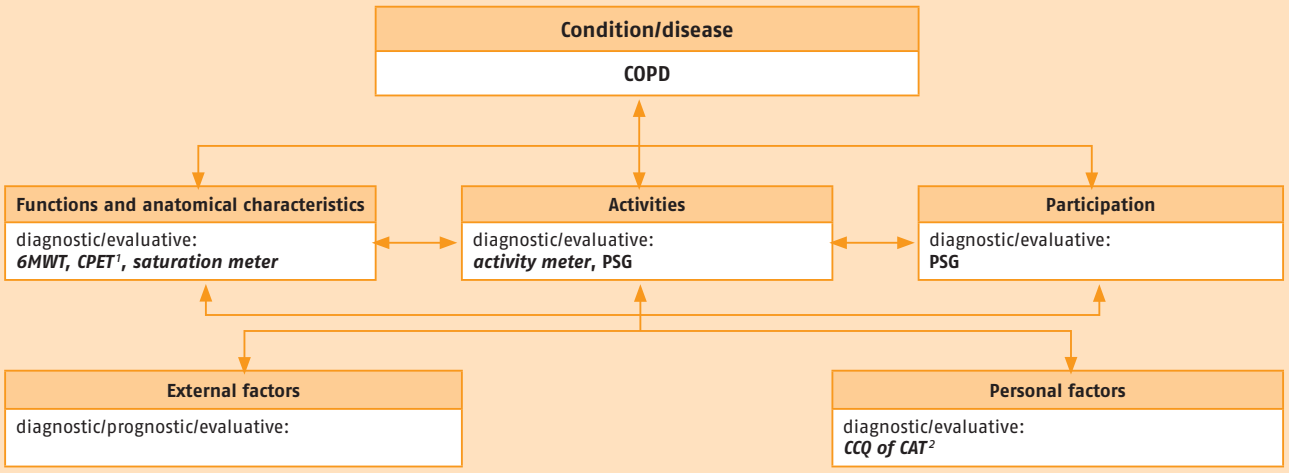
Basic examination:
- physical capacity (6MWT^{recomm} and/or SWT^{opt}, CWRT^{opt});
- degree of physical activity (activity meter^{recomm});
- oxygen saturation at rest and during exercise and (if applicable) with and without medical oxygen (saturation meter^{recomm});
- peripheral muscle strength (HHD^{opt} and/or 1RM^{opt});
- respiratory muscle function (MIP^{opt});
- balance/risk of falling (TUG^{opt}).

Parameters can be defined with the help of a recommended (^{recomm}) or optional (^{opt}) measurement instrument (see B.3.1 'Recommended and optional measurement instruments').
6MWT = Six Minute Walk Test; CWRT = Constant Work Rate Test on the bicycle; HHD = Hand-held dynamometer; MIP = Maximal Inspiratory Pressure test; SWT = Shuttle Walk Test; TUG = Timed Up & Go test.

B.3 Measurement instruments

B.3.1 Recommended and optional measurement instruments

Use the **recommended** measurement instruments for all patients, unless there is a patient-specific reason not to do this.
Use the **optional** measurement instruments (see the Explanation) only if there is a patient-specific reason to do this, specifically:
- there is a reason for assessing a parameter for which none of the recommended measurement instruments is suitable, or;
- there is a reason for assessing a parameter with a different measurement instrument than the measurement instrument recommended for this.



Explanation 6MWT = Six Minute Walk Test; CAT = COPD Assessment Test; CCQ = Clinical COPD Questionnaire; CPET = Cardiopulmonary Exercise Test; sPSG = Patient-Specific Goal-setting method.
italics = performance test/function test; non-italics = questionnaire/observation list. Note No relevant measurement instruments are available for recommended use as a measurement instrument to identify external factors.

[1] Only patients in profiles 4, 5 and 6 are referred for a CPET in consultation with the treating physician (see B.3.2 'Maximal exercise test' and B.5 'Patient profiles')
[2] If the CCQ or CAT has already been taken by a healthcare provider other than the therapist, and the therapist is aware of the results, this does not need to be done again.

Recommended measurement instruments

Recommended measurement instruments with interpretation and measurement frequency

Parameter	Measurement instrument	Interpretation (in relation to recommendations in this guideline)	Measurement time points*	Comments
physical activity	Activity meter	< 5,000 steps/day → insufficient ≥ 5,000 steps/day → sufficient	intake, interim evaluation, conclusion	
physical capacity	Six Minute Walk Test (6MWT)	< 70% of predicted value → insufficient ≥ 70% of predicted value → sufficient	intake, interim evaluation, conclusion	
max. exercise capacity	Cardiopulmonary Exercise Test (CPET)	see B.3.2 'Maximal exercise test'	intake	This test is recommended for patients in profiles 4, 5 and 6, in consultation with the treating physician requesting the test.
oxygen saturation	Saturation meter	see C.3.4 'Training in relation to oxygen desaturation'	intake and during treatment	
activities and participation in ADL	Patient-Specific Goal-setting method (PSG)	see B.6 'Setting goals'	intake, interim evaluation, conclusion	The PSG is the further elaborated version of Patient-Specific Complaints (PSC).
symptom burden	Clinical COPD Questionnaire (CCQ)	< 1 point → no symptom burden 1 to 1.8 points → mild to moderate symptom burden ≥ 1.9 points → high symptom burden	intake, interim evaluation, conclusion	It is recommended that the symptom burden be determined prior to commencing therapy (using the CCQ or CAT) by the medical specialist, general practitioner or nursing specialist.
	COPD Assessment Test (CAT)	< 10 points → no symptom burden 10 to 17 points → mild to moderate symptom burden ≥ 18 points → high symptom burden	intake, interim evaluation, conclusion	It is recommended that the symptom burden be determined prior to commencing therapy (using the CCQ or CAT) by the medical specialist, general practitioner or nursing specialist.

* The moment of the interim evaluation depends on the patient profile. See B.5 'Patient profiles' and C.7 'Evaluation and conclusion'.

B.3.2 Maximal exercise test

Consult with the treating physician about requesting a maximal exercise test (Cardiopulmonary Exercise Test; CPET) for clinically stable patients with limited physical capacity (profiles 4, 5 and 6; see B.5 'Patient profiles') for whom physical training is a part of the treatment. This test should preferably take place under the supervision of a pulmonologist.

Use the results of the maximal exercise test to determine whether physical training can be safely given, for identifying the constraints and for making a well-considered choice between the available therapy types and the intensity of the physical training.

Do not estimate the maximal exercise capacity based on submaximal exercise tests such as the Six Minute Walk Test.

No maximal exercise test needs to be done if there is a clear clinical indication that the test result has no added value for the treatment process, such as for patients in the palliative phase.

B.4 Red flags and referral

B.4.1 Red flags

Contact or refer (back) to the treating physician:
- if there is doubt about the follow-up of the medical treatment and/or;
- in the event of a suspected exacerbation;
- if red flags are found ('not OK'; see the next section) and/or;
- if this is the patient's wish.

Consult with the treating physician as to whether or not the therapy can be continued.

COPD-related red flags
- Desaturation in room air, measured with a saturation meter:
  - at SpO_2 < 90% at rest (after at least 10 minutes of sitting)
  - at SpO_2 < 85% during a physical test or exercise therapy
- Peripheral oedema
- Haemoptysis (coughing up blood)
- Excessive sputum production compared to normal
- Cyanosis and/or sleepiness during the day in combination with headache
- Fever
- Tachypnoea at rest
- Suspicion of previously unknown co-morbidity
- Exacerbation of known co-morbidity

Generic red flags
- Unstable angina pectoris, chest pain or heart spasms
- Heart palpitations ('a strong pumping feeling') in the chest, throat or neck
- Dizziness after physical exertion
- Decreased consciousness or loss of consciousness
- Acute onset of swelling in one leg, a heavy feeling or pain in the leg and/or red or blue discolouration of the leg
- Sudden, very severe pain or 'ripping pain' in the chest, possibly radiating to the neck, jaw and/or arms
- Sudden, very severe pain or 'ripping pain' in the back, between the shoulder blades, possibly radiating to the lower back and/or chest
- Pressure in the chest
- Sudden severe dyspnoea at rest
- Tingling and prickling in the arms and/or legs
- Nausea
- Weight gain due to fluid accumulation in the body, especially in the legs
- Systolic blood pressure > 200 mmHg at rest and/or diastolic blood pressure > 120 mmHg at rest
- Tachycardia at rest (> 120 beats/min) or bradycardia at rest (< 40 beats/min)
- Increased risk of falling (two or more falls in the past year or at least one fall in combination with increased risk of fracture, blackouts or a mobility problem (TUG ≥ 20 sec) of unknown origin
- Sudden onset of local muscle pain, often with spasms
- Passive stretching or tensing of an affected muscle causes pain
- Dented and/or abnormally swollen muscle belly above or underneath an affected area
- Blue discolouration underneath an affected area
- Long-lasting stiffness of an affected area
- Loss of function of a body part
- Sudden memory impairment, disorientation and/or language impairment

mmHg = millimetres of mercury; SpO_2 = peripheral oxygen saturation; TUG = Timed Up & Go test.

B.4.2 Referral to other healthcare providers

If the therapist has insufficient knowledge and skills to adequately treat a patient, but the patient can be adequately treated within the physiotherapy or exercise therapy C/M discipline, the patient should be referred to a therapist with the required knowledge and skills. Unskilled is unauthorised.

Contact the referring physician if the therapist determines that a patient has health problems that cannot be adequately treated within the physiotherapy or exercise therapy C/M discipline.

Referral to an occupational therapist can be considered in consultation with the treating physician or care coordinator if there is a need for assistance regarding the activity and/or participation level that cannot be optimally addressed with physiotherapy or exercise therapy C/M and whereby skills must be acquired to allow the patient to cope with their constraints in daily life (possibly with the support of aids and/or resources).

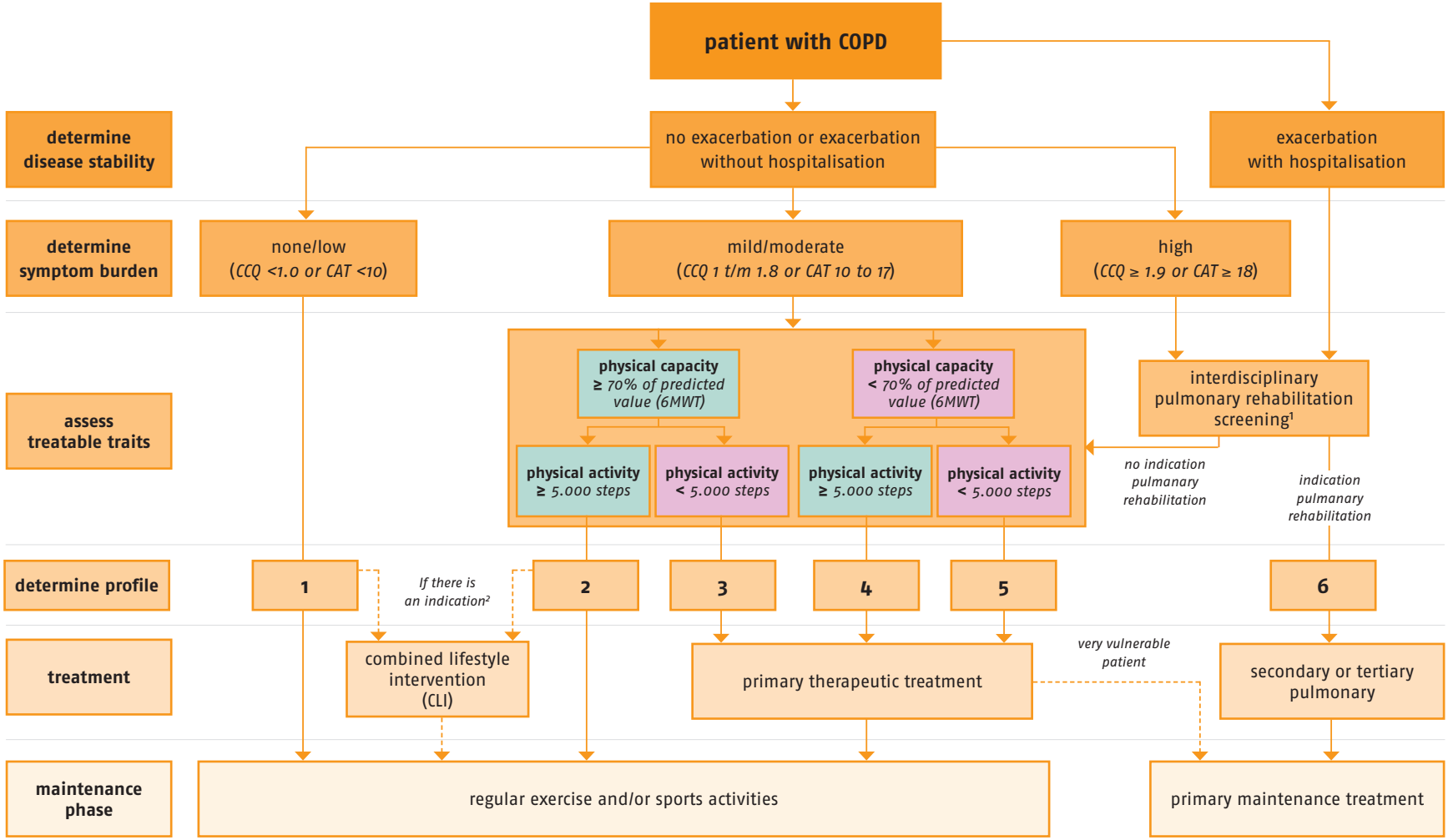
Referral to a dietician can be considered in consultation with the treating physician or care coordinator if there is a high risk of malnutrition (MUST and/or sarcopenia [SARC-F]).

Referral to a psychologist can be considered in consultation with the treating physician or care coordinator if there is a high risk of anxiety and/or depression (HADS) or in the presence of other psychological problems and/or symptoms that hinder the patient's treatment to a significant degree.

B.5 Patient profiles

Determine the patient profile based on the following traits:
- disease stability (no measurement instrument), assessed by the general practitioner or pulmonologist;
- symptom burden (CCQ or CAT), assessed by the general practitioner or pulmonologist;
- physical capacity (6MWT), assessed by the therapist;
- physical activity (activity meter), assessed by the therapist.

See the following diagram for determining the correct patient profile and the associated care:



1 For the assessment criteria, see the Explanation for this module. If the screening does not yield an indication for pulmonary rehabilitation, the patient is referred to primary care.

2 The general practitioner assesses whether there is an indication for a combined lifestyle intervention (CLI).

Patient profile flowchart

Offer care that is aligned with the patient profile:
- **Profile 1** No therapy, advise participation in regular exercise and/or sports activities, consider consultation with the general practitioner about a referral for a combined lifestyle intervention (CLI).
- **Profile 2** No (or very limited) therapy, advise participation in regular exercise and/or sports activities, consider consultation with the general practitioner about a referral for a CLI.
- **Profile 3** Primary care therapy primarily focused on optimising physical activity and then transition to regular exercise and/or sports activities or follow-up in the form of maintenance treatment.
- **Profile 4** Primary care therapy primarily focused on facilitating physical capacity and then transition to regular exercise and/or sports activities or follow-up in the form of maintenance treatment.
- **Profile 5** Primary care therapy primarily focused on facilitating physical capacity, optimising physical activity and then transition to regular exercise and/or sports activities or follow-up in the form of maintenance treatment.
- **Profile 6** Secondary or tertiary interdisciplinary pulmonary rehabilitation, followed by maintenance treatment in a primary care setting.

Reassess the patient profile if the patient experiences an exacerbation.

Only offer maintenance treatment to keep the physical functioning stable – in consultation with a multidisciplinary team or the treating physician – to patients who are not adequately able to perform exercise and/or sports activities independently. This can be patients who have undergone secondary or tertiary pulmonary rehabilitation or very vulnerable patients with at least one of the following traits:
- chronic oxygen therapy at home and/or;
- non-invasive ventilation and/or;
- co-morbidity resulting in significantly limited physical functioning (6WMD < 350 metres) and/or;
- limited health literacy (level 1 or 2: the recommendation is to estimate the health literacy based on the activation level, if possible assessed with the Patient Activation Measure (PAM). See the Explanation) and/or;
- on the lung transplantation waiting list and/or;
- in the palliative phase.

Conclude the maintenance treatment if the patient is able to perform exercise and/or sports activities independently.

B.6 Setting goals

Use the Patient-Specific Goal-setting method (PSG) to formulate personal treatment goals together with the patient that are commensurate with his need for assistance.

Focus both diagnostics as well as interventions on:
- facilitating the patient's physical functioning the way he/she wants this, within realistic possibilities;
- the health-related quality of life.

Concentrate on the patient's individual context and physical functioning:
- Obtain a complete picture of the patient's physical functioning (limitations and possibilities regarding activities in ADL and participation) and determine which exercises are feasible.
- If desired, formulate a treatment goal that is aimed at increasing self-management with regard to physical functioning.
- Tailor the specific treatment goals to the need for assistance. In doing so, aim to increase the patient's self-reliance, if necessary.

B.7 Diagnostic actions for sub-groups

B.7.1 Diagnostic actions in the presence of co-morbidity

Based on medical referral data and medical history, assess whether there is co-morbidity that could impact physical functioning, such as cardiovascular disease, musculoskeletal disorders, symptoms of anxiety and depression and/or abnormal body composition.

Assess medication use by requesting clinical information and the medication overview from the patient, referring physician and/or pharmacist. Be alert to medication that can impact physical functioning, such as anti-hypertensives, diuretics, antipsychotics, antidepressants and/or insulin.

When training for physical capacity (profile 4, 5 and 6) in people with cardiovascular disease, the maximal exercise test (Cardiopulmonary Exercise Test; CPET) is used to determine whether training is safe, and if so, at which intensity.

B.7.2 Diagnostic actions in the presence of an exacerbation

Be alert to symptoms that indicate an exacerbation and refer patients to the treating physician if there is a suspicion of an exacerbation.

Immediately initiate or resume therapy in patients with an exacerbation if the clinical status permits this. This applies to patients both with and without hospitalisation.

Be alert to red flags in relation to the exacerbation before initiating, resuming or continuing therapy. If such red flags are present, discuss these with the treating physician.

Be alert to the fact that after a hospitalisation patients need to be screened for interdisciplinary pulmonary rehabilitation. If screening is not feasible in the short term, the patient is referred – so as to bridge the gap – to primary care in order to maintain the level of physical functioning and train the respiratory muscle function, if necessary. This also applies if a pulmonary rehabilitation spot is not immediately available after screening.

In particular assess the following aspects with regard to an exacerbation and compare these to a patient's stable situation:
- course of symptoms and disease;
- factors impacting the symptoms and their progression;
- feelings of dyspnoea at rest and during exertion;
- decreased exercise capacity and limitations when performing normal daily physical activities;
- oxygen saturation at rest and during exertion and recovery;
- disrupted mucus transport;
- the patient's need for information.

B.7.3 Diagnostic actions in the palliative phase

Within the framework of proactive care planning, ensure that the patient and the treating physician/head practitioner engage in a timely discussion during which the goal of the physiotherapy and exercise therapy is also addressed.

Take into account the stages of palliative care and the patient's needs, boundaries and wishes. Based on the above, formulate therapeutic treatment goals together with the patient and coordinate these goals with other involved healthcare providers. During the palliative phase, gradually change the treatment goals from maintaining physical capacity to decreasing symptoms, such as fatigue, dyspnoea and depression/anxiety.

Potentially involve the patient's caregivers and loved ones in formulating the treatment goals.

C Therapeutic process

This section of the Practice Guideline contains the recommendations concerning the therapeutic process for COPD patients.

C.1 Counselling and advice

Integrate counselling and advice for patients and any caregivers into the therapy.

When providing counselling and advice, take into account the possible presence of limited health literacy, a cognitive limitation and/or other potential psychosocial factors.

Focus the counselling and advice on:
- Disease-specific information: Provide counselling on what COPD is, its effects on physical functioning in daily life and possible treatable traits of the therapy. Provide advice about the role of physical activity as a part of a healthy lifestyle.
- Self-management and empowerment: Discuss the impact of COPD and exacerbations on physical functioning and how to deal with this. Provide advice about the patient's own role in the treatment and learning to cope with the disease.
- Energy management and adjustments to daily activities: Provide advice about the patient's daily/weekly schedule and (physical) activities. Take into account the balance between work-load and load-bearing capacity and the impact of physical activities, therapy and exercise sessions.
- Use of (walking) aids: If necessary, advise the patient to use a (walking) aid and how to use this aid.
- Use of social services and contact with fellow patients: If necessary, advise the patient to make use of social services and establish contact with fellow patients.

C.2 Optimisation of physical activity

Offer interventions to facilitate physical activity in patients with insufficient physical activity (profiles 3, 5 and 6). Be alert to overload in patients who are sufficiently active.

Focus on achieving behavioural change aimed at optimising the patient's physical activity while taking into account the phases of behavioural change. In doing so, consider using Motivational Interviewing.

Employ the following activities (among others) per behavioural change phase:
- Inform and check whether the patient understands the information (knowing).
- Formulate goals together regarding functional physical activities (wanting).
- Jointly perform the physical activities (experiencing/being able).
- Make agreements regarding the home environment (doing) and evaluate these (continuing).

Discuss and take into account possible facilitating and inhibiting physical, psychological, social and/or external factors.

When possible, use an activity meter to provide the patient insight into his activity pattern and discuss the results together with the patient.

C.3 Facilitation of physical capacity

The following is used for facilitating physical capacity:
- endurance/interval training;
- muscle strength training;
- hydrotherapy;
- oxygen desaturation and training with oxygen supplementation;
- neuromuscular electrical stimulation.

C.3.1 Endurance/interval training

- Offer endurance/interval training to COPD patients with limited physical capacity (profile 4, 5 and 6), then use the FITT principles (frequency, intensity, type and time) as follows:

Frequency[1]	• 3-4 days per week during the initial treatment period to facilitate physical capacity • then 1-2 days per week to maintain physical capacity
Intensity[2]	• endurance training: 60-80% of the maximum workload • interval training: 85-100% of the maximum workload • build up intensity in part based on symptoms (Borg score 4-6 on a scale of 0-10 points)
Type	• depending on the patient's goal, but preferably on a treadmill or stationary bicycle
Time duration	• endurance training: exercise session of at least 10 consecutive minutes • interval training: 30-60 seconds with a 1-2 minute break between sets • total duration of the training session: 20-60 minutes

1 Here it's about the training frequency, both supervised and unsupervised.
2 The maximum workload is determined using a maximal exercise test (CPET) See B.3.2 'Maximal exercise test'.

Consider using interval training if:
- the maximal exercise test (CPET) shows that the patient is ventilatory limited and/or has an exercise-induced transcutaneously measured oxygen desaturation and can also continue exercising for < 10 minutes during an endurance cycling test at 75% of the maximal cycle load and/or
- increasing the time and/or intensity of the endurance training is not feasible (any longer).

Consider endurance training in all other cases.

Consider partially or entirely replacing the endurance/interval training with muscle strength training if the endurance/interval training becomes (almost) impossible due to inadequate muscle function and/or severe dyspnoea, for example. See C.3.2 'Muscle strength training'.

C.3.2 Muscle strength training

The preference is to offer muscle strength training if the patient has limited physical capacity and:
- muscle strength is decreased and there is a set goal of improving this and/or;
- the patient has (or is recovering from) an exacerbation and/or;
- endurance/interval training is almost impossible due to inadequate muscle function and/or severe dyspnoea, for example. See C.3.1 'Endurance/interval training'.

If muscle strength training is offered, then use the FITT principles (frequency, intensity, type and time) as follows:

Frequency[1]	• 2-3 days per week, both for facilitation and maintenance of muscle strength
Intensity	• 60-80% of 1RM
Type	• depending on the patient's goal, but preferably the large muscle groups of both the lower and upper extremity • exercises with equipment and/or functional exercises

Time duration	• 2–5 sets of 8–15 reps per exercise with at least a 2-minute break after each set

1 Here it's about the training frequency, both supervised and unsupervised.
RM = repetition maximum.

Consider replacing muscle strength training with neuromuscular electrical stimulation (NMES) if active exercise is entirely impossible due to pronounced dyspnoea. See C.3.5 'Neuromuscular electrical stimulation'.

The preference is to not use whole body vibration when administering muscle strength training. If the patient has balance problems, use of whole body vibration can be considered.

C.3.3 Hydrotherapy

The preference is to not offer physical training in the form of hydrotherapy to COPD patients. Only offer hydrotherapy if:
- the patient has additional physical problems that severely limit conventional physical training, such as joint osteoarthritis and/or pronounced obesity and/or
- the patient has a strong preference for physical training in the form of hydrotherapy.

C.3.4 Training in relation to oxygen desaturation

Measure the oxygen saturation with a transcutaneous Sp02 meter (saturation meter).

Only start the physical test or exercise therapy with a transcutaneously measured resting SpO_2 ≥ 90%.

Contact the referring physician if the transcutaneously measured resting SpO_2 is still < 90% after 10 minutes of sitting before the COPD patient starts a physical test or exercise therapy.

Stop the physical test or exercise therapy with a transcutaneously measured SpO_2 < 85% and contact the referring physician.

With SpO_2 values of < 90% during physical activity, monitor the Sp02 recovery after completing the physical test or exercise therapy. Contact the referring physician if the transcutaneously measured SpO_2 in the recovery phase (2 minutes after the physical activity) does not recover sufficiently (= pre-exercise resting SpO_2).

C.3.5 Neuromuscular electrical stimulation

Do not treat patients with stable COPD with neuromuscular electrical stimulation (NMES) if they are able to perform physical training themselves.

Consider (a referral for) treatment with NMES if patients with stable COPD are not able to perform physical training themselves for a longer period of time.
This approach can be applied, for example, for patients with very severe dyspnoea when dressing/changing clothes in combination with weakened leg muscles, for patients with orthopaedic problems, for bedridden patients and/or for patients with a severe COPD exacerbation.

Consider NMES treatment in combination with mobilisation exercises for patients who were hospitalised due to a COPD exacerbation.

Administer NMES treatment for patients who are ventilated, are long-term bedridden and/or for severely weakened patients who are difficult to mobilise.

If treatment with NMES is indicated, administer this as follows:
- stimulate at least the femoral quadriceps muscles;
- the preference is to place large, rubber electrodes on the abdominal muscle with the greatest possible spacing;
- use a rectangular pulse with a frequency of at least 35 Hz and a pulse duration of at least 300 µs in a series time with a 1:1 to 1:2 ratio;
- set the intensity (pulse amplitude) so high that the contraction is visible and/or tangible, preferably to a maximum tolerance threshold without pain;
- stimulate for at least 15 minutes per session for at least four weeks, with a treatment frequency of three times per week;
- when possible, combine NMES with active exercises.

C.4 Interventions focused on the respiratory system

C.4.1 Respiratory muscle training

The preference is to offer respiratory muscle training to patients with decreased respiratory muscle function (PI_{max} < 70% of the predicted value):
- if a patient has dyspnoea and if the goal is to decrease this dyspnoea and/or;
- if severe dyspnoea makes endurance/interval training nearly impossible.

Only offer respiratory muscle training if the patient has sufficient motivation and skills to independently perform the respiratory muscle training (after instruction) and is willing to acquire the required equipment.

If respiratory muscle training is offered, then use the FITT principles (frequency, intensity, type and time) as follows:

Frequency	• at least 5 days per week, 1-2 sessions per day to facilitate the respiratory muscle function • then 2 to 3 days per week to maintain the respiratory muscle function
Intensity	• 30-50% PI_{max} (depending on the device)
Type	• resistance training with threshold and flow-resistive, or with threshold in combination with a flow-resistive device (tapered flow-resistive loading)
Time duration	• 30 breaths per session (a session lasts about 5 minutes)

C.4.2 Breathing techniques

Respiratory interventions should preferably be administered to COPD patients in order to decreases dyspnoea.

Consider teaching pursed lip breathing (PLB) to patients with exercise-induced dyspnoea and patients who are not yet automatically applying PLB. Make all patients aware of this technique and its effect (even if patients are already automatically applying it) and that PLB can be applied during and after exercise.

The preference is not to teach diaphragmatic breathing to COPD patients, especially not patients with hyperinflation and/or Hoover's sign.

Only consider applying ventilation feedback if a feedback device is available at the practice. Preferably do not administer the intervention if the patient is too fatigued for this.

Consider administering a combination of the various above-mentioned breathing techniques, but at least consider administering PLB. Also consider administering breathing techniques in combination with exercise interventions. After instructing the patient on a breathing technique (taking into account the patient's preferences), assess which additional respiratory intervention could be of added value.

Teach the breathing techniques for those activities in the patient's daily life that are difficult due to dyspnoea.

C.4.3 Relaxation techniques

Consider using relaxation techniques for COPD patients who have dyspnoea, sleeping problems, stress and/or a high degree of muscle tension in order to decrease the dyspnoea, stress and/or anxiety. Discuss with the patient what the cause of the stress/anxiety could be.

If the patient has persistent or a very high degree of anxiety (possibly even panic) with dyspnoea, and if performing relaxation exercises does not result in anxiety reduction, consult with the treating physician or care coordinator to see whether there might be an indication for a referral to a psychologist.

Together with the patient, tailor the relaxation technique to the patient's preferences so that the technique can also be used at home in case of increased dyspnoea.

C.4.4 Posture adjustments

To decrease dyspnoea, consider having the patient perform (breathing) exercises and activities slightly bent over forward, with the patient (potentially) additionally supporting himself with his hands and arms (e.g. on his knees or on a chair or walker). This posture can also be adopted after the exercises or activities for decreasing dyspnoea. Ask the patient whether this posture is comfortable.

C.4.5 Mucus clearance

Preferably apply techniques for facilitating mucus clearance for patients with COPD (both stable COPD and with an exacerbation) and symptomatic hypersecretion.

Start by teaching active breathing techniques with which the patient can facilitate mucus clearance independently.

The preference is to use an aid if the patient has grasped the active breathing techniques but is still unable to cough up the sputum adequately and/or efficiently (retention).
If an aid is used, administer positive expiratory pressure (PEP) or oscillating positive expiratory pressure (O-PEP).

The preference is not to use any passive techniques such as vibration, percussion and/or postural drainage.

C.5 Therapist supervision

C.5.1 Supervision duration and frequency

In the intensive treatment phase, focus on *achieving* the treatment goal. In the scale-down phase, focus on *maintaining* the treatment goal and *transitioning* to regular sports and exercise activities in the maintenance phase.

Align the duration and frequency of supervision with the patient's treatment goals, but consider maintaining at most the following number of sessions (the recommended maximum number of sessions may deviate from the reimbursement entitlement):

Profile 1 → 0 sessions (no indication for physiotherapy/exercise therapy C/M);
Profile 2 → at most 6 sessions;
Profile 3 → at most 42 sessions;
Profile 4 → at most 62 sessions;
Profile 5 → at most 70 sessions;
Profile 6 → n/a (secondary or tertiary pulmonary rehabilitation).

For patients in profile 2: Do not initiate treatment unless there is an indication for respiratory system interventions whereby the patient needs to be instructed over the course of several sessions.

For patients in profile 3, 4 or 5: Wherever possible, integrate interventions focused on counselling and advice and interventions focused on the respiratory system into the sessions that primarily focus on facilitating physical activity and/or facilitating physical capacity.

The recommended maximum number of sessions does not apply to patients who are eligible for maintenance treatment. See B.5 'Patient profiles'. Consider a permanent treatment frequency of once per week for these patients. Conclude the maintenance treatment if the patient is able to perform exercise and/or sports activities independently.

C.5.2 Group exercise therapy

Preferably offer group exercise therapy where intensive customised supervision can be provided. Only if this is not possible for practical reasons (for example, if the patient must be treated at home) should the supervision take place on an individual basis.

Estimate the optimal therapist/patient ratio based on patient factors (symptom burden, patient traits), therapist factors (skills) and organisational factors (facilities), but do not exceed six patients per therapist.

C.6 Therapeutic actions for sub-groups

C.6.1 Therapeutic actions in the presence of co-morbidity

If necessary, monitor specific parameters extra thoroughly and be alert during the treatment session to signs of unknown/new co-morbidity, exacerbation of existing co-morbidity and/or red flags regarding co-morbidity during the diagnostic and therapeutic process.

Be alert to symptoms related to a cardiovascular risk during the training, such as sudden chest pain. See B.4.1 'Red flags'.

Consider adjusting exercises if problems with the musculoskeletal system inhibit the training. You can opt for joint-alleviating training so that the patient can still train at the optimal intensity, or for specific exercises to help decrease the problems of the musculoskeletal system.

If the patient has symptoms of anxiety and depression, be alert to a possible drop-out during the treatment period. See B.4.2 'Referral to other healthcare providers'. Consult with the referring physician, if necessary.

Be alert to (an increased risk of) malnutrition and/or sarcopenia. See B.4.2 'Referral to other healthcare providers'. Consult with the referring physician, if necessary.

In addition to knowledge and skills regarding COPD, modifying exercise therapy also requires knowledge and skills relating to the co-morbidity. The general principle of 'unskilled is unauthorised' applies here. If the treating therapist has insufficient knowledge and skills with regard to the patient's existing co-morbidity, the therapist should refer the patient to a therapist who does have the required knowledge and skills.

C.6.2 Therapeutic actions in the presence of an exacerbation

In the event of an exacerbation, the patient should be activated or mobilised as quickly as possible as permitted by the clinical status.
If the usual exercise therapy cannot be administered to the patient experiencing an exacerbation with sufficient intensity to achieve the physical capacity goals due to dyspnoea and/or fatigue, strategies should be applied that make fewer demands on the patient's ventilation and gas exchange, such as muscle strength training and NMES.

Be alert to sputum retention and administer mucus clearance techniques, if necessary.

Be alert to the fact that after hospitalisation due to an exacerbation the patient needs to be screened for interdisciplinary pulmonary rehabilitation.

In the event of an exacerbation, be alert to a decrease of physical capacity and physical activity and adjust interventions in order to optimise physical capacity and physical activity, if necessary.

C.6.3 Therapeutic actions in the palliative phase

Take into account the stages of palliative care and the needs, boundaries and wishes of the patient and his caregivers and loved ones and adjust interventions accordingly. Prior to each session, ask the patient which treatment type he currently needs.

During the palliative phase the interventions should be gradually focused more and more on lessening symptoms such as fatigue, dyspnoea and depression/anxiety, and less on improving physical capacity. Consider physical training to maintain physical capacity.

Be alert to decreases in physical activity. Consider using facilitating interventions if the patient's physical capacity permits this. See C.2 'Optimisation of physical activity'.

Do not direct information and advice solely to the patient but also to the patient's caregivers and loved ones, for example information and advice about (lying) posture and doing transfers. Involve an occupational therapist if the patient is unable to independently perform basal transfers (such as from the bed to a chair).

Consider using neuromuscular electrical stimulation to stabilise the muscle function of the muscle groups of the lower extremity if active exercise is not possible. See C.3.5 'Neuromuscular electrical stimulation'.

Consider teaching breathing techniques and relaxation exercises in order to combat dyspnoea and anxiety, respectively. See C.4.2 'Breathing techniques' and C.4.3 'Relaxation techniques'.

Treat the patient if he experiences a positive effect on the symptom burden and tailor the treatment frequency to the individual situation.

If none of the therapeutic interventions have an effect on the symptoms, the therapy should be stopped – in consultation with the patient and the treating physician.

C.7 Evaluation and conclusion of the therapeutic process

Evaluation and conclusion take place in accordance with the valid KNGF Guideline on File-keeping or the VvOCM Guideline on Reporting.

For each therapist-patient contact, the relevant treatment data are documented according to the SOAP (subjective, objective, analysis and plan) system.

Evaluate the treatment goals after 12 weeks and after therapy conclusion, preferably using measurement instruments as described in B.3.1 'Recommended and optional measurement instruments'.

When the therapeutic process has concluded, the patient is advised about independently maintaining the achieved goals during the maintenance phase, where possible.
The therapist can give the patient tips about maintaining physical capacity and physical activity in their daily life, among other things.

After conclusion of the treatment period, evaluate the symptom burden, physical activity and physical capacity two to three times per year.

Consider restarting the treatment based on the profile classification if the patient experiences a clinically relevant setback in:
- symptom burden (from none to mild/moderate or from mild/moderate to severe); and/or
- physical activity (a decrease of 1,500 steps per day or more); and/or
- physical capacity (a decrease of the 6-minute walking distance by 45 metres or more).

If the patient experiences an exacerbation in the interim, the treatment is immediately resumed.

The therapy is stopped early if:
- the patient's need for assistance has been resolved because the therapeutic treatment goals have been achieved; and/or
- interim evaluations reveal that no or inadequate therapeutic effect has been achieved without a clear explanation; and/or
- the patient is able to continue the treatment through regular exercise and/or sports activities; and/or
- the patient, regardless of the symptom burden and regardless of the degree of physical capacity or physical activity, cannot in any way be motivated to be/remain therapy-compliant; and/or
- there are red flags or contraindications for exercise therapy.

Inform the referring physician about the reason for stopping the therapy early.

Notes

Note A.1 Introduction

The Practice Guideline explains the reason for and the objective of this guideline revision. This section of the guideline contains an explanation of the 2016 System Advice and the most important terms in this guideline. The KNGF Guideline on COPD was developed in accordance with the 2019 KNGF Guideline Methodology. The Justification describes how this methodology was applied to this specific guideline.

System Advice

In 2016 the Healthcare Institute of the Netherlands (Zorginstituut Nederland [ZiN]) issued advice to the Ministry of Health, Welfare and Sport to change the way of determining physiotherapy and exercise therapy claims with regard to the fee structure. The most important reason for this was that current claims result in patients/insured parties opting for more expensive types of care that are fully reimbursed.
The Ministry adopted this advice in part, and stresses that experimentation should take place in particular with regard to disorders where physiotherapy and exercise therapy offer a good chance of substitution (replacing expensive care with inexpensive care with comparable effectiveness). The ZiN determined priorities within the framework of the advice implementation. Part of the ZiN's advice is that there must also be guidelines for the respective disorders that comply with the Assessment Framework (ZiN 2018). Within the framework of the System Advice, development of this guideline was co-financed by the Ministry of Health, Welfare and Sport – in addition to the financing from the KNGF and the VvOCM.

Status of a guideline

Recommendations in a guideline are not laws or mandatory rules. In principle, therapists should adhere to the provisions of the guideline, but substantiated deviation is legitimate and even necessary if this is commensurate with the individual patient's situation and wishes (AQUA 2014).

Most important definitions and terms

- *COPD*. Chronic obstructive pulmonary disease, a disease characterised by persistent respiratory symptoms and chronic airflow limitation resulting from airway and/or alveolar anomalies, usually caused by significant exposure to harmful particles and gasses (GOLD 2020).
- *Traits of the individual patient*. Disease-related traits, environmental factors and demographic factors that can be influenced by therapy or that can influence therapy.
- *Symptom burden*. A COPD patient's physical, emotional and psychological and/or social discomforts (Slok 2014).
- *Integral health status*. An overall concept comprised of the following four main domains: 1) physiological functioning, 2) symptoms, 3) functional impairment and 4) quality of life (Wilson 1995; Vercoulen 2008). Each of these four domains represents a unique aspect of someone's integral health status. In COPD, physiological functioning entails the primary lung function disorder(s), any systemic consequences and potential co-morbidity. Whether and to what extent physiological functioning leads to symptom burden is moderated through adaptation (Peters 2017). Adaptation to physiological dysfunction is determined by psychological and cultural traits. See the Diagram of the integral health status and its sub-components.

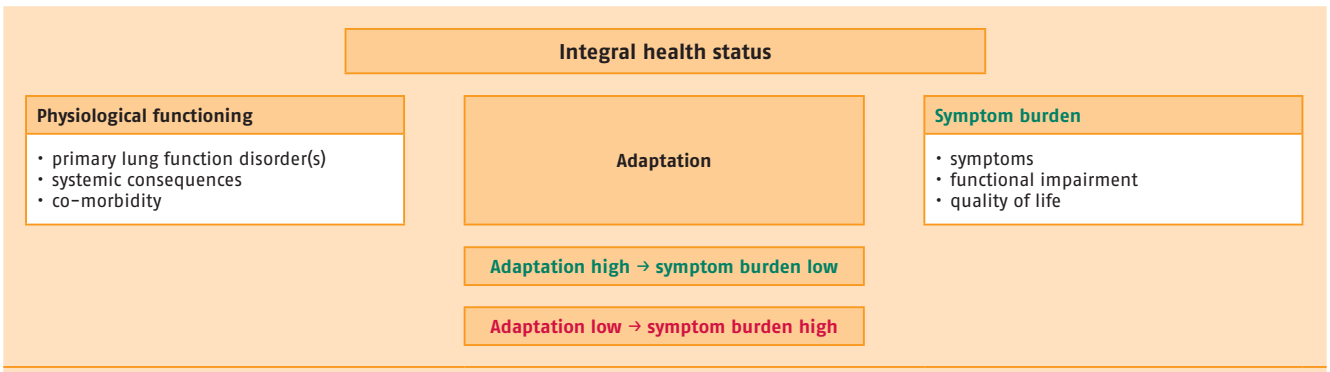


Diagram of the integral health status and its sub-components.

- *Exacerbations*. An acute exacerbation of respiratory symptoms resulting in additional treatment (Burge 2003; Hurst 2007; Seemungal 1998; Wedzicha 2007) with or without hospitalisation (GOLD 2020).
- *Co-morbidity*. One or more disorders presenting in the same patient in addition to the primary disorder of COPD for which the patient is being treated (index disease). This co-morbidity is: 1) a medical condition that occurs simultaneously with, but is independent of, the other medical condition or 2) a medical condition that causes the other medical condition, is caused by the other medical condition or is related in some other manner to the other medical condition in the same patient (Valderas 2009).
- *Physical capacity*. The ability to perform activities that require physical actions (Puente Maestu 2016), expressed in the following measures that can be influenced by therapy: muscle strength, muscle endurance, cardiovascular exercise capacity (maximal and submaximal) (De Morree 2011) and balance. For more information, see A.3.3 'Treatable traits for physiotherapy and exercise therapy C/M'.
- *Physical activity*. A parameter for exercise behaviour, consisting of every physical activity that is generated by skeletal muscles and requires energy utilisation (Caspersen 1985; WHO 2018). The guideline expresses physical activity as the ratio between sedentary behaviour and active behaviour that can be influenced by therapy, such as lying, sitting, standing and moving. For more information, see A.3.3 Treatable traits for physiotherapy and exercise therapy C/M'.
- *Respiratory system*. The vital pump for ventilation, consisting of the chest wall (thorax and abdomen) and respiratory muscles (Gosselink 2016). The respiratory system is characterised by the following functions that can be influenced by therapy: respiratory muscle function, breathing technique, posture and mucus evacuation. For more information, see A3.3 'Treatable traits for physiotherapy and exercise therapy C/M'.

Note A.2 COPD background

Note A.2.1 Pathophysiology

Clinical question
What is the pathophysiology of COPD?

This guideline uses the definition of the Global Initiative for Chronic Obstructive Lung Disease (GOLD) from 2020 (box).

The definition of COPD according to the 2020 GOLD Guideline
According to the GOLD Guideline, COPD is defined as a common, preventable and treatable (incurable) disease characterised by persistent respiratory problems (symptoms) and chronic airflow limitation resulting from airway and/or alveolar anomalies, usually caused by significant exposure to harmful particles and gasses (GOLD 2020) (www.goldcopd.com).

The COPD pathology consists of emphysema and chronic bronchitis. The relative contribution of emphysema and chronic bronchitis to COPD varies from person to person. For more background information on the pathophysiology, go to www.goldcopd.com.

Note A.2.2 Clinical presentation

Clinical question
What is het clinical presentation of COPD?

The clinical presentation is characterised by permanent airflow limitation and respiratory symptoms, such as dyspnoea during exercise (and possibly also at rest afterwards) and possibly chronic cough with or without sputum production (Gibson 2013). These symptoms increase when airflow limitation is worsened due to an exacerbation. In addition, co-morbidity with COPD is a common occurrence (GOLD 2020).
FEV1 is the traditional physiological indicator for determining the severity of the airflow limitation in COPD patients. However, this measurement provides insufficient information about the symptom burden and the disease course. The functional exercise capacity, measured by the Six Minute Walk Test (6MWT), is only related to FEV1 to a limited extent (Agusti 2012; Spruit 2010). Dyspnoea during physical activity occurs in patients with mild to very severe COPD and therefore has a limited relationship with the degree of airflow limitation (O'Donnell 2016).

In addition to physical aspects, emotional, psychological and/or social aspects are also important when identifying the symptom burden and determining therapy. The more a patient's vulnerability increases, the more important these aspects become for a therapist in the care process. For more background information about clinical presentation, go to www.goldcopd.com.

Note A.2.3 Etiological and prognostic factors

Clinical question
What are the etiological and prognostic factors of COPD?

Etiological factors
The chronic inflammatory process in the small airways and the lung parenchyma is caused by factors that can cause and maintain inflammation. Smoking is the most important and also the most influenceable etiological factor for COPD. Approximately 40–50% of people who smoke their entire lives develop COPD, compared to 10% of people who have never smoked (Gibson 2013). Smokers have a higher prevalence of respiratory symptoms and abnormal lung function and a larger annual decrease of the FEV1. Moreover, more smokers die of COPD than non-smokers. Nevertheless, not all smokers develop clinically relevant COPD. This finding therefore suggests that genetic factors also influence the risk of a person developing COPD.
Other factors also play a role in the development of COPD, such as exposure to atmospheric pollution (inside and outside), socioeconomic status, environmental factors in the early life stage and genetic factors (Gibson 2013). In Europe, 30–40% of the general population is exposed to atmospheric pollution at work. When this exposure is intensive or long-term, dust, chemicals and gases can cause COPD, independent of cigarette smoking. For more background information about etiological factors, go to www.goldcopd.com.

Prognostic factors
The natural development of COPD is marked by lots of variation. Factors that contribute to a bad prognosis of COPD are: continuing to smoke, exacerbations, respiratory failure, bad nutritional status and co-morbidity (Gibson 2013; GOLD 2020). For more background information about prognostic factors, go to www.goldcopd.com.

Note A.2.4 Epidemiology and societal impact

Clinical questions
1. What is de prevalence and incidence of COPD (epidemiology)?
2. What is the societal impact of COPD?

Epidemiology
In 2018 there were 613,800 COPD patients in the Netherlands: 304,800 men and 309,000 women. That year saw an additional 27,100 patients with emphysema (13,400 men and 13,700 women) and 10,200 patients with chronic bronchitis (4,300 men and 5,900 women). Based on demographic developments, the absolute number of COPD patients is expected to increase by 36% between 2015 and 2040. The expected increase is 44% for men and 28% for women (RIVM 2019).
Some 6,820 patients died of COPD in the Netherlands in 2017: 3,457 men (40.1 per 100,000 men) and 3,363 women (36.6 per 100,000 women). The WHO (2017) predicts that COPD will be the third most common cause of death worldwide by 2030.
The presented statistics are national estimates based on the NIVEL Primary Care Healthcare Registry (NIVEL Zorgregistratie Eerste Lijn). These figures may be an underestimate, because not all patients with symptoms of chronic cough, mucus expulsion and dyspnoea see their general practitioner. Patients with airflow limitation may have slowly become accustomed to their dyspnoea and/or may have adapted their lives to it and no longer consider this symptom to be a problem. Furthermore, not all patients are immediately recognised by the general practitioner (RIVM 2019).

Societal impact
About one-third of COPD patients find that their pulmonary disease has emotional repercussions on their lives (Waverijn 2017). About one-third (37%) of COPD patients < 65 years of age is occupationally disabled, of which the great majority (69%) is fully disabled (Waverijn 2017). From a societal viewpoint, COPD is a serious pulmonary disease with irreversible consequences (WHO 2017). COPD patients are not only at an increased risk of premature death (Wedzicha 2003), they are also at an increased risk of hospitalisation, especially as a result of exacerbations (Gibson 2013). More than 50% of COPD patients who are discharged from the hospital after an

exacerbation are rehospitalised within one year, many of them within several weeks after discharge (Gibson 2013; LAN 2019).
The healthcare costs for COPD are about EUR 912 million annually (in 2017) in the Netherlands (RIVM 2019). This translates into 1% of total healthcare costs and 31% of the costs for all respiratory diseases. Of the total healthcare costs, 32% is spent on geriatric care, 24% on hospital care and 21% on medications and aids.
The healthcare costs for COPD patients are expected to continue to increase due to 'double ageing' (increase in the number of elderly persons and the increasing age of elderly persons) and the associated increase of chronic diseases (RIVM 2019).

Note A.3 Organisation of care

Note A.3.1 The therapist's role

Clinical question
What is the role of the therapist in the healthcare process of COPD patients?

The role of the therapist is described in the 'Physical Therapist Professional Profile' and the 'Exercise Therapist Professional Profile' (KNGF 2014; VvOCM 2015). The module in this guideline specifically concerns the role of the therapist in the treatment of COPD patients.
The therapist has multiple roles in the treatment of COPD patients. The therapist's role consists of assessing and analysing COPD-related health problems in the area of physical functioning, compiling the treatment plan and treatment goals related to the therapeutic treatable traits and supervising and monitoring the therapy. This supervision is effective with regard to decreased symptoms, exercise capacity improvement, quality of life improvement and decreased anxiety and depression (ATS/ERS 2013; McCarthy 2015; Puhan 2016).
The therapist's role is also to encourage physical activity outside the therapeutic setting by actively introducing the patient to regular sports and exercise options. Decreased physical activity is associated with an increased risk of co-morbidity development and faster deterioration of health (Troosters 2019).
It is also important for the therapist to encourage empowerment in COPD patients. The principle here is for patients to be actively involved in their own treatment and how they cope with the disease. The more empowerment patients have over their lives, the better the perceived quality of life is (Lung Foundation 2018). The patient and therapist actively work together during the care process.
After all, the therapist has a role in detecting issues in the areas of physical functioning, psychosocial functioning and participation. If a problem in one of these areas is outside the therapist's expertise, it is important for this problem to be approached integrally in order to prevent worsening of the health problem. The therapist has intensive contact with the patient during the course of treatment and is able to properly monitor the patient and contact the treating physician if another healthcare provider's expertise is deemed necessary.
In current daily practice, the general practitioner and/or pulmonologist and the therapist are often the first healthcare providers with whom the COPD patient comes into contact. Good coordination and cooperation between the general practitioner and/or pulmonologist and therapist is therefore very important in providing optimal care. The way in which this coordination and cooperation takes place is personal and depends on the patient's need for assistance and health problems.

Note A.3.2 Organisation of multidisciplinary collaboration

Clinical question
How is multidisciplinary collaboration organised for COPD patients?

Multidisciplinary collaboration between various healthcare professionals contributes to the possible success of the treatment plan for people with COPD.

COPD networks and sequenced healthcare
One of the ways in which multidisciplinary collaboration takes place is collaboration within a COPD network or sequenced healthcare. Many regions have networks for therapists focused on COPD. The goal of these networks is to expand knowledge and discuss case histories, among other things. Furthermore, the networks can be used to foster accessible multidisciplinary collaboration, potentially also with secondary and tertiary care entities. This multidisciplinary collaboration aims to improve the quality of care and employs short lines of communication, which are beneficial if the COPD patient's health status changes and there is a need for additional care.

Sequenced healthcare is defined as 'a type of care which is tailored to the patient's needs and is provided based on agreements about collaboration, coordination and direction between all healthcare providers during the entire course of prevention, diagnosis, treatment and (follow-up) care. In this form of care there is communal responsibility with explicit partial responsibilities' (Healthcare Standard 2016). Thanks to the dynamics within the sequenced healthcare model, changes in the patient's integral health status are detected early on and can help give direction to the types of treatment the patient needs at that moment. Timely detection of changes in the integral health status (preferably initially by patients themselves) and the resulting customised care prevent escalation of health problems.

Primary care

Treatment in a primary care setting takes place in the patient's immediate surroundings and is aimed at improving or maintaining physical condition and quality of life (LAN 2016). The general practitioner has final medical responsibility (head practitioner) for patients who are only receiving primary care. He has final responsibility for the diagnosis and treatment and/or supervision of the patient and ensures continuity of care. In addition, local agreements are made about who will fill the position of care coordinator. The care coordinator ensures that agreements, tasks and actions are properly coordinated with each other within the multidisciplinary collaboration (LAN 2016). The head practitioner and care coordinator are part of a multidisciplinary team that consists of the following: a practice nurse/nurse assistant, a pulmonary nurse, a pharmacist, a pharmacy assistant, a psychologist, a physical therapist/exercise therapist C/M, a dietician, an occupational therapist, a speech therapist and the responsible person from a home-care organisation. Physiotherapeutic treatment in a primary care setting is generally monodisciplinary, but collaboration with other disciplines is possible, if necessary. If multidisciplinary collaboration with other primary care healthcare providers (except for the referring physician) is needed, the therapist consults with the general practitioner about a possible referral to another discipline, so that this collaboration can be organised. See B.4.2 'Referral to other healthcare providers'.

Secondary and tertiary care

For patients with a high symptom burden who are receiving more specialised treatment in a secondary or tertiary care setting, the pulmonologist is essentially the head practitioner. This may be deviated from in mutual consultation between the pulmonologist and general practitioner. However, the patient must be clear on who the head practitioner is. Such transmural agreements between the pulmonologist and general practitioner are specified in the NHG Standard on COPD (NHG 2015). For complex COPD patients, the pulmonologist or the intramural pulmonary nurse of the multidisciplinary team may handle the care coordination (LAN 2016).
Every year 30,000 people as hospitalised for a COPD exacerbation in the Netherlands. The goal of the national 'COPD Exacerbation with Hospitalisation' Transmural Pathway is to provide better care to COPD patients during and after hospitalisation in close coordination with sequenced healthcare. The Pathway states that by applying better care, the number of hospitalisation days can be substantially decreased while maintaining at least the same quality of life and patient satisfaction (LAN 2019).
Secondary or tertiary pulmonary rehabilitation is aimed specifically at patients with a severe symptom burden. The pulmonologist is the head practitioner for patients treated in a secondary or tertiary care setting or who are referred from a secondary care setting (LAN 2016). Secondary and tertiary care rehabilitation programmes focus not only on the patient's physical condition and handling of medication and exacerbations, but also on other aspects of physiological functioning and adaptation to the disease. This care is aimed at optimising the patient's overall health status, participation and autonomy. The intensity of pulmonary rehabilitation varies and can take place on an outpatient basis as well as in a clinical setting. The basic principle is that pulmonary rehabilitation is a multidisciplinary programme in which several disciplines work closely together (LAN 2016). After completion of the pulmonary rehabilitation, the patient can be referred back to primary care so that his physical functioning and quality of life can be maintained or further improved close to home.

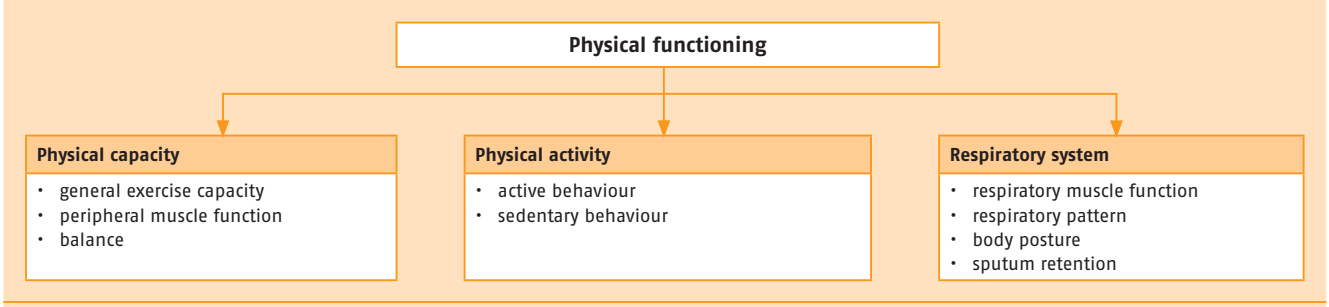
Note A.3.3 Treatable traits for physiotherapy and exercise therapy C/M

Clinical question

What are the most important treatable traits for physiotherapy and exercise therapy C/M for COPD patients?

Despite optimal medical treatment by the general practitioner and/or pulmonologist, many COPD patients have a mild to high symptom burden on a daily basis. Dyspnoea and fatigue are the most common symptoms (Goertz 2019; Janssen 2011). Daily symptoms can result in decreased daily physical activity and a loss of physical capacity. Due to this, patients with COPD wind up in a vicious circle of physical deconditioning, which can ultimately lead to psychological problems, worse quality of life and decreased autonomy and participation

(Gimeno-Santos 2014). This process can be accelerated by severe exacerbations, which result in hospitalisation (Pitta 2006; Ramon 2018; Spruit 2003).
To end or slow down this vicious circle of physical deconditioning, the therapist's diagnostic and therapeutic process is focused on the treatable traits 'physical capacity', 'physical activity' and 'respiratory system'. The relevant treatable traits for physiotherapy and exercise therapy C/M for COPD are shown in the following diagram.



Relevant treatable traits for physiotherapy and exercise therapy for COPD

The *physical capacity* is the ability to perform activities that require physical actions (Puente Maestu 2016). Physical capacity is expressed in a number of measures that can be influenced by therapy, specifically: general exercise capacity (maximal and submaximal), peripheral muscle function (muscle strength and endurance) and balance (static and dynamic) (De Morree 2011; ERS 2019; ERS/ATS 2014a,b; Hernandes, 2011; Mesquita, 2013; Robles, 2011).
The *physical activity* is a parameter for exercise behaviour and concerns every physical activity that is generated by skeletal muscles and that requires energy utilisation (Caspersen 1985; WHO 2018). This parameter is expressed as the ratio between sedentary behaviour and active behaviour that can be influenced by therapy, such as lying, sitting, standing and moving (e.g. number of steps per day).
The *respiratory system* is the vital pump for ventilation and consists of the chest wall (thorax and abdomen) and respiratory muscles (Gosselink 2016). The respiratory system is characterised by a number of functions that can be influenced by therapy, specifically: respiratory muscle function, respiratory pattern (at rest and during exercise), posture and sputum retention (Charususin 2016; Langer 2018; Priori 2013; Singer 2011).
Physical activity and physical capacity, both measures of physical functioning, are rather closely connected but are not interchangeable (Koolen 2019; Lummel 2015). As such, they are measured separately. Physical functioning is influenced by physical, social and environmental factors. Treatment is primarily focused on improving (limited) physical functioning and the associated symptom burden, and on improving the patient's degree of participation and quality of life.
During frequent contact with the patient the therapist can focus on lifestyle changes, thus adopting a coaching role. Treatable traits for lifestyle change, such as healthy nutrition and counselling for quitting smoking, are not part of the primary domain of the physical therapist and exercise therapist C/M, however. The therapist is not the head practitioner for these treatable traits. In the event of a referral, multidisciplinary consultation with the respective healthcare provider can be considered for treatment coordination.

Note A.3.4 Information exchange with referring physicians

Clinical questions

1. Which information does the therapist need from the referring physician (general practitioner or pulmonologist)?
2. Which information does the therapist report to the referring physician?

Information exchange from referring physician to therapist

A COPD patient can be referred by the general practitioner or the pulmonologist. A referral consists of:

- administrative and logistical data;
- the core, which contains all the relevant information about the patient;
- an appendix containing the other medical categories.

The referral must contain the following (recently measured) information: FEV1, the score on the mMRC (or MRC) scale, the score on the Clinical COPD Questionnaire (CCQ) or the COPD Assessment Test (CAT), the number of exacerbations and the number of lung-related hospitalisations in the last 12 months. The following required data must be enclosed: problem/reason for referral, relevant co-morbidity, current medication overview and results of relevant medical diagnostic tests (including the maximal exercise test (CPET), if applicable). The following are optional: family medical history, psychosocial history and, if applicable, information about facilities required during a consult (NHG/ KNGF 2012). If the patient uses oxygen, you must find out how many l/min of oxygen the patient needs and whether the oxygen is indicated continuously or only during exercise.
To be able to categorise a COPD patient according to the requirements of the reimbursement entitlement, the referral must include the following information:

- the FEV1;
- the score on the (m)MRC scale and/or the CAT score and/or the CCQ score;
- the number of exacerbations experienced in the last 12 months;
- the number of exacerbation-related hospitalisations in the last 12 months.

Information exchange from therapist to referring physician
In all cases, the therapist sends reports to the referring physician and the care coordinator (if applicable) both in the interim and at the end of the treatment. For multidisciplinary collaboration, a copy of the report can be sent to other healthcare providers who are involved with the respective COPD patient, if desired. Even if the patient does not start the programme, regardless of the reason (financial, compliance, logistics, etc.), the therapist still issues a report to the referring physician.
The therapist includes at least the following information on the interim reports: problem/reason for referral, conclusion/therapeutic diagnosis, treatment plan and treatment course/result. Including the following information is optional: medical history, physical exam, administered interventions and the result of the discussion with the patient (advice and agreements) (NHG/KNGF 2012).
The final report must contain at least the following information: problem/reason for referral, conclusion, physiotherapeutic/exercise therapeutic diagnosis, treatment plan, treatment course/result of the treatment and result of the discussion with the patient (advice and agreements). Information from the interim report may also be included. The final report also lists the reason for the conclusion of treatment, and whether follow-up sessions are planned for monitoring the patient's health. In the event of follow-up sessions, an interim evaluation report is compiled and sent for every session that explains whether there has been consolidation or deterioration of the patient's health and the treatment course.

With long-term treatment processes, the therapist sends a report to the referring physician and care coordinator (if applicable) at least once per year.
For more information on information exchange, see the NHG-KNGF Guideline on Structured Information Exchange between General Practitioners and Physical Therapists and for more information on file-keeping, see the valid KNGF Guideline on Physiotherapeutic File-keeping and the VvOCM Guideline on Reporting (NHG/KNGF 2012, KNGF 2019, VvOCM 2018).

Note B.1 Medical history taking

Clinical question
Which information is collected when taking the medical history of a COPD patient?

When obtaining information during the therapeutic medical history taking, a differentiation is made between the following: a) aspects that assess the treatable traits for the therapeutic actions; and b) aspects that do not represent treatable traits, but which can be used to assess the context in which the patient receives the therapeutic treatment.
Patients experiencing (or who recently experienced) an exacerbation require special attention. These patients are at an increased risk of a new exacerbation (Hurst 2010) and (further) deterioration of their physical functioning, daily physical activity and quality of life (Seemungal 2009; Spruit 2003; Troosters 2013). They need support in order not to end up in a negative spiral of continued deterioration (Groenewegen 2003; GOLD 2020; Miller 2013).
With regard to co-morbidity, it is important for the therapist who treats COPD patients to have knowledge of common physical and psychological co-morbidity. Special attention must be paid to co-morbidity and the related medication that interfere with the physical therapeutic interventions and physical activity (Beekman 2013). It may be necessary to modify the set goals and/or the treatment plan.

The psychosocial data (cognition, motivation, coping and environmental aspects) are collected in order to support the analysis of the health problems, the interpretation of the test results and the formulation of the treatment goals.

Note B.2 Physical examination

Clinical question
What does the physical examination for a COPD patient consist of?

Clinical impression
The global impression is observed. The following in particular can be looked at:
- Does the patient prefer to sit leaning forward or prefer to sit using an arm support?
- Is there visible muscle atrophy (lower extremities) or hypertonia of the (auxiliary) respiratory muscles?
- Is there visible peripheral oedema?
- Is the patient short of breath when speaking? Is the patient's speech fluid or is it frequently interrupted?

Shape of the torso
When examining the torso, the following in particular can be looked at:
- Are there signs of static hyperinflation?
- Are there deformities of the chest (e.g. pectus excavatum, pectus carinatum or kyphoscoliosi)

Manner of breathing
When examining the patient's breathing, the following can be looked at:
- Does spontaneous breathing cause visible exertion (e.g. flared nostrils or spontaneous pursed lip breathing)?
- Is there an abnormal respiratory rate or depth of respiration?
- Are squeaky, high-pitched rhonchi (wheezing) audible? Are rattling, low-pitched rhonchi audible? Or are normal breath sounds audible?
- What is the movement of the abdominal wall and chest during inspiration and expiration (especially direction and timing)?
    - Is there exaggerated elevation of the upper part of the ribcage during initial inspiration ('pump handle')?
    - Is there paradoxical thoracoabdominal movement at rest and during exertion? Is the upper part of the rib cage pulled inward during inspiration (Hoover's sign)?
    - Is there asymmetrical range of motion of the ribcage?
- What is the respiratory movement like for actions during ADL (expiration during exertion or delaying breathing)?
- Is there activity of the auxiliary respiratory muscles during inspiration and expiration at rest?
- Is there a visible drawing in of infraclavicular or supraclaviculare fossae during inspiration (tracheal dip)?

Manner of coughing and forced expiration for mucus clearance
Based on the information from the medical history, there may be sputum retention. The presence of sputum retention may additionally be assessed by listening to the breathing sounds and palpation of the chest. The coughing and forced expiration techniques of patients with sputum retention are evaluated. If necessary, various basic postures can be tried (sitting, supine, lateral, prone position). Parameters that are evaluated to examine the effectiveness of the cough are the expiratory (abdominal) muscle contraction and the occurrence (or lack) of airway collapse or (thoracic) pain during coughing. Whether or not sputum is actually coughed up, indicating that the cough is effective, is also assessed. In addition, the colour and volume of the sputum are evaluated (Gosselink 2016). A check is done to see whether the patient uses an aid (such as a Flutter) and whether the patient is aware of techniques other than coughing and forced expiration.

Basic examination
A basic examination provides a picture of the patient's physical functioning. It is important to assess the 'physical capacity' treatable trait. The physical capacity can be objectively assessed with a submaximal test, preferably the 6MWT. If this test shows that the physical capacity is limited (< 70% of the predicted value), the treating physician is consulted regarding a request for a maximal exercise test (see B.3.2 'Maximal exercise test'). The physical activity is also assessed. The patient will preferably be issued an activity meter on loan for a week, after which an assessment can be made as to whether the patient's physical activity is limited (< 5,000 steps per day). It is also useful to get an idea of the peripheral muscle strength (especially of the

lower extremity), the respiratory muscle function, the balance and the risk of falling. Where necessary, these parameters can be assessed with a measurement instrument. See B.3.1 'Recommended and optional measurement instruments'.

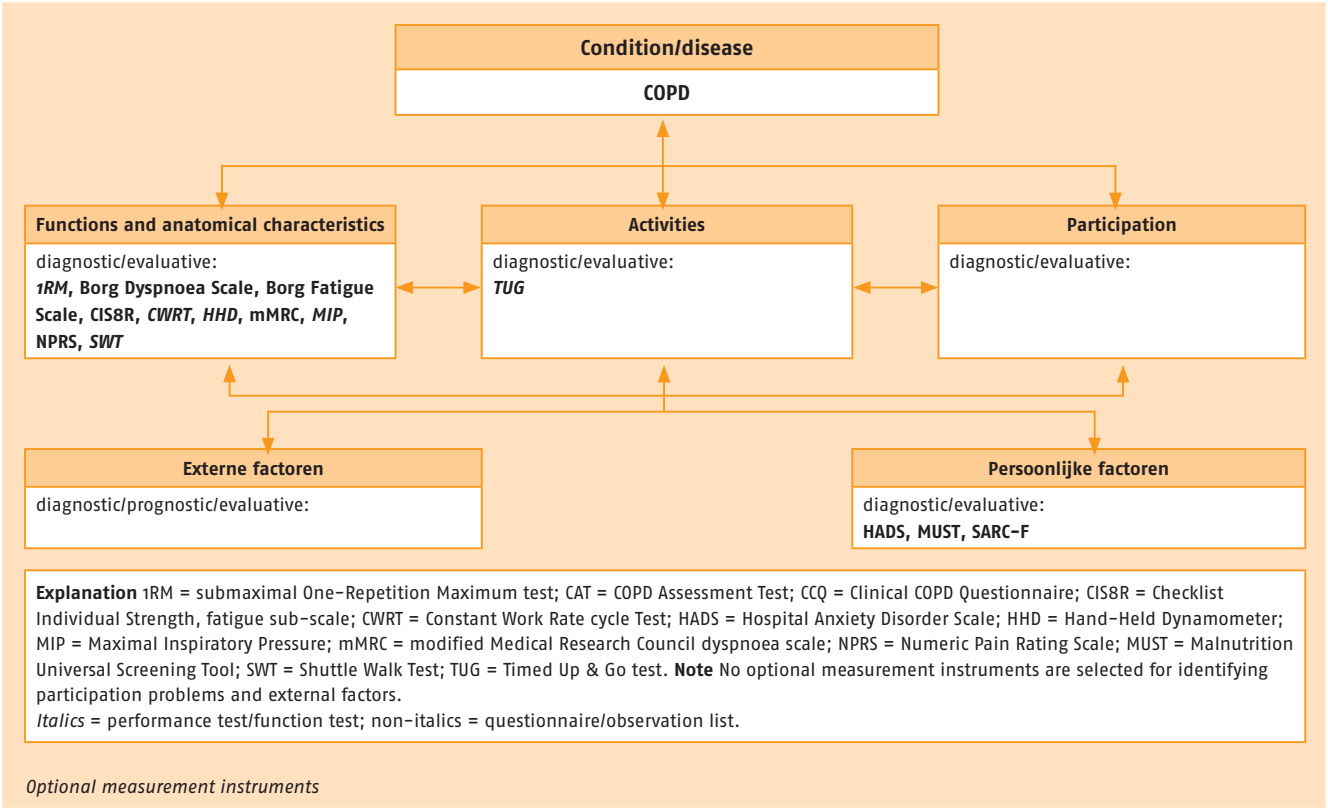
Note B.3 Measurement instruments

Note B.3.1 Recommended and optional measurement instruments

Clinical questions

- Which parameters are objectified per ICF domain with the help of measurement instruments for diagnostic, prognostic and/or evaluation purposes?
- Which measurement instruments best assess the parameters per ICF domain per objective (recommended and optional measurement instruments)?

This module describes which measurement instruments can be used to assess relevant parameters. These parameters can be assessed in both the diagnostic process (taking the medical history and physical examination) and the therapeutic process. All measurement instruments named in the guideline are summarised in this module.
The following diagram and table contain an overview of the optional measurement instruments and the measurement points. These instruments can be applied during the diagnostic phase and when evaluating the treatment in patients with COPD if there is a reason for this in practice. All these measurement instruments are available at www.meetinstrumentenzorg.nl. The recommended measurement instruments are listed in the Practice Guideline.



Explanation 1RM = submaximal One-Repetition Maximum test; CAT = COPD Assessment Test; CCQ = Clinical COPD Questionnaire; CIS8R = Checklist Individual Strength, fatigue sub-scale; CWRT = Constant Work Rate cycle Test; HADS = Hospital Anxiety Disorder Scale; HHD = Hand-Held Dynamometer; MIP = Maximal Inspiratory Pressure; mMRC = modified Medical Research Council dyspnoea scale; NPRS = Numeric Pain Rating Scale; MUST = Malnutrition Universal Screening Tool; SWT = Shuttle Walk Test; TUG = Timed Up & Go test. **Note** No optional measurement instruments are selected for identifying participation problems and external factors.
Italics = performance test/function test; non-italics = questionnaire/observation list.

Optional measurement instruments

Optional measurement instruments and measurement points			
Parameter	**Measurement instrument**	**Measurement points**	**Comments**
dyspnoea	modified Medical Research Council – dyspnoea scale (mMRC)	intake, interim evaluation and conclusion	If the MRC was used instead of the mMRC in the referral information, this is simple to calculate by decreasing the score by 1 point.
	Borg Scale for Dyspnoea	during the exercise test and during treatment	
fatigue	Checklist Individual Strength, Fatigue Sub-Scale (CIS8R)	intake, interim evaluation and conclusion	The CIS8R is a sub-scale of the CIS.
	Borg Fatigue Scale	during the exercise test and during treatment	
muscle strength	Hand-Held Dynamometer (HHD), knee extension	intake, interim evaluation and conclusion	
	One-Repetition maximum test (1RM)	intake, interim evaluation, during the treatment and conclusion	
physical capacity	Shuttle Walk Test (SWT)	intake, interim evaluation and conclusion	The Incremental SWT (ISWT) as well as the Endurance SWT (ESWT) variations of the SWT are optional.
	Constant Work Rate Cycle Test (CWRT)	intake, interim evaluation and conclusion	
nutritional status	Malnutrition Universal Screening Tool (MUST)	intake	
	SARC-F	intake	
respiratory muscle function	Maximal Inspiratory Pressure (MIP)	intake, interim evaluation and conclusion	
pain	Numeric Pain Rating Scale (NPRS)	intake, interim evaluation and conclusion	
anxiety and/ or depression	Hospital Anxiety and Depression Scale (HADS)	intake, interim evaluation and conclusion	
balance/risk of falling	Timed Up & Go test (TUG)	intake, interim evaluation and conclusion	The TUG can also be used to measure functional exercise capacity if other exercise tests are not possible, e.g. in the home environment.

Note B.3.2 Maximal exercise test

Clinical question
When are COPD patients referred for a maximal exercise test?

COPD patients have decreased physical capacity compared to healthy elderly people, which is often the consequence of a combination of physiological factors that limit physical activity early on (ERS 2019). The physical capacity and the underlying constraints cannot be adequately determined for the individual COPD patient based on the degree of airflow limitation (Andrianopoulos 2014; Spruit 2010). In addition, a sub-group of COPD patients has an increased risk of cardiovascular disease, whose condition may deteriorate further

with high-intensity exercise therapy (including chest pain due to ischemia and pain in the lower legs due to peripheral arterial disease) (Houben-Wilke 2017; Vanfleteren 2011). The limited physical capacity can be determined with various exercise tests, such as the maximal exercise test (Cardiopulmonary Exercise Test, CPET), an endurance test with a constant workload (Constant Work Rate Test, CWRT, the Six Minute Walk Test (6MWT), the Shuttle Walk Test (SWT) with increasing speed (Incremental Shuttle Walk Test, ISWT) and the SWT with the same speed (Endurance Shuttle Walk Test, ESWT).
The CPET is unique in several aspects and therefore has a lot of added value in the therapeutic examination of COPD patients (Puente-Maestu 2016; ERS 2019).
The maximal exercise test is the only test that enables the therapist to:

1. *accurately determine the individual patient's maximum exercise capacity.*
   Explanation: A cycle load or an aerobic capacity at the end of the maximal exercise test of < 70% of the predicted value is a clear sign of a limited maximal exercise capacity.
2. *recognise the physiological factors (i.e. cardiac, ventilatory and diffusion capacity) that limit the exercise (with or without psychological constraints).*
   Explanation: A cardiac limitation exists if the difference between the heart rate at the end of the maximal cycle test and the calculated heart rate (220-age) is < 15 beats. A ventilatory limitation exists if the ventilation at the end of the maximal cycle test is > 85% of the calculated maximal voluntary ventilation (FEV1 x 40) or if the inspiratory reserve volume is < 0.5 litres or if an increase in arterial $PaCO_2$ is observed compared to the initial value. An impaired diffusion capacity exists if a decrease in transcutaneous oxygen saturation of > 4% is measured during the maximal cycle test or there is a decrease of arterial PaO_2 compared to the initial value.
3. *make a well-informed choice between the available therapy types.*
   Explanation: Endurance training is indicated in the presence of a cardiac limitation. For patients with a ventilatory limitation and/or an impaired diffusion capacity, a submaximal exercise test must take place at 75% of the maximal cycle load. If the patient continues the test for fewer than 10 minutes, interval training is indicated. If the patient continues the test for more than 10 minutes, endurance training may be considered. Note: The referring physician must be contacted if the patient has an impaired diffusion capacity. See C.3.4 'Training in relation to oxygen desaturation'
4. *quantify the degree of the exercise limitation.*
   Explanation: The exercise limitation can be quantified by expressing the maximal cycle load and maximal aerobic capacity as a percentage of the predicted value.
5. *adequately set the cycle load during the physical training (only after a maximal cycle test).*
   Explanation: The absolute maximal cycle load (expressed in watts) must be equated to 100% of the maximal work that the individual patient can perform. A percentage of the absolute maximal cycle load can then be used for adequately setting the exercise workload.
6. *determine that heavy physical activity is safe, in part because it often concerns older patients (> 50 years) with an unhealthy lifestyle (including smoking and physical inactivity) and severe limitations in physical functioning (Koolen 2019).*
   Explanation: During the maximal exercise test the physician supervising the test must monitor the patient for unexpected exercise-related pressure/pain in the chest, fluctuations in blood pressure and/or irregular heart rhythms on the ECG and assess them for cardiovascular risk before the COPD patient starts the physical training.

Other exercise tests, such as the Six Minute Walk Test, cannot be used for accurately estimating the maximal cycle load for COPD patients. Use of arithmetic formulas for estimating the maximal exercise capacity with a Six Minute Walk Test results in a significant underestimation or overestimation in three-fourths of these patients (Sillen 2012).
A maximal exercise test (preferably under the supervision of a pulmonologist) is done for clinically stable patients with profile 4, 5 or 6 before the start of the exercise training. Prior to the start of a pulmonary rehabilitation programme (for clinically stable patients with profile 6), the maximal exercise capacity is determined with a CPET (as a standard) (Sillen 2012). For COPD patients who are referred for pulmonary rehabilitation screening due to an exacerbation during the period directly after hospital discharge, the CPET can only be performed if the pulmonologist deems this to be appropriate. Until such time, the patient performs low-intensity exercise. The CPET does not need to be done if there is a clear clinical indication that the test result has no added value for the treatment process, such as for patients in the palliative phase. The following table shows which exercise test is best to use in relation to the goal of the test.

Goal and value of the maximal exercise test (CPET) and other exercise tests

Indication	CPET	CWRT	6MWT	ISWT	ESWT
recognise the systems that limit the exercise (with or without psychological constraints)	+	–	–	–	–
identify the potential therapeutic targets based on the limiting systems and make a well-informed choice between the available therapy types	+	–	–	–	–
determine whether physical activity is safe, and if so, to what extent	+	–	–	–	–
determine the maximal exercise capacity	+	–	–	–	–
determine the submaximal physical capacity	–	+	+	–	+
set an adequate training intensity when using a treadmill	–	–	+	+	–
set an adequate training intensity when using a stationary bike	+	–	–	–	–
evaluate the effectiveness of the therapy	±	+	+	+	+

CPET = Cardiopulmonary Exercise Test (maximal exercise test on the bike or treadmill); CWRT = Constant Work Rate Test; 6MWT = Six Minute Walk Test; ISWT = Incremental Shuttle Walk Test; ESWT = Endurance Shuttle Walk Test.

Note B.4 Red flags and referral

Note B.4.1 Red flags

Clinical question
When is it necessary to refer a patient with COPD (back) to the general practitioner or pulmonologist?

An important aspect within the therapeutic examination, as well as during therapy, is the evaluation of whether the symptoms are 'OK' or 'not OK'.
If there is any doubt about the severity or the nature of the COPD, the treating general practitioner or pulmonologist is consulted. The therapist also contacts the treating physician if there is any doubt about whether the patient is receiving optimal medical treatment or if there is doubt about whether the medical treatment is being complied with by the patient as intended (e.g. medication use). The treating physician is also contacted in the event of a suspected exacerbation.

The therapist aims to identify any disease-related red flags. The conclusion 'OK' or 'not OK' is made by the individual therapist, based on his/her perspective. Disease-related red flags during the diagnostic and therapeutic process are a reason for referral (back) to the physician.

Disease-related red flags that are a reason for referral (back) to the physician
- Oxygen desaturation in ambient air (Walsh 2019), measured with a saturation meter:
  - refer back if the resting Sp02 is < 90%
  - refer back if the exercise-induced SpO_2 ισ ≤ 85%
- Peripheral oedema (McNulty 2014)
- Haemoptysis (coughing up blood) (McNulty 2014)
- Excessive sputum production compared to normal (McNulty 2014)
- Cyanosis and/or sleepiness during the day in combination with headache (McNulty 2014)
- Fever
- Tachypnoea at rest

- Suspicion of previously unknown co-morbidity
- Exacerbation of known co-morbidity

SpO_2 = transcutaneously measured oxygen saturation.

The therapist is also alert to generic red flags. These are disease-independent but are a reason for referral back to the physician.

Generic red flags that are a reason for referral (back) to the physician

- Unstable angina pectoris, chest pain or heart spasms
- Heart palpitations ('a strong pumping feeling') in the chest, throat or neck
- Dizziness after physical exertion
- Decreased consciousness or loss of consciousness
- Acute onset of swelling in one leg, a heavy feeling or pain in the leg and/or red or blue discolouration of the leg
- Sudden, very severe pain or 'ripping pain' in the chest, possibly radiating to the neck, jaw and/or arms
- Sudden, very severe pain or 'ripping pain' in the back, between the shoulder blades, possibly radiating to the lower back and/or chest
- Pressure in the chest
- Sudden severe dyspnoea at rest
- Tingling and prickling in the arms and/or legs
- Nausea
- Weight gain due to fluid accumulation in the body, especially in the legs
- Systolic blood pressure > 200 mmHg at rest and/or diastolic blood pressure > 120 mmHg at rest
- Tachycardia at rest (> 120 beats/min) or bradycardia at rest (< 40 beats/min)
- Increased risk of falling (two or more falls in the past year or at least one fall in combination with increased risk of fracture, blackouts or a mobility problem (TUG ≥ 20 sec) of unknown origin
- Sudden onset of local muscle pain, often with spasms
- Passive stretching or tensing of an affected muscle causes pain
- Dented and/or abnormally swollen muscle belly above or underneath an affected area
- Blue discolouration underneath an affected area
- Long-lasting stiffness of an affected area
- Loss of function of a body part
- Sudden memory impairment, disorientation and/or language impairment

mmHg = millimetres of mercury; TUG = Timed Up & Go test.

If the therapist comes to the 'not OK' conclusion during the diagnostic or therapeutic process, the treating physician is contacted. In consultation with the treating physician, it can then be determined whether the therapy can still be started or continued.

Note B.4.2 Referral to other healthcare providers

Clinical question
When is it necessary to consult with the referring physician about referrals to other healthcare providers?

To be able to offer the right care at the right time, it is important for a therapist to know in which cases a patient must be referred to other healthcare providers (LAN 2016). The principle of 'unskilled is unauthorised' applies here. Referring within the physical therapist's or exercise therapists C/M's own domain (e.g. to a therapist with specific knowledge and skills) is possible without the involvement of the referring physician (KNGF 2014; VvOCM 2015). The referring physician should, however, be informed of this. The therapist will contact the referring physician if the therapist determines that a patient has health problems outside the domain of the physical therapist and/or exercise therapist C/M. After consultation, the referring physician can refer the patient to another healthcare provider, if appropriate.

Referral outside the physical therapy of exercise therapy C/M domains
Patients may be referred to the following healthcare providers outside the domain of the physical therapist and/or exercise therapist C/M, if needed:

- *Occupational therapist.* Referral to an occupational therapist can be considered in consultation with the treating physician or care coordinator if there is a need for assistance regarding activities and/or participation level that is not optimally addressed with physiotherapy or exercise therapy C/M and whereby skills need to be learned to help the patient deal with limitations in their daily life (if needed, with the support of aids and/or resources. Interventions can be aimed at applying ergonomic principles, learning to deal with dyspnoea during activities and energy management in the event of both overperformance as well as underperformance (EN 2016).
- *Dietician.* Referral to a dietician can be considered in consultation with the treating physician or care coordinator if there is a high risk of malnutrition (MUST ≥ 1) or sarcopenia (SARC-F ≥ 4) (GLIM 2019).
- *Psychologist.* Referral to a psychologist can be considered in consultation with the treating physician or care coordinator if there is a high risk of anxiety and/or depression (HADS > 10 points) or in the presence of other psychological problems and/or symptoms that impede the patient's treatment to a significant degree (Zichmond 1983).

Note B.5 Patient profiles

Clinical question
Based on which traits of COPD patients are patient profiles differentiated in order to choose the right type of care?

To determine the appropriate intervention, a number of disease characteristics and the consequences thereof for the patient are decisive: the extent of the disease stability, the self-reported daily symptom burden, the measured physical capacity and the measured physical activity (Koolen 2019; Smid 2017). By assessing these traits, a patient profile can be established. This profile indicates whether the patient has an indication for physiotherapy/exercise therapy, which setting (primary, secondary or tertiary care) is most suitable and which treatable traits the treatment should focus on (Spruit 2020).

Determination of disease stability
The degree of the disease stability is determined by the general practitioner or the pulmonologist. The following can be differentiated when categorising the disease stability: 1) no exacerbation or an exacerbation without hospitalisation, or 2) an exacerbation with hospitalisation.

No exacerbation or exacerbation without hospitalisation
If a patient has no exacerbation or an exacerbation that does not require hospitalisation, the symptom burden is assessed to determine whether the patient should be referred, and if so, in what manner.

Exacerbation with hospitalisation
Screening for pulmonary rehabilitation is indicated after discharge from the hospital, given that there is a large chance of more than merely physical problems, which may require interdisciplinary intervention for proper recovery. An exception applies to patients in the palliative phase and to patients who do not wish to be screened. In this case, the patient is referred to primary care.

Determination of the symptom burden by the general practitioner or the pulmonologist
The symptom burden is also determined by the general practitioner or the pulmonologist. To this end, a CCQ or CAT is done. The score for these measurement instruments determines whether there is: 1) no or low symptom burden, 2) mild or moderate symptom burden and 3) high symptom burden (Smid 2017).

Degree of daily symptom burden (Smid 2017)

Daily symptom burden	None/low	Mild/moderate	High
CAT total score, points	< 10	10–17	≥ 18
CCQ total score, points	< 1.0	1–1.8	≥ 1.9

CAT = COPD Assessment Test; CCQ = COPD Clinical Questionnaire.

No or low symptom burden
These patients are classified as profile 1. Physiotherapy or exercise therapy C/M is not indicated.

Mild or moderate symptom burden
Referral to primary physiotherapy or exercise therapy C/M is indicated. The therapist assigns profile 2, 3, 4 or 5 to the patient based on his physical activity and physical capacity.

High symptom burden
These patients must be screened for secondary or tertiary pulmonary rehabilitation, given that a high symptom burden can indicate more than only physical problems, due to which interdisciplinary intervention may be indicated. This does not apply to patients in the palliative phase and to patients who have indicated that they do not wish to be screened. They are referred to primary care, after which the therapist assesses their physical activity and physical capacity.
The criteria for a referral to an interdisciplinary rehabilitation programme at an expertise centre are listed in the following table.

Demarcation criteria for an interdisciplinary rehabilitation programme at a knowledge centre for patients with complex chronic pulmonary disorders (Spruit 2020).

Domain	Test	Criteria
care dependency	Care Dependency Scale (CDC)	≤ 68 points
body composition	body weight	undesired weight loss of ≥ 5 kg in the past 12 months
	body mass index	< 18.5 kg/m² or > 35 kg/m²
	lean body mass index	< 17 kg/m² (men) or < 15 kg/m² (women)
physical capacity	Six Minute Walk Test (6MWT)	< 350 m
	Shuttle Walk Test (SWT)	< 70% of predicted value
mobility and balance	Short Physical Performance Battery (SPPB)	≤ 9 points
symptoms of dyspnoea	Modified 'Medical Research Council Dyspnoe' vragenlijst (mMRC)	score ≥ 2
symptoms of fatigue	Checklist Individual Strength – sub-scale 1 (subjective perception of fatigue)	≥ 36 points
symptoms of anxiety	Hospital Anxiety and Depression Scale (HADS)	≥ 10 points on the anxiety scale
symptoms of depression	HADS	≥ 10 points on the depression scale
degree of adaptation to the disease (burden)	Nijmegen Clinical Screening Instrument (NCSI)	high symptom burden in combination with 'no adaptation' or 'increased risk'
severe hypercapnia	arterial blood gas	pCO_2 > 7.0 kPa

Domain	Test	Criteria
cardiovascular co-morbidity	patient file	being treated by a cardiologist
cognitive functioning	Montreal Cognitive Assessment (MCA)	< 26 points
health literacy	European Health Literacy Survey Questionnaire	≤ 12 points
oxygen desaturation due to exercise despite oxygen supplementation	transcutaneously measured oxygen saturation (SpO_2)	< 90%

Patients who are not eligible for interdisciplinary pulmonary rehabilitation after the screening are referred to primary care, where they are assigned profile 2, 3, 4 or 5 based on their physical activity and physical capacity. Patients who are eligible for interdisciplinary pulmonary rehabilitation are assigned profile 6.
After the rehabilitation programme the patient is referred to primary care, where a maintenance programme is started.

Assessment of physical functioning in primary care
If the patient is referred to primary care physiotherapy or exercise therapy C/M, then the therapist determines the type of therapy the patient receives based on their limitations in physical activity and/or physical capacity. The physical capacity should preferably be determined with the help of the 6MWT, with the difference between sufficient and insufficient capacity being set at 70% of the predicted value (Koolen 2019). See the calculation tool for calculating the predicted value for individual patients. The physical activity should preferably be assessed with the help of an activity meter, with a cut-off point for insufficient physical activity at 5,000 steps (Depew 2012; Tudor-Locke 2013). The criteria for determining the degree of physical functioning are listed in the table below.

Criteria for determining physical functioning in primary care

Physical functioning	Sufficient	Insufficient
physical capacity: 6MWT, % predicted value	≥ 70	< 70
physical activity: steps per day	≥ 5,000	< 5,000

6MWT = Six Minute Walk Test.

Sufficient physical activity and sufficient physical capacity
A supervised treatment programme is not indicated for these patients. These patients are classified as profile 2. The patient is advised to remain active through regular exercise and/or sports activities. A referral for a combined lifestyle intervention (CLI) is possible as well. For more information about the CLI, see https://www.loketgezondleven.nl/leefstijlinterventies/gecombineerde-leefstijlinterventie. If there is an indication for interventions aimed at the respiratory system, the recommendation is to offer these in just a few sessions. See C.5.1 'Supervision duration and frequency'.

Insufficient physical activity but sufficient physical capacity
A supervised treatment programme that is aimed at optimising physical activity is indicated for these patients. These patients are classified as profile 3. Additionally, counselling and advice are indicated, as well as potentially interventions aimed at the respiratory system. See C.5.1 'Supervision duration and frequency'.

Insufficient physical capacity, but sufficient physical activity
A supervised programme that is aimed at facilitating physical capacity is indicated for these patients. These patients are classified as profile 4. Counselling and advice are also indicated for these patients, as well as potentially interventions aimed at the respiratory system. See C.5.1 'Supervision duration and frequency'.

Insufficient physical activity and insufficient physical capacity
A supervised programme that is aimed at facilitating both physical capacity and physical activity is indicated for these patients. These patients are classified as profile 5. Just like the patients in profile 3 and 4, counselling and advice are indicated, as well as potentially interventions aimed at the respiratory system. See C.5.1 'Supervision duration and frequency'.

Patient profile reclassification
The symptom burden, the physical capacity and the physical activity are reassessed after every exacerbation. It may be necessary to reclassify patients to another patient profile and switch to a different treatment type based on the results of this assessment. For patients without an exacerbation but with a significantly increased symptom burden (from none/low to mild/moderate or from mild/moderate to high), reduced physical capacity (a decrease on the 6MWT by 45 metres or more) and/or reduced physical activity (a decrease of 1,500 steps per day or more), the patient profile is determined anew and a reassessment is done to see which therapy is indicated.

Degree of the airflow limitation
In COPD patients, the degree of the airflow limitation, which is traditionally expressed in 'Forced Expiratory Volume in one second' (FEV1), is not related (or only related to a limited extent) to the degree of dyspnoea, the degree of fatigue, the physical capacity, the physical activity and the quality of life (Goertz 2019; Smid 2017; Spruit 2007, 2010; Waschki 2012). That's because the physical capacity and the physical activity are already limited in COPD patients with mild airflow limitation compared to healthy elderly persons (Spruit 2010; Waschki 2012). This limitation is significant enough to have a negative impact on the quality of life and participation of these patients (Franssen 2018; Watz 2009). For this reason, the degree of airflow limitation is not used for classifying patients into patient profiles.

Maintenance treatment
A maintenance programme after interdisciplinary pulmonary rehabilitation is necessary in order to achieve the long-term effect of the rehabilitation. Maintenance treatment may be needed for very vulnerable COPD patients if they are unable to independently maintain their physical functioning (Jenkins 2018). Maintenance treatment can therefore be considered – in consultation with a multidisciplinary team or the treating physician – for patients who have undergone secondary or tertiary pulmonary rehabilitation or for very vulnerable patients with at least one of the following traits:
- chronic oxygen therapy at home and/or;
- non-invasive ventilation and/or;
- co-morbidity resulting in very limited physical functioning (6WMD < 350 m) and/or;
- limited health literacy (level 1 or 2 of patient activation; see table below) and/or;
- are on the lung transplantation waiting list and/or;
- are in the palliative phase.

The four patient activation levels are described in the table below.

Four patient activation levels (Hibbard 2005; Nivel 2013)*

Level 1	Level 2	Level 3	Level 4
Start assuming a role	**Build knowledge and trust**	**Take action**	**Maintain behaviour**
Individuals do not have the self-confidence to assume an active role with regard to their health. They tend towards passive receipt of care.	Individuals lack self-confidence and knowledge about their health or about recommended principles of a healthy lifestyle.	Individuals are aware of the most important facts and start taking action but may have a lack of self-confidence and skills in order to shape their behaviour.	Individuals have adopted new behaviour but may not be able to maintain this behaviour in a stressful situation.

* If possible, the activation level is measured using the Patient Activation Measure (PAM). If this instrument is not available, the activation level is estimated based on this table.

Consider ending the maintenance treatment (and only performing an evaluation periodically) if the patient is able to perform exercise and/or sports activities independently. See C.7 'Evaluation and conclusion'.

Note B.6 Setting goals

Clinical question
How can the therapist best set goals together with the patient?

The patient's individual treatment goals are identified to ensure patient-oriented care. These personal treatment goals are based on the need for assistance, the medical history discussion, the physical examination and the patient's expectations. In practice, setting goals is not easy, especially when it comes to goals in the area of participation.

Setting goals within the framework of participation
The Patient-Specific Goal-setting (PSG) method is recommended as a helpful tool during the cyclical process of problem identification, goal-setting, treatment plan compilation and evaluation. The patient plays an active role in this method (Stevens 2017a,b).

Alignment with the patient's functioning
The diagnostics are aimed at the patient's functioning with regard to ADL activities and participation in the patient's individual context and especially at the health-related quality of life. This focus guides the diagnostic process and is intended to improve the patient's empowerment and can take shape as follows:

- The therapist acquires a complete picture of the patient's limitations and capabilities with regard to ADL activities and participation and also determines which (functional) exercises are feasible for the patient.
- If d esired, one or more treatment goals are defined, with increasing self-management taking centre stage. Self-management is aimed at learning and maintaining new behaviour, whereby COPD patients consciously make decisions in all areas of their daily lives with regard to (dealing with) physical functioning, within the therapist's domain.
- Specific treatment goals are aligned with the need for assistance. When treating COPD, the aim is to increase or normalize the patient's self-reliance, if this is a patient goal. For example, 'being able to walk up the stairs again' can be a treatment goal in the rehabilitation (LAN 2016).

Evaluation of the treatment goals
Every treatment goal is regularly evaluated, in the time frame agreed upon with the patient and in accordance with the recommended evaluation times for the outcome measures. This contributes to mutual effort and expectations, and the evaluation times provide reference points for the follow-up process.
Within the cyclical process of setting goals, after a treatment goal has been achieved a new related treatment goal can be defined together with the patient, if necessary, based on which a new treatment plan is drafted. In this case, the treatment period is not yet concluded, taking into account the maximum number of recommended treatments.
If the treatment goal is not achieved within what the patient deems to be a reasonable time period, the goal can be modified or the patient can be referred to another discipline, if necessary.

Multidisciplinary actions
The set goals can also help provide indications for multidisciplinary actions. First the goals are determined, and then an assessment is done to identify what is necessary to achieve these goals and what type of care or assistance is required to achieve the goals.

Note B.7 Diagnostic actions for sub-groups

Note B.7.1 Diagnostic actions in the presence of co-morbidity

Clinical question
How are diagnostic actions defined if a COPD patient has a co-morbidity (and takes the related medication) that impacts their physical functioning?

The basis for answering this clinical question resides in the recommendations regarding regular diagnostic actions (see B.1 through B.6). The recommendations in this section are intended to be a supplement to this.

Reason

COPD patients are at increased risk for other medical disorders, so-called co-morbidity (Brenner 2012; Fry 2012; Vanfleteren 2013). Co-morbidity can impact the physical capacity, physical activity, quality of life, number of hospitalisations and adequate coping with dyspnoea (GOLD 2020; Houben-Wilke 2017; McNamara 2018; Vanfleteren 2013; Watz 2009). Co-morbidity can also in part determine the care needs and the patient's capacity to adequately cope with the disease and the treatment (NIVEL 2017).
Information about co-morbidity is therefore part of the relevant referral and medical history information. This information is also needed for formulating goals and compiling the treatment plan in consultation with the patient. The table below provides an overview of common co-morbidities for COPD.

Common co-morbidities for COPD

Cardiovascular disease:
- chronic heart failure
- atherosclerosis
- ischemic electrocardiogram
- metabolic syndrome
- peripheral artery disease

Symptoms of anxiety and depression

Abnormal body composition:
- obesity
- underweight

Musculoskeletal system disorders:
- osteoporosis
- vertebral compression fractures
- joint osteoarthritis

Other disorders:
- cognitive dysfunction
- lung cancer
- obstructive sleep apnoea
- diabetes mellitus
- anaemia
- kidney failure
- problems swallowing
- gastrointestinal problems
- urinary incontinence
- pulmonary hypertension

Cardiovascular co-morbidity symptoms of anxiety and depression, abnormal body composition and musculoskeletal system disorders are the most important concomitant diseases that can potentially impact the diagnostic actions and/or the therapy. Cardiovascular co-morbidity is the most common and often remains unknown and untreated (Breyer 2014; Houben-Wilke 2017; Kaszuba 2019; Rutten 2005; Vanfleteren 2011; Vitacca 2018). It is important for the therapist to know that cardiovascular co-morbidity exists, given that a patient's condition can suddenly deteriorate, which can manifest as unstable angina pectoris or acute coronary syndrome, for example (see B.4.1 'Red flags').
Many COPD patients often experience a combination of anxiety and depression symptoms (Harrison 2012; Janssen 2012).
Many COPD patients also have an abnormal body composition (including obesity, underweight and/or a lean body mass that is too low (Franssen 2014)) and musculoskeletal system disorders such as osteopenia, osteoporosis, vertebral compression fractures and/or joint osteoarthritis (Graat-Verboom 2012; Wschah 2018). These disorders can contribute to decreased physical capacity and decreased physical activity in COPD patients (Lee 2017; Spruit 2010).

Other common disorders in COPD patients are: cognitive dysfunction, lung cancer, obstructive sleep apnoea, infections, anaemia, kidney failure, problems swallowing, gastrointestinal problems, urinary incontinence and pulmonary hypertension (Aigon 2018; ATS/ERS 2013; Cleutjens 2018; GOLD 2020; Grimminger 2016; Vanfleteren 2013).

Co-morbidity treatment

In addition to providing optimal drug treatment for COPD, the pulmonologist or general practitioner should also treat the various co-morbidities. Drug treatment should be initiated before COPD patients are referred to the therapist for diagnosis and therapy (ATS/ERS 2013).

The pharmacological treatment of co-morbidity can impact the physical functioning of COPD patients. Such drugs include, among other things, antihypertensives, especially beta blockers (fatigue, headache, problems sleeping, vivid dreams, depression, and inadequate heart rate increase during exercise), insulin (hypoglycaemia) and medication that impacts responsiveness, such as antipsychotic agents (Vanfleteren 2013; ZIN 2019). Information about medication use should not only be obtained from the patient but also from the general practitioner, pulmonologist and/or pharmacist in order to prevent adverse clinical effects based on an incorrect assumption (Beekman 2013).

Assessment

During the initial contact with the patient, the therapist assesses the presence of co-morbidity in a structural manner (ATS/ERS 2013) based on the referral information and the medical history. If the referral contains no information regarding co-morbidity and medication, the therapist always contacts the referring physician to inquire about this (Beekman 2013). The potential impact (or the share) of cardiac co-morbidity on physical capacity (McNamara 2018) can, if the patient is stable, be determined with the maximal exercise test (see B.3.2 'Maximal exercise test'). The physician shares the result of the test with the therapist so the exercise therapy can be determined (Neder 2018).

When taking the medical history (see B.1 'Medical history taking'), the patient should be asked about the following (Van der Leeden 2011):

- The treatment (now or in the past 5 years):
  - Are you being treated by a doctor? Which kind? For what?
  - Have you been hospitalised? For what? The lungs or the lungs and heart? When was the last time? For how long?
  - Did you have surgeries? Which kind?
  - Do you take medication? For what?
  - Are you doing anything about your psychological or physical symptoms at your own initiative or with another healthcare provider?
- The impact of the disease on daily life:
  - What is the impact of the disease/symptoms on your daily life?

If it is impossible to obtain the required information when taking the medical history due to a cognitive dysfunction, the caregiver may be solicited to provide this information (if applicable), or the referring physician may be contacted.

The impact of potential cardiovascular co-morbidity on the patient's exercise capacity is demonstrated with a maximal exercise test, which is used to fine-tune the physical training programme. The CPET is recommended for all patients who are training for physical capacity (profiles 4, 5 and 6), as this test can show whether the training can be performed safely. The optimal training intensity is also determined based on the CPET (ERS 2019). See also B.3.2 'Maximal exercise test'.

Detection

The therapist must understand that the medical (referral) information is not always complete or correct, for example due to underdiagnosis of co-morbidity (Triest 2015). This is why a therapist fulfils a 'detective' role during the entire diagnostic and therapeutic process (GOLD 2020). Therapists are aware of the presence of known co-morbidities and are alert to potential unknown/new co-morbidities, in part due to the potential sudden deterioration or new symptoms, such as chest pain (see B.4.1 'Red flags'). If unknown/new co-morbidities are suspected and/or an existing co-morbidity worsens, the therapist immediately contacts the referring physician.

The following principle applies when detecting unknown/new co-morbidities during the diagnostic process: unskilled is unauthorised. If the treating therapist cannot assess the effect of the co-morbidity due to a lack of knowledge and/or skills, then the therapist should seek advice from another therapist who is qualified to evaluate this effect, or the general practitioner or pulmonologist.

For vulnerable COPD patients who have another complex disease (or a combination of diseases), such as multiple sclerosis, CVA, Alzheimer's and/or Parkinson's, the therapist may contact the referring physician, a geriatric therapist and/or another healthcare provider. During this consultation the participants determine which screening/treatment will be given simultaneously by various healthcare professionals in order to achieve the therapeutic goals. Referral to geriatric rehabilitation care can also be considered if a patient has a combination of (complex) diseases.

Note B.7.2 Diagnostic actions in the presence of an exacerbation

Clinical question
How is the diagnostic process for COPD patients with an exacerbation defined?

The basis for answering this clinical question resides in the recommendations regarding regular diagnostic actions (see B.1 through B.6). The recommendations in this section are intended to be a supplement to this.

Reason
An exacerbation is a deterioration of a patient's condition within one or several days that is characterised by increased dyspnoea and/or cough – with or without mucous discharge – that is greater than the normal day-to-day variability and for which a modification of the medical treatment is justified (NVALT/LAN 2017).
The severity of an exacerbation is characterised by the following aspects:
- hoorbare ademhaling of stridor;
- audible breathing or stridor;
- respiratory rate: > 24/min;
- saturation < 92% (with COPD < 88%) or < 94% with co-morbidity or a high respiratory rate;
- systolic blood pressure < 100 mmHg or > 40 mmHg lower than normal;
- heart rate > 100 beats per minute;
- dullness, sluggishness and confusion;
- temperature > 38 °C.

An exacerbation causes a wide range of symptoms, including increased dyspnoea, depression and fatigue, which can result in a marked decrease in physical activity (Pitta 2006). In addition, the symptoms of any co-morbidities may worsen, the strength of the femoral quadriceps muscle decreases significantly, the exercise tolerance decreases and the daily symptom burden increases (possibly permanently) (Seemungal 1998; Spruit 2003).
Early detection of changes in daily symptoms that can lead to an exacerbation is very important, and initiating timely treatment can decrease the severity of the exacerbation (Trappenburg 2011). It is important to counsel patients about this and to make them understand that quickly reporting a possible exacerbation will result in less serious symptoms. Use of the Exacerbation Action Plan is aimed at faster recovery and preventing hospitalisation (LAN 2016).
Factors that (can) result in hospitalisation are the following (NVALT/LAN 2017):
- insufficient response to at-home treatment with prednisolone with or without antibiotics (> 24 hours);
- acute respiratory failure (different from existing chronic respiratory failure):
  - new hypercapnia or increased hypercapnia;
  - increased hypoxemia;
- heavy use of auxiliary respiratory muscles;
- decreased consciousness;
- respiratory rate > 25/min;
- heart rate > 110/min;
- severe COPD (FEV1 < 30%pred and/or frequent exacerbations or recent hospitalisation for a COPD exacerbation);
- severe co-morbidity;
- social aspects, such as inadequate ability to take care of oneself, not having a caregiver at home and/or not having any professional home care.

It is important for all patients to start with physiotherapy or exercise therapy C/M, resume it or continue it if it has been stopped, whether a patient has been hospitalised or not (Puhan 2016). Persistent fever is a reason for not resuming therapy or temporarily suspending it. Other contraindications are described in B.4.1 'Red flags'.

Exacerbation with hospitalisation

Every year 30,000 people as hospitalised for a COPD exacerbation in the Netherlands. This totals about 200,000 hospitalisation days, half of which being rehospitalisations. In 20% of cases the patient is again hospitalised for an exacerbation within the same year, sometimes even three times or more. (LAN 2019) The 'COPD Exacerbation with Hospitalisation' National Pathway states that by applying the Pathway, the number of hospitalisation days can be substantially decreased compared to regular care, while maintaining at least the same quality of life and patient satisfaction (LAN 2019).

For recovery from an exacerbation, conservative treatment should preferably be administered at the hospital, such as oxygen delivery, nebulisation and/or medication, and no invasive ventilation applied; the preference is administration of optiflow and/or NIV ('non-invasive ventilation').

Additionally, problems and opportunities are identified during hospitalisation, which are largely discussed and addressed together with the patient after hospitalisation. Topics that are addressed during hospitalisation are early mobilisation of the patient. Hospitalisation is also a good time to determine whether a patient will be eligible for proactive care planning consultations after hospitalisation. This early care planning enables people to formulate goals and preferences for future medical treatments and care, to discuss these with family and healthcare providers and potentially to define and – if proactive care planning was already discussed with the patient in the past – modify them (Rietjens 2018).

Diagnostic actions by the therapist during hospitalisation

Therapeutic interventions lessen decreases in muscle function, balance and exercise tolerance during the hospital stay (Troosters 2010). Early mobilisation also promotes recovery after hospitalisation, without this mobilisation causing serious negative side effects (Spruit 2018). That's why the 'COPD' National Pathway recommends use of physiotherapy in the hospital (LAN 2019).

Rehabilitation interventions are generally effective and safe even for ventilated and seriously ill patients (Spruit 2018). However, consultation with the treating physician (pulmonologist or intensivist) may be needed if there are (relative) contraindications (Sommers 2015).

The following information is important for the therapist for the diagnostic process during hospitalisation:

- course of symptoms and disease;
- factors impacting the symptoms and their progression;
- feelings of dyspnoea at rest or during exertion;
- decreased exercise capacity and limitations in normal daily physical activities;
- oxygen saturation at rest and during exertion and recovery;
- disrupted mucus transport;
- the patient's need for information regarding (limited) physical functioning.

Immediately after hospitalisation a patient is screened for secondary or tertiary interdisciplinary pulmonary rehabilitation (Spruit 2019, 2020). Section B.5 'Patient profiles' describes the criteria for interdisciplinary pulmonary rehabilitation.

If a patient is not eligible for pulmonary rehabilitation, he is referred to primary care therapy. This continued treatment should preferably take place immediately after discharge from the hospital or otherwise at most within four weeks (Ryrsø 2018).

If the patient cannot be screened for pulmonary rehabilitation within four weeks, the patient is referred to primary care to bridge the gap, so that physical functioning can be retained, for potential training of the respiratory muscle function and for interventions to decrease dyspnoea and sputum retention. This also applies if the waiting list for pulmonary rehabilitation is four weeks or longer.

Exacerbation without hospitalisation

In many cases, hospitalisation is not necessary during the period of an exacerbation, or it has already been ascertained within the scope of proactive care planning or the individual care plan that a patient does not wish to be hospitalised.

The following focus areas are important for the primary care therapist regarding the diagnostic process for an exacerbation:

- Be alert to symptoms that indicate an exacerbation and refer patients to the treating physician if there is a suspicion of an exacerbation. This also applies to a situation where a patient cancels treatment due to worsening symptoms, for example.
- Unless there is a specific contraindication, the therapy should preferably not be interrupted due to an exacerbation. However, you should discuss this with the treating physician. If the treatment is continued, the intensity and/or duration of the therapy will likely have to be adapted.

- Assess the following in particular:
  - course of symptoms and disease;
  - factors impacting the symptoms and their progression;
  - feelings of dyspnoea at rest or during exertion;
  - decreased exercise capacity and limitations in normal daily physical activities;
  - disrupted mucus transport;
  - the patient's need for information.

Note B.7.3 Diagnostic actions in the palliative phase

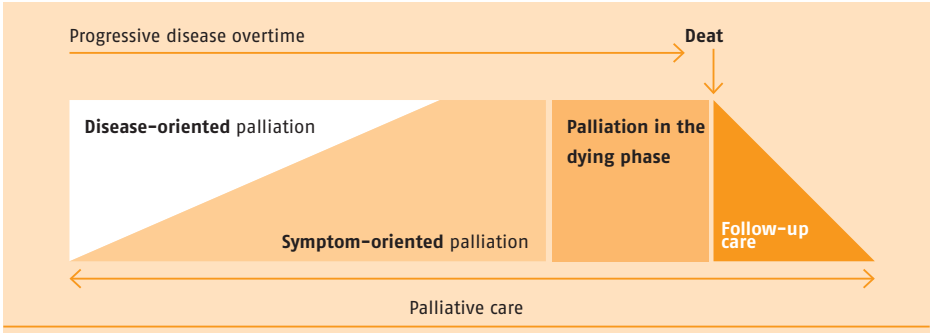
Clinical question
How are the therapist's diagnostic actions defined for COPD patients in the palliative phase?

The basis for answering this clinical question resides in the recommendations regarding regular diagnostic actions (see B.1 through B.6). The recommendations in this section are intended to be a supplement to this.

Reason
In this guideline, palliative care is seen as an approach that improves the quality of life of patients and their loved ones who are dealing with a life-threatening situation (in part) due to the consequences of COPD, by preventing and alleviating suffering through early detection and careful assessment and treatment of pain and other problems of a physical, psychosocial and spiritual nature (De Graeff 2017; WHO 2018). During the palliative phase care shifts from disease-oriented to symptom-oriented.
The palliative phase cannot be objectively defined. There is currently no validated prognostic instrument available that can predict when a COPD patient will die, due to which palliative care is often started too late or not started at all (Coventry 2005; Curtis 2008). The gradual shift from disease-oriented care to symptom-oriented care is determined by the results of conversations between the treating physician and the patient within the framework of proactive care planning (Rietjens 2017). In proactive care planning, the end-of-life wishes and needs of patients and their loved ones are discussed with a healthcare provider and documented. However, implementation of proactive care planning is still a point of attention (Janssen 2011; Van der Plas 2017). Important indications that a conversation regarding proactive planning is necessary are a negative response to a so-called 'surprise question' (Would it surprise you if the patient were to die within a year?), a deterioration of the clinical presentation, having undergone intensive treatments without a (permanent) effect and the patient's wishes (LAN 2011).
The care given a patient in the palliative phase can be classified into three stages, which gradually overlap (De Graeff 2017):

1. disease-oriented palliation, where care is aimed at maintaining or improving quality of life by treating the underlying illness; disease-oriented palliation can also be aimed at extending life;
2. symptom-oriented palliation, where care is primarily aimed at maintaining or improving quality of life by alleviating the patient's symptoms and the symptoms of the underlying illness and preventing them, if possible;
3. palliation in the dying phase, where the patient is expected to die within several weeks. Just as the shift from disease-oriented palliation to symptom-oriented palliation, the transition to palliation in the dying phase cannot be objectively defined; this is a subjective estimation by the physician.

The following diagram shows the stages of palliative care:



The stages of palliative care (De Graeff 2017)

It is important for an individual care and treatment plan to be compiled – taking into account the stages of palliative care and based on the patient's individual goals, needs, boundaries and wishes – which is regularly re-evaluated and adjusted (De Graeff 2017; Mathews 2017).

Focus areas for the therapist with regard to palliative care

- Within the framework of proactive care planning, ensure that the patient and the treating physician/head practitioner engage in a timely discussion during which the use of physiotherapy or exercise therapy is also addressed. Consult with the treating physician if it appears that there may be a reason for a discussion within the framework of proactive care planning.
- Take into account the stages of palliative care and the patient's needs, boundaries and wishes. Based on this, formulate therapeutic treatment goals together with the patient and coordinate these goals with other involved healthcare providers. During the palliative phase, gradually shift the treatment goals from physical capacity and physical activity (disease-oriented palliation) to decreasing symptoms, such as fatigue, dyspnoea and depression/anxiety (symptom-oriented palliation).
- Involve (with the patient's consent) caregivers and loved ones when formulating the treatment goals.
- Do not perform a maximal exercise test due to the workload of this test and the limited added value thereof in the palliative phase.

Note C.1 Counselling and advice

Clinical question

Which counselling and advice does the therapist give to COPD patients?

Reason

COPD patients and their loved ones generally have limited knowledge of health-related topics (Nakken 2017). A lack of knowledge can hinder empowerment (Stoilkova-Hartmann 2018). Therapists should be aware of the fact that approximately 40% of COPD patients experience cognitive dysfunction (Cleutjens 2016, 2018). In addition, research has shown that 46% of COPD patients have insufficient or limited health literacy (Nivel 2018). This can potentially impede comprehension, recall and/or application of the offered knowledge. Coordination regarding how the advice is provided (by means of a folder, verbally or video) and repetition of the counselling/advice is therefore desirable for this target group.

Advice is considered to be an integral component of the therapy and effectuating behavioural change. Offering advice solely in a group setting does not result in a significant increase of physical capacity in COPD patients (Ries 1995). Similarly, only providing written information (e.g. about the importance of physical activity) does not have a positive effect on the exercise behaviour of COPD patients (Arbillaga-Etxarri 2018). Advice can therefore not be considered as standalone therapy but should be a part of the integral treatment.

The goal of counselling and advice is to teach patients and their loved ones to be physically active and to support patients in staying physically active and maintaining their physical capacity themselves (self-management and adequate coping) (LAN 2016). Advice also contributes to patients' empowerment by increasing the knowledge of patients and their loved ones (Marques 2015; Nakken 2017).

For therapists the emphasis will always be on the topics that are closely associated with the treatable traits: physical capacity, physical activity and the respiratory system (ATS/ERS 2013; Stoilkova 2013). When providing advice, the therapist and the COPD patient (and any potential caregivers) together examine the patient's options and skills and his potential barriers. This alone increases the chance that the intended behavioural change is effectuated and is maintained by the patient (LAN 2016). Advice can be provided in a group or individual setting, potentially in the presence of the patient's loved ones. It is the therapist's responsibility to assess whether it is better for a patient to receive counselling and advice in a group or individual setting. Advice can be backed up with eHealth applications, if desired.

Diagnostics and interventions can be targeted at facilitating daily activities and participation. Advice aimed at self-management, energy management and recommendations for the selection and use of walking aids play an important role (LESA 2007; LAN 2016). Motivational Interviewing can be used for providing counselling and advice (Naderloo 2018).

Self-management

Self-management is aimed at learning and maintaining new behaviour, based on which COPD patients consciously make decisions in all areas of their daily lives. Physiotherapy and exercise therapy C/M are about acceptance of COPD and its consequences and about increasing self-efficacy by encouraging physical activity, working towards mobilisation and maintaining social contacts, and discussing a physical and emotional balance, among other things. This can result in patients taking more responsibility for their own treatment (LAN 2016).

The literature lists tools for the therapist for increasing self-management:

- What? What the patient would like to be able to do (again) and what the patient needs from the therapist to achieve this. Giving the patient responsibility for his treatment. For example, taking the initiative to exercise more/continue exercising or asking for guidance with this (LAN 2016).
- Why? The literature shows that having an active role in one's own healthcare process and asking for guidance leads to powerful effects on symptom perception and quality of life. The patient is therefore a co-practitioner with regard to his disease and must be aware of his own role in the treatment (Houben-Wilke 2017; LAN 2016; Wang 2017).
- How? To fulfil this role, it is important for the patient to also be offered 'tools' (knowledge, trust and skills) and to be guided in acquiring knowledge about COPD and COPD treatment. It is desirable for the patient to be informed/trained in the following aspects in any case: the nature of the disease and its consequences on physical functioning in daily life and the setting and monitoring of personal goals (LAN 2016). It is also crucial for the therapist to understand that the patient's behaviour is central to the adaptation (the extent to which a patient succeeds in adapting to the disease) (LAN 2016).
- For whom? This is important for all COPD patients (LAN 2016; LESA 2007).

Self-management interventions (aimed at adopting empowerment) are associated with improved quality of life and reduced hospitalisations in COPD patients (Cannon 2016; Jonkman 2016; Lenferink 2017; Wang 2017; Zwerink 2014). There are various self-management interventions. Important aspects with regard to content that reappear in every programme are: disease-specific advice, discussion of energy distribution aimed at activity performance (daily and weekly), recommendations on exercise at home, dealing with shortness of breath and discussion of a healthy lifestyle. An important aspect of the effectiveness of self-management interventions is for the treating physician to address what happens during an exacerbation and make a plan for this together with the patient (exacerbation action plan). Use of information materials (e.g. Lung Foundation videos) can be helpful for this.

Energy management

Advice aimed at energy management is an important and integral component of the therapy. A COPD patient who has trouble properly distributing his energy over the course of the day, for example, can learn to use ergonomic principles (such as temporising or exerting force when exhaling) (Lakerveld-Heyl 2005; Prieur 2020). Additionally, the therapist can provide recommendations about proper distribution of (physical) activities throughout the day/week. The therapist gives the patient insight into the current distribution of his day/physical activities and the effect this has on the patient's burden or symptoms. Then the therapist discusses with the patient how he can adapt the distribution of his day, e.g. spread activities throughout the day, in order to improve the burden or symptoms. The therapist provides recommendations about the best ways and times of the week the patient can exercise/play sports and how this compares to the therapy days. The therapist takes into account the patient's individual load-bearing capacity on the one hand and the workload of the physical activities on the other hand. During the treatment course patients may also be pointed towards regular exercise or sports activities, such as walking the dog, gardening, biking (e-bike) or yoga. The patient may also become involved in regional or national initiatives, such as exercise programmes in the regular sports sector, locally organised hiking groups and the National COPD Challenge. Additional therapy by an occupational therapist may be considered.

Advice on the use of (walking) aids

Walking aids are available for people with COPD that enable them to perform physical activities with fewer symptoms and/or for a longer duration. In general, aids are things that increase mobility, can make the patient less dependent on assistance and improve the quality of life. It will depend on the specific physical activity, the necessity thereof and the patient's healthcare need whether a specific aid is used and/or a specific resource is requested (LAN 2016). The therapist assists in selecting and instructing the patient how to use a walking aid and, if necessary, the occupational therapist can be contacted.

Use of a walking aid, such as a walker, should be considered for patients with a limiting score on the Six Minute Walk Test (6MWT) (< 350 metres) (Probst 2004; Vaes 2012, 2015). If the treatment goal 'being able to walk up the stairs again' is not feasible, installation of a stairlift may be a solution (LAN 2016).

When selecting a means of transportation for somewhat longer distances, an electric bike can be considered (which will allow the patient to remain self-reliant as much as possible). If this does not succeed (any longer), a more passive solution can be considered, such as a mobility scooter. Contact with the occupational therapist should be considered with regard to recommendations on (walking) aids.

Advice on social services and contact with fellow patients

At-home resources, such as domestic help and assistance with ADL, can be requested from health insurance companies, the municipality based on the Social Support Act (Wet maatschappelijke ondersteuning [WMO]) or other agencies. The availability and where the request for specific care/help/resources must be submitted depends on currently valid laws.

A therapist can refer a patient to a care coordinator or MEE (Dutch organisation for the promotion of an inclusive society). MEE has branches throughout the country and supports patients in all aspects of daily life by providing information and counselling. No referral or indication is required to be eligible for support by MEE (LAN 2016).

Patients can be referred to a Lung Point (Longpunt) for contact with fellow patients. A Lung Point is a meeting for patients that is held four times per year at about 60 locations in the Netherlands. Lung Points also help increase patients' knowledge and encourage empowerment.

Note C.2 Optimisation of physical activity

Clinical question

How can the therapist optimise physical activity during ADL for COPD patients?

Reason

Optimisation of physical activity is considered an essential element in treating COPD (GOLD 2020), given that the positive impact of exercise therapy on the physical capacity of COPD patients does not automatically translate into more physical activity (Cindy Ng 2012; Mesquita 2017; Osadnik 2018; Spruit 2015). However, the presence of a certain degree of physical capacity does appear to be a condition for achieving increased physical activity (Osadnik 2018).

Physical capacity and physical activity are related but are two different focal points for a therapist (see also A.3.3 'Treatable traits for physiotherapy and exercise therapy C/M'). Physical capacity and physical activity have a positive relationship but are not interchangeable (Bootsma-Van der Wiel 2001; Koolen 2019). This stems in part from the fact that 14% of COPD patients that were initially referred for a consult with the pulmonologist by their general practitioner have reasonable to good physical capacity (> 70% of the predicted value on the 6MWT), but were still physically inactive (< 5,000 steps per day, the so-called 'underachievers'); however, 21% of the referred patients were physically active with > 5,000 steps per day despite their limited physical capacity (the so-called 'overachievers'; Koolen 2019; Tudor-Locke 2013). These findings show that in addition to limited physical capacity, psychological and social factors can impact physical activity in COPD patients (Gimeno-Santos 2014; Koolen 2019; Kosteli 2017). These results also show that the emphasis does not need to be on facilitating physical activity in all COPD patients. It is important for both groups to find a good balance between workload and load-bearing capacity and apply these in daily life. With the overachievers the treatment emphasis may be on decreasing physical activity and an improved distribution of energy throughout the day, in part by applying energy-conserving measures (Vaes 2019; Velloso 2006).

Literature and considerations

Recommended physical activity for COPD

International and national guidelines for the quantity of physical activity for the general population recommend at least 30 minutes of moderate to intensive physical activity at least five days per week (total ≥ 150 minute per week) (Garber 2011), combined with muscle- and bone-strengthening activities and balance exercises for older people at least twice per week and sitting still as little as possible (Dutch Health Council 2017). The activity level of COPD patients is usually much lower than that of the general population (Pitta 2005; Tudor-Locke 2001; Wallaert 2013; Waschki 2012).

In addition to the above recommendation, this guideline also adheres to a cut-off point of 5,000 steps per day, which is considered to be sufficient physical activity for COPD patients (Depew 2012; Tudor-Locke 2013). The literature mentions successful interventions for increasing physical activity in COPD patients if the intervention results in an increase of 600 to 1,100 steps per day (Demeyer 2016). This stems from a study in which a decreased risk of hospitalisation resulting from an exacerbation was observed in COPD patients who progressed by more than 600 steps three months after rehabilitation (Demeyer 2016). Depending on the patient's situation, it is important to set a feasible goal together with the patient for progress in the number of steps.

Use of eHealth

Monitoring exercise quantity using exercise journals or by wearing activity meters can provide insights into the activity level. Through eHealth the therapist receives specific information about how much the patient is actually exercising. Jointly discussing these data provides patients insights into their progress and their daily distribution of physical activities.

Various studies have reported an increase in physical activity through the use of exercise journals or the wearing of activity meters, even for COPD patients. In the applied interventions, activity meters are used alone or in combination with other behavioural change strategies (Mantoani 2017; Strath 2018). There is currently little evidence that use of activity meters can increase the degree of physical activity in the long term in COPD patients. Activity meters can be used as a resource for providing the patient and therapist with insights into the degree of exercise.

An option is to offer the patient a digital exercise programme, but supervision by a therapist is considered necessary in this case ('blended care') (Spruit 2015). Use of digital support for self-management without supervision is insufficient for facilitating maintenance of physical activity in the long term (12 months) (Hoaas 2016).

Patients with sufficient physical activity

Physiotherapy or exercise therapy is not indicated for patients who have sufficient physical capacity and sufficient physical activity. It is the therapist's task to encourage the patient to keep up the current physical activity by providing recommendations, information and/or referrals to available regional or national exercise and/or sports activities if the patient hasn't found any suitable options for this himself. The therapist actively assists the patient when switching to these regular activities. Maintenance of the desired behaviour can be promoted by discussing which inhibiting factors could arise in the future and formulating a suitable plan on how to cope with this. For additional exercise tips, COPD patients can be referred to the Lung Foundation's website (Lung Foundation 2019).

For patients who are sufficiently physically active but do not have sufficient physical capacity, the therapist's task is primarily to help facilitate physical capacity. It is also good to monitor the physical activity and adjust it, if necessary. Because patients in this group have insufficient physical capacity, it is important to be alert to the symptoms of overload (the workload caused by the physical activity is greater than the patient's load-bearing capacity). It is important to inform patients about this balance and about how they can properly distribute their energy throughout the day (temporise).

See C.1 'Counselling and advice'. The principles of behavioural change can be used for this.

Patients with insufficient physical activity

For patients with sufficient physical capacity but insufficient physical activity, the therapist's most important task is to help promote behavioural change with regard to physical activity. For patients who are insufficiently physically active and do not have sufficient physical capacity, the therapist's task is to use interventions aimed at both treatable traits.

Changing exercise behaviour so that the patient starts engaging in physical activities again can be a long-term process, because there are various factors at play when it comes to changing exercise behaviour. The literature shows that programmes with physical exercises or pulmonary rehabilitation that last more than 12 weeks and are aimed at increasing physical activity in COPD patients (and co-morbidity) are a successful method (Mantoani 2016, 2017). The principles of behavioural change should preferably be applied for facilitating physical activity.

Principles of behavioural change

According to the principles of behavioural change, there are five phases involved in bringing about behaviour: 1) being open (knowing), 2) wanting, 3) experiencing (being able), 4) doing and 5) continuing to do/maintaining (Poelgeest 2010; Prochaska 1992).

Steps 1 and 2: being open (knowing) and wanting

In step 1 and 2, being open and wanting can be facilitated by informing the patient about the importance of exercise and discussing the patient's facilitating and inhibiting factors for being optimally physically active (Kosteli 2017). Inhibiting and facilitating factors can be present in various areas: motor skills (for patients with good physical capacity, motor skills play a smaller role), psychological factors, social factors or external factors.

Facilitating factors for physical activity for COPD patients can be the following (Kosteli 2017; Mesquita 2017; Thorpe 2012, 2014):

- social support;
- professional support;

- personal motivations (internal motivation to do more or have fewer symptoms);
- experiencing personal benefits from physical activity (feeling better);
- having control of their own disease (empowerment);
- setting (specific) goals;
- therapy-specific factors (accessibility, a safe environment, supervision, disease-specific exercises, etc.).

Inhibiting factors for physical activity for COPD patients can be the following (Thorpe 2012, 2014; Pitta 2006; Watz 2008, 2009):

- changed disease status (exacerbations and worsening of symptoms);
- co-morbidity or physical injury;
- personal factors (anxiety, depression, limited health literacy, feeling uncomfortable during physical exercises, being busy with other issues such as work or family, laziness, etc.);
- lack of support (single), external factors (transportation, finances, the weather, etc.);
- continuing to smoke;
- therapy-specific barriers (unfamiliarity with a care provider, uncertain or negative care provider with regard to possible benefits of physical activity, not experiencing personal benefits and negative previous experiences with exercise therapy, such as an unpleasant incident, excessive intensity, inadequate follow-up).

It is important to be alert to the presence of facilitating and inhibiting factors and to address these. The therapist can provide advice on how to deal with inhibiting factors (see C.1 'Counselling and advice'). The therapist can also consider physically inhibiting factors, such as decreased balance and increased risk of falling when deciding on the treatment. Setting goals with regard to physical activities can also encourage the patient to align (optimise) their physical activity with their physical capacity (see B.6 'Setting goals').

Step 3: experiencing/being able

In step 3, the therapist has the patient perform functional activities in practice and emulates the patient's situation as much as possible. It is important to have the patient experience where the underload and overload thresholds are during the treatment and how the patient can perform ADL activities, such as vacuuming, making coffee, walking up the stairs or walking to the corner store. The facilitating and inhibiting factors also play a role in this step; for example: the shape of the staircase or the quality of the sidewalk/footpath (smooth or uneven). The therapist can ask the patient to take pictures or make videos of the home environment in order to provide insight into the home environment. The patient's environment is then emulated as much as possible in the therapeutic setting. Where possible, the activity is actually performed in the home environment or outside. The therapist helps the patient adequately respond to their body's signals and to the symptoms experienced and mentioned by the patient.

Step 4: doing

To facilitate doing in step 4, sub-goals may be set between the various sessions that the patient can work on independently. These sub-goals are then evaluated together with the therapist. During the evaluation the therapist again discusses the possible presence of inhibiting and facilitating factors. The goals with regard to physical activities can then be increasingly expanded. Motivational interviewing, setting personal goals, managing inhibiting factors, either combined or not combined with exercise therapy, certainly have potential in this respect (Mantoani 2017). The most evidence has been found in a combination of counselling and performance of physical activities with coaching during which feedback is given on individual goals (e.g. by means of feedback from an activity meter) (Mantoani 2016, 2017; Spruit 2015).

Step 5 continuing to do/maintaining

During step 5 the challenge is to maintain the change in the long term and optimise moderately intense physical activity. The therapist can give advice, inform and refer to regional or national exercise and/or sports activities if the patient himself still hasn't found any suitable options for being sufficiently active. For additional information, COPD patients can be referred to the Lung Foundation's website for exercise tips (Lung Foundation 2019).

Note C.3 Facilitation of physical capacity

Note C.3.1 Endurance/interval training

Clinical questions

1. What is the best type of training to facilitate physical capacity in COPD patients: interval training or endurance training?
2. How (FITT) should endurance/interval training be administered to COPD patients?

Reason

Physical training is an essential component of therapy whose goal is to increase physical capacity in COPD patients (ATS/ERS 2013). In addition, physical training leads to a decrease in daily symptoms (such as less dyspnoea, fatigue, anxiety and depression) and an increased quality of life, while the degree of airflow limitation remains the same (McCarthy 2015; Harrison 2012, Van Herck 2019). The physical capacity of COPD patients will not improve if only counselling (without physical training) is offered (Ries 1995).
There are various types of physical training that can be used to increase physical capacity. You can choose from endurance training, interval training and muscle strength training.
The benefit and feasibility of the various types of training will be described against the background of the cardiocirculatory, ventilatory and/or peripheral factors that are related to the limited physical capacity (ERS 2019). The degree to which these factors can impact the limited physical capacity can differ greatly from person to person. That is why each of these factors is evaluated separately, and the physical training is tailored to the patient's individual needs and capabilities. The fact that the combination of factors often results in limited physical capacity must also be taken into account. Furthermore, it must be understood that therapy will (in part) initially remedy constraints, due to which other factors will have a greater impact on physical capacity (Saey 2003).
This section of the guideline answers the question of how endurance/interval training should be structured and especially when endurance training should be chosen and when interval training is the better choice.

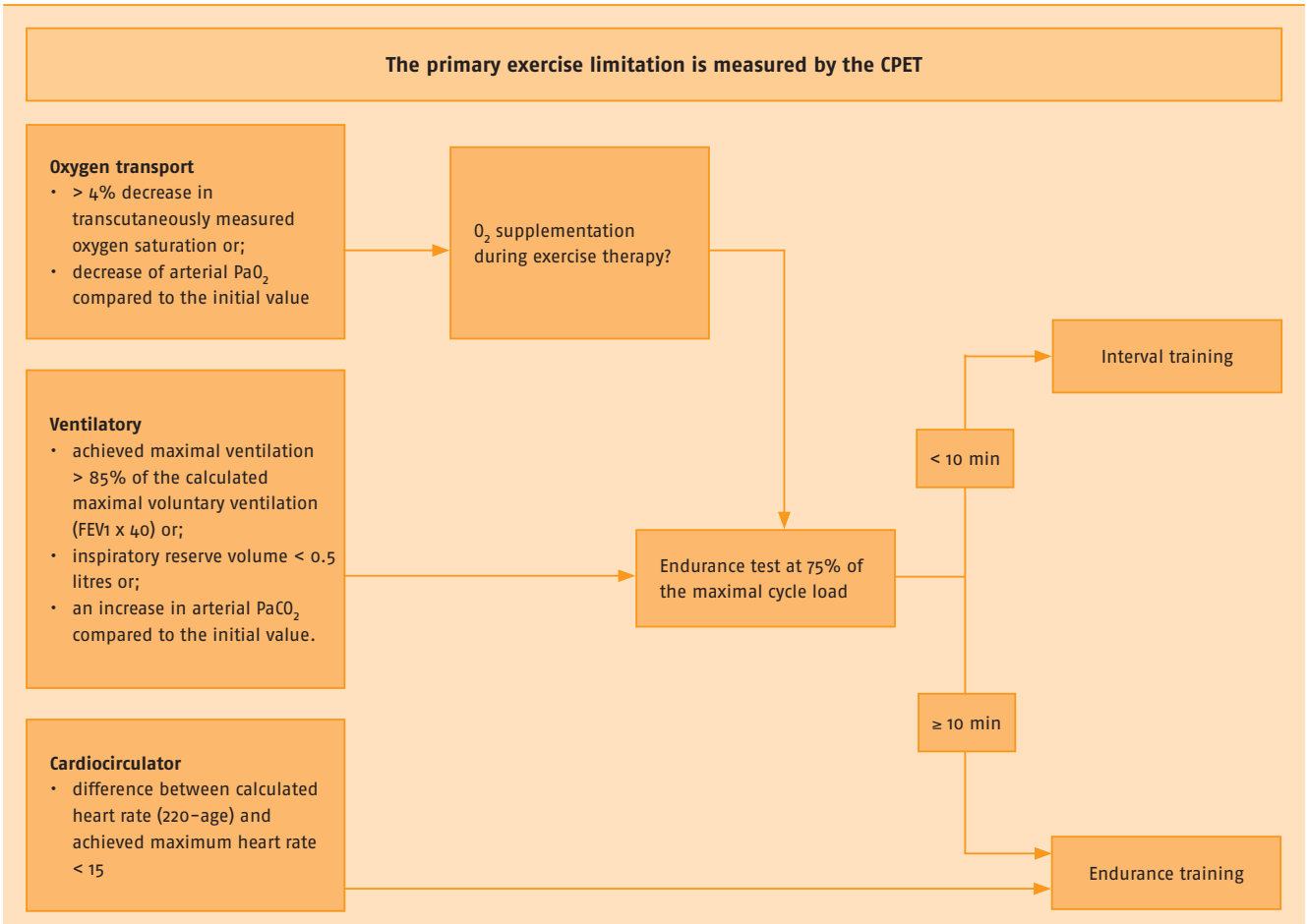
1 What is the best type of training for COPD patients: interval training or endurance training?

Literature

A systematic review was carried out to determine whether endurance training or interval training is preferable. No significant differences were found during the review between endurance training and interval training for improving physical capacity and quality of life or decreasing dyspnoea. The quality of evidence of the encountered studies is low to moderate.

Considerations

Not all COPD patients are able to perform endurance training with the right intensity and/or duration (Maltais 1997; Puhan 2008). Due to this the training stimulus may not be sufficient to increase physical capacity. Often times patients have severe airflow limitation and weakened thigh muscles (Spruit 2007). Based on the factors that limit physical capacity, in combination with the patient's goals and preferences, the therapist should judiciously select the most optimal type(s) of training. The diagram below contains a flowchart on how to determine the most optimal type of training based on exercise limitation.



Choice of the most optimal type of training based on exercise limitation

If patients have a limited cardiocirculatory capacity during the maximal exercise test (< 15 beats from the calculated maximum heart rate (220 – age)), endurance training seems appropriate.
For COPD patients who are ventilatory limited (the ratio of maximal ventilation and the calculated or measured maximal voluntary ventilation > 85% or an inspiratory reserve volume < 0.5 litres or an increase in $PaCO_2$ compared to the initial value), an endurance cycling test should be performed at 75% of the maximal cycle load (Van 't Hul 2003). If this endurance cycling test can be kept up for ≥ 10 minutes, the patient can undergo endurance training. However, if the endurance cycling test is kept up for less than 10 minutes, this patient will likely be a candidate for interval training.
During an interval training session, COPD patients have less dynamic hyperinflation compared to an endurance training session, and the ventilation (compared to the maximal voluntary ventilation [MVV]) is significantly lower (Kortianiou 2010; Sabapathy 2004; Vogiatzis 2004). This explains in part why patients are able to achieve a high training intensity with relatively low scores for dyspnoea and with fewer breaks in the training session and hence why this type of training is better tolerated (Puhan 2008; Vogiatzis 2002, 2005).
If the training is still very difficult due to the high degree of exercise-induced dyspnoea, the therapist can have the patient listen to music. That's because COPD patients are able to exercise longer at high intensity with fewer dyspnoea symptoms if they listen to self-selected music compared to physical activity without music (Lee 2018). Therapists can also consider limiting the workload on the disrupted respiratory system or increasing the load-bearing capacity.
The workload on the disrupted respiratory system is decreased by reducing the quantity of active muscle mass during physical training with the help of single-leg training (see C.3.2 'Muscle strength training'). The load-bearing capacity of the disrupted respiratory system can be increased through non-invasive respiratory support. This is mostly indicated for patients with hypercapnia, reduced inspiratory muscle strength and/or severely increased static hyperinflation of the lungs. The clinical value of training still needs to be researched more in depth (Menadue 2014).

If a decrease of > 4% in transcutaneously measured oxygen saturation is measured in a COPD patient during the maximal exercise test or there is a decrease of arterial PaO_2 compared to the initial value, then this patient may be a candidate for oxygen supplementation during the endurance and/or interval training. (See C.3.4 'Training in relation to oxygen desaturation'.)

See the Justification for this module for more information.

2 How (FITT) should endurance/interval training be administered to COPD patients?

Where possible, the general training advice from the American College of Sports Medicine for healthy seniors is applied to COPD patients (ACSM 1998, 2009).
During endurance training, a longer period (> 10 minutes) of physical activity is often performed at a moderate to high intensity (60–80% of the maximum workload as determined with a maximal exercise test). Endurance training often takes place on a treadmill and/or stationary bike (Spruit 2014). Additionally, Nordic walking is a training modality that can result in increased physical capacity (Breyer 2010). When choosing the type of training it is important to take into account the individual patient's goals.
Interval training is characterised by high-intensity physical activity (85–100% of the maximum workload as determined by a maximal exercise test) for a short duration (30–60 seconds) with sufficient rest between sets (1–2 min). This type of exercise therapy is safe and effective for improving physical capacity and quality of life (Vogiatzis 2002), even for very vulnerable patients who are on the waiting list for a lung transplantation (Gloeckl 2012).
The training intensity and/or duration of the above-described general types of training are often linearly structured based on symptoms (score of 4–6 on a Borg Scale [0–10]) in order to increase the physical capacity of COPD patients (McCarthy 2015; Li 2019). Non-linear periodic exercise training appears to have even greater effects on physical capacity compared to conventional, linearly structured types of training (Klijn 2013).

Note C.3.2 Muscle strength training

Clinical questions

1. What is the value of muscle strength training for COPD patients?
2. How (FITT) should muscle strength training be administered to COPD patients?
3. What is the added value of whole body vibration when administering muscle strength training?

Reason

There are various types of physical training that can be used to increase physical capacity. The choice includes endurance training, interval training and muscle strength training. However, based on the factors that limit physical capacity, in combination with the patient's goals and preferences,
the therapist should judiciously select the most optimal type(s) of training. Where possible, the general training advice from the American College of Sports Medicine for healthy seniors is applied to COPD patients (ACSM 1998, 2009).
The College makes recommendations about administering muscle strength training. It also answers the question of how muscle strength training should be structured and whether use of whole body vibration has any added value.

1 Muscle strength training and endurance/interval training versus endurance/interval training alone

Literature

The systematic review did not find any significant effects on physical capacity, quality of life and dyspnoea when muscle strength training as additional therapy to endurance/interval training is compared with endurance/interval training alone. The quality of evidence is very low. However, a moderate effect on muscle strength is found in favour of the muscle strength and endurance/interval group. The quality of evidence of this is low.

Considerations

Weakening of the muscle groups of the lower extremity can contribute to premature stopping of physical activity in COPD patients (Gosselink 1996; Man 2003; Singer 2011). This can be expressed during a maximal cycle test by symptom scores of ≥ 7 points on a Borg Scale (0–10). In addition, these patients will have a decreased function of the quadriceps muscles in specific muscle strength tests (Robles 2011; Seymour 2010). Muscle strength

training of the larger muscle groups of the lower extremity is an effective training method for increasing muscle mass and strength, which helps increase physical capacity (Li 2019). The muscle strength training often takes place with the assistance of training equipment, allowing the therapist to properly set the training intensity after determining the 1RM. The big advantage of muscle strength training is the relatively low workload on the limited respiratory system, due to which COPD patients experience a lot fewer symptoms of dyspnoea compared to endurance training (Probst 2006; Sillen 2008). The workload on the disrupted respiratory system can be further decreased by reducing the quantity of active muscle mass during physical training with the help of single-leg training. Compared to dual-leg training, single-leg training results in lower ventilation and greater improvement of physical capacity in COPD patients. Of course, the training duration does double. Based on the literature and considerations, muscle strength training is conditionally recommended to COPD patients with limited physical capacity (profiles 4, 5 and 6) if endurance/interval training is virtually impossible due to inadequate muscle function and/or severe dyspnoea or in combination with endurance/interval training if the larger muscle groups of the lower extremity are weakened (Spruit 2013).

See the Justification for this module for more information.

2 How (FITT) should muscle strength training be administered to COPD patients?

Where possible, the general training advice from the American College of Sports Medicine for healthy seniors is applied to COPD patients (ACSM 1998; ACSM 2009).
The training intensity and/or duration of the muscle strength training is often linearly structured based on the maximum muscle strength (60-80% of the 1RM). Non-linear periodic exercise training appears to have even greater effects on physical capacity compared to conventional, linearly structured types of training (Klijn 2013). The benefit of using equipment is that the intensity can be properly determined. However, functional muscle strength exercises are best administered in the ADL. Both types of training are therefore suitable.

3 What is the added value of whole body vibration when administering muscle strength training?

Whole body vibration with the use of a vibration platform is a supplementary intervention that has been increasingly used for clinically stable COPD patients in recent years (Zhou 2018). A vibration platform, on which the patient stands when performing strength exercises, emits mechanical stimuli for improving the neuromuscular function of the lower extremity. Vibrations in frequencies between 15 and 60 Hz and amplitudes varying from 1 to 10 mm are possible.

Literature
Use of whole body vibration during muscle strength training may slightly improve functional physical capacity and quality of life compared to regular muscle strength training. The quality of evidence is low. Whole body vibration may significantly improve balance compared to regular muscle strength training. The quality of evidence is very low.

Considerations
The effects of whole body vibration on physical capacity and quality of life are slight and the quality of evidence is low. However, a greater effect on balance should be possible, although the quality of evidence is also very low here. The costs of a vibration platform are relatively high, and there are less expensive alternatives available for training balance. Based on these considerations, a conditional recommendation against the use of whole body vibration is formulated, whereby whole body vibration may potentially be considered for balance problems.

See the Justification for this module for more information.

Note C.3.3 Hydrotherapy

Clinical question
Does hydrotherapy have added value for COPD patients compared to conservative therapy for improving physical capacity?

Reason
Hydrotherapy is physical training (endurance, interval and/or strength training) in a swimming pool. In part due to the upward pressure of the water, hydrotherapy can be beneficial for patients with additional physical problems such as joint osteoarthritis and/or pronounced obesity (McNamara 2013b).

Literature
Hydrotherapy improves physical capacity in COPD patients to virtually the same degree as training on land (McNamara 2013a).

Considerations
In general, the effects of hydrotherapy are the same as those of training on land, and therefore these effects to not outweigh the costs and the practical issues of hydrotherapy. Hydrotherapy can only be of added value for patients with additional physical problems that severely limit conventional training on land, such as joint osteoarthritis and/or pronounced obesity. Additionally, patients may have a distinct preference for physical training in the form of hydrotherapy.

Note C.3.4 Training in relation to oxygen desaturation

Clinical question
This clinical question is further divided into the following sub-questions:
1. What is the minimum transcutaneously measured resting Sp02 with which a COPD patient may start a physical test or exercise therapy?
2. To what extent is medical oxygen supplementation during a physical test or exercise therapy useful for COPD patients?
3. At what transcutaneously measured Sp02 is the physical test or exercise therapy stopped?

Reason
During physical tests or exercise therapy the transcutaneously measured Sp02 decreases in 30 to 40% of COPD patients (Andrianopoulos 2014, 2016). This decrease can also occur in patients with normal arterial oxygen tension at rest (Andrianopoulos 2014). The degree of dyspnoea and the degree of oxygen desaturation experienced very rarely correlate. Due to this, patients themselves generally do not feel exercise-induced oxygen desaturation. Therefore, the Sp02 should be measured with a transcutaneous Sp02 meter (B3.1 'Recommended and optional measurement instruments').
Although the transcutaneously measured Sp02 of COPD patients is often measured during physical tests and exercise therapy, exercise-induced oxygen desaturation does not appear to lead to a worse overall health status in clinically stable COPD patients (Afzal 2018). Nevertheless, therapists and patients prefer to have the transcutaneously measured Sp02 regularly measured during physical activity. However, it is unclear how oxygen desaturation during physical activity should be handled.

1 What is the minimum transcutaneously measured resting Sp02 with which a COPD patient may start a physical test or exercise therapy?

Literature
A narrative review of the literature did not yield any studies on the effects of the SpO_2 resting value prior to exercise that would help answer this sub-question.

Considerations
An exercise-induced SpO_2 decrease can reduce the physical capacity of COPD patients, and a decreased resting SpO_2 increases the chance of an exercise-induced SpO_2 decrease (Andrianopoulos 2016). Therefore, the physical test or exercise therapy should only be started with a transcutaneously measured resting $SpO_2 \geq 0\%$ (ERS/ATS 2014). If the transcutaneously measured resting Sp02 after 10 minutes of sitting is still < 90%, the treating physician should be contacted before the COPD patient starts a physical test or exercise therapy.

2 To what extent is medical oxygen supplementation during a physical test or exercise therapy useful for COPD patients?

Literature
For patients with COPD and hypoxemia (PaO_2 < 8.0 kPa) at rest and for patients with exercise-induced oxygen desaturation, medical oxygen supplementation can directly increase the exercise capacity (Jarosch 2017). However, use of medical oxygen supplementation during physical training of patients with COPD and with exercise-induced oxygen desaturation does not appear to result in a greater increase of exercise capacity compared to physical training with ambient air (Alison 2019; Nonoyama 2007).

Considerations

Medical oxygen therapy for COPD patients can only be administered after consultation with the treating physician. That's because oxygen supplementation in patients with chronic hypoxemia can lead to hypercapnia (or its exacerbation), since oxygen supplementation decreases the hypoxic drive in these patients and leads to an increase of the V/Q mismatch (hypoxic vasocontstriction) (Abdo 2012). Although an excessive decrease of the SpO_2 can limit the physical capacity of COPD patients, the majority of COPD patients can safely perform the exercise therapy when they desaturate slightly (Alison 2019; Walsh 2019).

Therefore, for COPD patients who have a transcutaneously measured SpO_2 < 85% during a physical test or exercise therapy and have no chronic oxygen therapy, the treating physician should be contacted in order to discuss the potential use of medical oxygen supplementation during physical activity.

Medical oxygen supplementation does not prevent a decrease of the SpO_2 during physical activity for all COPD patients (Dyer 2012; Jarosch 2017). Therefore, the sub-maximal exercise test should be performed at 75% of the maximal cycle load once with medical oxygen supplementation and once without it. If the medical oxygen supplementation leads to a higher resting SpO_2 and a small or no decrease of the transcutaneously measured SpO_2, then use of medical oxygen supplementation would appear to be indicated. The treating physician should also be contacted if patients with chronic oxygen therapy have a transcutaneously measured SpO_2 < 85% during the physical test or exercise therapy, in order to discuss whether the medical oxygen supplementation during physical activity might be increased.

3 At what transcutaneously measured SpO2 should the physical test or exercise therapy be stopped?

Literature

A narrative review of the literature did not yield any studies on oxygen desaturation during exercise that would help answer this sub-question.

Considerations

An exercise-induced SpO_2 decrease can lead to a limitation of physical capacity. It is suspected that long-term, extreme SpO_2 decreases and the associated severe desaturation can lead to cardiac ischemia and arrhythmias (Walsh 2019). That is why the physical test or exercise therapy should be stopped with a transcutaneously measured SpO_2 < 85% and the referring physician should be contacted.

An exercise-induced decrease of the transcutaneously measured SpO_2 is not immediately a reason to stop the physical activity as long as it remains ≥ 85%. However, with SpO_2 values of < 90% during physical activity, the SpO_2 recovery after completing the physical test or exercise therapy should be monitored. The treating physician should also be contacted if the transcutaneously measured SpO_2 in the recovery phase (2 minutes after physical activity) is not adequately restored (= pre-activity resting SpO_2).

Note C.3.5 Neuromuscular electrical stimulation

Clinical questions

1. When should treatment with neuromuscular electrical stimulation (NMES) be administered to COPD patients?
2. How should NMES be administered to COPD patients?

Reason

Although the positive effect of exercise therapy for COPD patients is generally known, not all COPD patients are capable of regular physical training due to severe dyspnoea, for example, or because they are bedridden and receiving (invasive) ventilation. Treatment with neuromuscular electrical stimulation (NMES) may improve the physical functioning and quality of life for these patients.

1 When should treatment with neuromuscular electrical stimulation (NMES) be administered to COPD patients?

Literature

For patients with stable COPD, NMES in combination with exercise therapy barely has any added value compared to exercise therapy without NMES (low to very low quality of evidence).

For patients with stable COPD who are not performing physical training, treatment with NMES results in a very significant improvement of functional exercise capacity and a slight improvement of the peripheral muscle strength compared to usual care (low quality of evidence). For COPD patients who are hospitalised due to an

exacerbation, the combination of NMES and mobilisation exercises results in a very significant improvement of physical functioning, exercise capacity and peripheral muscle strength and a significant decrease of dyspnoea (low to very low quality of evidence).
There are no indications of increased risk of mortality (moderate quality of evidence) or adverse events related to the NMES treatment (low quality of evidence).

Considerations
The effects of NMES are significant and valuable for hospitalised patients. NMES may also be of value for patients with stable COPD who are not capable of physical training. Treatment with NMES is not painful and is well-tolerated by patients. The required equipment is already available in most rehabilitation centres and hospitals and in some primary care practices.

See the Justification for this module for more information.

2 How should NMES be administered to COPD patients?

With NMES, large rubber electrodes are used in combination with sponges and Velcro tape (Lieber 1991). The femoral quadriceps muscles are stimulated, possibly in combination with the hamstrings or the gastrocnemius muscles. The electrodes are placed on the abdominal muscle with the greatest possible spacing, preferably on the motor points. A biphasic rectangular pulse is used, with a frequency
of at least 35 Hz for at least 300 µs in a series time with a 1:1 to 1:2 ratio. The intensity (pulse amplitude) should at minimum result in a visible and/or tangible contraction, preferably up to the maximum tolerance limit without pain. The duration of the stimulation is at least 15 minutes and is administered for at least four weeks with a treatment frequency of three times per week (Herzig 2015; Maffiuletti 2018; Vivodtzez 2008).

Parameters for optimal stimulation
- waveform: rectangular pulse
- frequency: at least 35 Hz
- pulse duration: at least 300 µs
- intensity: maximum tolerance or visible and clearly tangible contraction
- session duration: at least 15 minutes
- number of training sessions: at least 12 sessions
- series time (on/off):
  - on = at least 5 sec. on
  - off = at most twice as long as 'on'

Note C.4 Interventions aimed at the respiratory system

Note C.4.1 Respiratory muscle training

Clinical questions
1. What is the value of inspiratory muscle training for COPD patients?
2. How (FITT) should inspiratory muscle training be administered to COPD patients?

Reason
Respiratory muscle training is an intervention applied for improving the inspiratory muscle strength, with the goal of decreasing dyspnoea in patients with COPD (or other lung diseases) (Clini 2018). A patient has a reduced respiratory muscle function if the maximal inspiratory mouth pressure (PImax) is less than 70% of the predicted value (ERS 2019; Rodrigues 2017). The respiratory muscle training can be applied in various ways, with the use of FITT principles.

1 What is the value of inspiratory muscle training for COPD patients?

Literature
No effect of respiratory muscle training was found on the 'quality of life' outcome measure. However, respiratory muscle training does lead to a moderate improvement of physical capacity and possibly to a significant decrease of dyspnoea (depending on the measurement instrument) compared to no therapy. The quality of evidence is low.

Considerations
Given that respiratory muscle training as a standalone intervention does lead to a moderate improvement of physical capacity and possibly to a significant decrease of dyspnoea compared to no therapy, a conditional recommendation was decided on. This means that the intervention is recommended for patients with a decreased respiratory muscle function (< 70% of the predicted value) in combination with dyspnoea in patients for whom the goal is to reduce this dyspnoea and/or in patients with such severe dyspnoea that endurance/interval training is virtually impossible. In addition, the patient must be sufficiently motivated to independently perform the respiratory muscle training (after instruction) and be willing to acquire the required equipment.

See the Justification for this module for more information.

2 How (FITT) should inspiratory muscle training be administered to COPD patients?

Literature and considerations
The training can consist of resistance training with 'threshold, flow-resistive' or a combination of 'threshold' and 'flow-resistive' (Bellman 1988; Göhl 2016; Larson 1988, 2015). The intensity depends on the equipment used, but thirty breaths at about 30 to 50% of the PImax is recommended (Clini 2018; Hill 2010). Inspiration (contraction) must be performed as fast and as deep as possible; expiration (relaxation) should be calm and full. The optimal ratio of inspiration to expiration is one part inspiration to two to three parts expiration. If this is too fast and the patient risks hyperventilating and/or becoming dizzy, then the recommendation is to briefly pause after every expiration before beginning with the next inspiration. A brief pause may also be taken every 10 breaths (Langer 2015).
In 32 of the 37 included studies in Beaumont's review, a frequency of five days per week is maintained (Beaumont 2018). This is considered the minimum number of days per week for bringing about an effect on the respiratory muscle function, with there having to be at least four weeks of consecutive training in order to achieve a relevant training result (Clini 2018). Thirty breaths are practiced one to two times per day, which takes about five minutes. These short intensive training sessions appear to be more effective than long, less-intensive training sessions of 15 minutes or more (Hill 2006; Langer 2015; Sturdy 2003). A training session two to three times per week is recommended to retain the respiratory muscle function. (Weiner 2004).

Noot C.4.2 Ademhalingstechnieken

Clinical question
What is the value of breathing techniques for COPD patients?

Reason
Various breathing techniques may reduce the dyspnoea of COPD patients. Pursed lip breathing (PLB) and diaphragmatic breathing are examples of breathing techniques. However, the degree to which interventions help provide these techniques and which techniques are preferred is unknown.
Based on the results, the following breathing techniques were selected:
1. pursed lip breathing (PLB);
2. diaphragmatic breathing;
3. ventilation feedback;
4. combined respiratory interventions.

1 Pursed lip breathing (PLB)

Literature
- Immediately after the intervention, PLB brings about a *moderate decrease* of dyspnoea compared to no respiratory intervention. The quality of evidence is *very low*.
- Eight weeks after the intervention, PLB brings about a *very significant increase* of physical capacity compared to no respiratory intervention. The quality of evidence is *very low*.
- Eight weeks after the intervention, PLB brings about a *moderate improvement* of quality of life compared to no respiratory intervention. The quality of evidence is *very low*.
- The risk of adverse events is unknown; adverse events have not been reported.

Considerations
PLB is a safe and easy to administer respiratory intervention with positive results and has very few or no undesirable effects. There is variation in the effects, and the quality of the scientific evidence is very low. It is

important to teach PLB to patients who are not yet able to apply this technique and to make patients who are already unconsciously using this technique aware of this and explain in which situations they can apply PLB even more. This results in a conditional recommendation for the intervention.

See the Justification for this module for more information.

2 Diaphragmatic breathing

Literature

- Four weeks after the intervention, diaphragmatic breathing compared to no respiratory interventions brought about a *slight decrease* of dyspnoea with *low quality of evidence*; a *moderate increase* of physical capacity with *low quality of evidence* and a *significant improvement* of quality of life with *low quality of evidence*.
- The risk of adverse events is unknown.

Considerations

Only one RCT with moderately positive results is known for diaphragmatic breathing, and the quality of the evidence is low. The effects in practice and from the other literature vary greatly, and it is not yet clear for which patient group diaphragmatic breathing works and does not work. One important consideration is that diaphragmatic breathing should not be applied in the presence of hyperinflation and/or Hoover's sign. Mobility of the diaphragm is not or is barely possible due to the hyperinflation, and further emphasis on diaphragmatic breathing is mechanically unfavourable and energy inefficient. Dyspnoea symptoms could potentially worsen due to this. Nowadays, therapists very rarely teach diaphragmatic breathing anymore. Based on the above considerations, a conditional recommendation is made against teaching diaphragmatic breathing.

See the Justification for this module for more information.

3 Ventilation feedback

Literature

- After conclusion of the intervention, respiratory training with the aid of ventilation feedback brings about a *small decrease* of dyspnoea compared to no respiratory intervention. The quality of evidence is *very low*.
- Four and 15 weeks after the intervention, respiratory training with the aid of ventilation feedback brings about a *small increase* of physical capacity and a *small improvement* of quality of life compared to no respiratory intervention. The quality of evidence of both is *very low*.
- The risk of adverse events is unknown; these have not been reported.

Considerations

Ventilation feedback has a slight effect, and the equipment is very expensive to acquire. Ventilation feedback can be performed by therapists who have the equipment at their practice. Therapists must make sure that the patient is not too fatigued to perform the intervention. These considerations have resulted in a conditional recommendation against this intervention in general. Should the therapist have the equipment at their practice, then the equipment can be used to provide some insight.

See the Justification for this module for more information.

4 Combined respiratory interventions

Literature

- Immediately and two months after the intervention, combined respiratory interventions bring about a *significant decrease* of dyspnoea and a *very significant increase* of physical capacity compared to no respiratory intervention. The quality of evidence of both is *very low*.
- After conclusion of the intervention, combined respiratory interventions bring about a *small to large increase* of quality of life compared to no respiratory training. The quality of evidence is *very low*.
- The risk of adverse events is unknown; these have not been reported.

Considerations

The clinical application of combined respiratory intervention is very good because this intervention enables individual counselling and customised care. It is a safe and easy to administer intervention with positive results

and has very few or no undesirable effects. There is some variation in the effects because sometimes it takes a while to determine what works for a patient, and coordination of various interventions requires some effort. Teaching PLB is important in any case. Furthermore, the recommendation is to not teach multiple respiratory interventions at the same time, but rather one respiratory intervention at a time and then to assess which additional respiratory intervention could be of added value for the individual patient. These considerations result in a conditional recommendation for the intervention.

See the Justification for this module for more information.

Note C.4.3 Relaxation techniques

Clinical question
Which relaxation techniques can be performed to decrease dyspnoea?

Reason
Dyspnoea may cause patients to experience severe fatigue, most likely due in part to sleep problems (Spruit 2017). COPD patients may also become tense, anxious or stressed by the dyspnoea and fatigue. There may also be an interaction; increased stress can cause the patient to be more tired and/or short of breath (Halpin, 2016; Yilmaz, 2016). This module addresses possible relaxation techniques you can apply.

Literature and considerations
Relaxation exercises can be applied to reduce dyspnoea and for slight stress or anxiety. It is also important for patients to learn that they don't need to be afraid of their dyspnoea. However, if the patient has persistent or a very high degree of anxiety (or panic) with dyspnoea, and performing relaxation exercises does not result in anxiety reduction, consultation with the referring physician is necessary. Referral to a psychologist can also be considered.
In general, the recommendation is to integrate the relaxation technique into the therapy. It is important to take into account the patient's preference with regard to the type of relaxation technique. Multiple studies have shown small positive effects of relaxation techniques on both psychological well-being as well as respiratory functioning, including dyspnoea (Cafarella 2012; Gosselink 2003; Hyland 2016; Yilmaz 2016; Volpato 2015). There are various accessible relaxation techniques that can be used in therapy. All relaxation techniques have a form of mental focus. This focus can be the body or the patient's own attitude, the here and now, going to a 'safe place' in your thoughts or more abstract aspects, such as counting in a specific order. Often it's about shifting and focusing attention.
A study was conducted on the preference of patients (with COPD) regarding six relaxation techniques (Hyland 2016). In this study, patients evaluated each technique – after applying it – as to how effective it was for decreasing anxiety and dyspnoea and how likely they thought they would be to continue applying the technique in their personal situation. All techniques were positively evaluated during the study, but the following three techniques received the highest ratings:

- **Guided imagery** Patients think of a nice place where they feel happy and relaxed and concentrate on the experience that being in such a beautiful spot evokes.
- **Jacobson progressive muscle relaxation** This technique consists of consciously tensing and relaxing large muscle groups, from the hands to the feet, in order to decrease muscle tension. This way patients become aware of the stress status of their muscles.
- **Counting** Patients count from one to five and keep repeating this.

The other techniques that were also positively evaluated, although to a lesser degree, were:

- **Word repetition** Patients repeat a meaningless word so they start associating that word with relaxation.
- **Positive imagery** Patients are given the task of generating a positive emotion by imagining a ball of light that fills them with rays of happiness and love.
- **Simplified form of Kundalini yoga** Patients are instructed to concentrate on slowly lifting and lowering their hand.

In addition, progressive muscle relaxation appears to have a positive effect on dyspnoea, fatigue and sleep problems, and positive side effects have been reported, such as being more energetic, happy or refreshed and feeling mentally and physically relaxed (Yilmaz 2017).
The researchers (Hyland 2016) conclude that it is important to coordinate together with the patient which relaxation technique is best suited for them. This makes it easier for the patient to continue doing the exercise at home and apply it when dyspnoea increases.

In addition to the listed relaxation technique, there are other techniques that might be effective for treating COPD patients. However, it was not possible to evaluate all the techniques within the framework of this guideline.

Note C.4.4 Posture adjustments

Clinical question
What is the best posture for decreasing dyspnoea?

Reason
This module looks at which posture is best for decreasing dyspnoea. Posture recommendations are therapeutic interventions that have a proven effect on dyspnoea and quality of life (LAN, 2016).

Literature and considerations
COPD patients often exhibit increased ventilation and decreased functioning of the diaphragm compared to healthy people (Porto 2017; Yamada 2017). The mobility of the diaphragm may be increased by increasing the abdominal pressure during active expiration or by adopting a forward leaning position.
The goal of adopting various body positions is to improve the ratio between the muscle length and tension of the respiratory muscles (especially the diaphragm). The adoption of various body positions is also used for increasing the endurance of the inspiratory muscles (Gosselink 2003). The forward leaning position is often seen in COPD patients; patients experience a slight alleviation of dyspnoea with this posture (Gosselink 2003). A reason for this is that leaning forward from the hips along with a slight bend in the thoracic spine could improve the muscle length-tension curve of the diaphragm. The arms should also be used in this posture, for example by placing the hands on the knees and placing the elbows on a table, and potentially supporting the head with the hands. This way the diaphragm is passively placed into an inspiration posture, and a closed chain of auxiliary respiratory muscles is created (including the pectoralis minor and major muscles), which can then correspondingly deliver more power (Gosselink 2003, 2004; Kim 2012). Patients who prefer to stand are encouraged to adopt a similar posture while standing, and to use the top of a tall chair's backrest to support themselves, for example. The posture can be adapted during or after performing exercises or activities of daily life by using a shopping cart or walker or the handrails of a treadmill for support.

Note C.4.5 Mucus clearance

Clinical question
Which techniques for facilitating mucus clearance are indicated for COPD?

This clinical question is divided into the following sub-questions:
1. Which techniques for facilitating mucus clearance are indicated for patients with stable COPD?
2. Which techniques for facilitating mucus clearance are indicated for COPD patients with an exacerbation?

Reason
Common symptoms of COPD, such as chronic coughing and increased sputum production, are related to an increased risk of exacerbations, hospitalisation and premature death due to COPD (Burgel 2009; Ekberg-Aronsson 2005; Lange 1990; Prescott 1995). When a patient has difficulty mobilising and evacuating sputum from the airways, supporting interventions can be used to facilitate mucus clearance and reduce the complications associated with sputum retention. Mucus clearance can be facilitated using conventional techniques, breathing techniques and use of PEP devices with or without vibration; use of larger and advanced equipment is also possible.
Conventional techniques such as vibration, percussion and postural drainage (as a standalone intervention) arose from the idea that the generated vibrations would loosen the sputum from the walls of the airways. However, these techniques are rarely applied nowadays. The intrapulmonary air mass, fatty tissue, muscle tissue, lung tissue and thoracic wall absorb the vibrations, making these techniques barely effective. They are also labour-intensive, patients are dependent on the therapist and the therapy compliance is low. Application of breathing techniques and use of (O-)PEP devices, on the other hand, are interventions that patients can use independently. Active breathing techniques that patients can learn to facilitate mucus clearance are: the active cycle of breathing technique (ACBT), the forced expiration technique (FET), autogenic drainage (AD) and expiration with an open glottis in the lateral posture (ELTGOL). PEP devices use a mask or mouthpiece to bring about positive expiratory pressure (PEP). O-PEP devices combine the positive expiratory pressure with high-frequency oscillation.

1 Which techniques for facilitating mucus clearance are indicated for patients with stable COPD?

Literature
PEP and O-PEP likely have very favourable effects on quality of life, dyspnoea and physical capacity. They may also reduce the risk of exacerbation.
No studies were found on the effects of breathing techniques (ACBT, forced expiration/FET, AD or ELTGOL).

Considerations
Based on the favourable effects, a conditional recommendation is formulated for techniques that facilitate mucus clearance. The recommendation is to start teaching techniques with which the patient can facilitate mucus clearance independently. If the patient has mastered this technique but cannot yet sufficiently and/or efficiently cough up the sputum (retention), use of an aid is advised. PEP or O-PEP is recommended in this case, given the demonstrated effectiveness of these aids. Hygiene should be discussed when using aids. The preference is not to use any passive techniques such as vibration, percussion and/or postural drainage.

See the Justification for this module for more information.

2 Which techniques for facilitating mucus clearance are indicated during an exacerbation?

For patients with an exacerbation, no or hardly any effects of breathing techniques, manual techniques and use of PEP were seen on quality of life, dyspnoea, hospitalisation duration, ventilation, physical capacity and future exacerbations and lung-related hospitalisations (desirable effects) and minor adverse events and mortality (undesirable effects). Only indications were found that breathing techniques might reduce dyspnoea and that in patients with non-invasive ventilation (NIV), PEP might decrease the duration of this ventilation by two days.

Considerations
Although the effects of techniques for facilitating mucus clearance are limited, it is unlikely that these effects are less pronounced in patients with an exacerbation than in patients with stable COPD. That is why the same recommendations apply during an exacerbation as for stable COPD with regard to breathing techniques, aids (PEP and O-PEP) and other techniques, such as vibration, percussion or postural drainage.

See the Justification for this module for more information.

Note C.5 Therapist supervision

Note C.5.1 Therapy duration and frequency

Clinical questions
1. What is the optimal duration of the treatment period for COPD patients?
2. What is the optimal supervision frequency during a treatment period for COPD patients?

Literature and considerations

Duration of the treatment period:
The literature review identified one systematic review. The review searched for studies comparing short-term and long-term exercise programmes (Beauchamp 2011). The included RCTs compare exercise programmes lasting 4 and 7 weeks, 8 and 20 weeks and 6 and 18 months.
- In three of four studies that reported on quality of life, a difference in effect was found immediately after the intervention in favour of a long-term programme. The quality of evidence was low to very low, however.
- In one of the four studies that reported on physical capacity, a difference was found immediately after the intervention in favour of a long-term programme. The quality of evidence was very low, however.
- None of the studies reported on physical activity (by means of an activity meter) or undesirable effects.

Because the comparisons in the identified studies vary widely and the quality of evidence of the findings is very low, no clear optimal treatment duration can be concluded from the literature.
Based on studies that demonstrate the effectiveness of physical training, it is possible to state that approximately 8 to 12 weeks are needed in order to achieve a clinically relevant effect on physical capacity (McCarthy

2015). This time frame corresponds to the principles laid out by The American College of Sports Medicine (ACSM 2009). Nevertheless, extending the training period is worthwhile, because the training effects last longer with a longer training period (Jenkins 2018; Pitta 2008). Additionally, it takes time to bring about behavioural change (Mantoani 2016, 2017). The conclusion is hence that the length of the treatment period depends to a large extent on the patient. It is therefore impossible to formulate a recommendation about the optimal treatment duration per patient profile.
Long-term treatment is taxing on both patients and the healthcare system. It is therefore desirable to works towards the patient being able to independently maintain physical functioning. The treatment should be stopped as soon as the patient is able to perform exercise and/or sports activities independently. The recommendation is to continue treatment as a maintenance programme with the goal of keeping the symptom burden, physical capacity and physical activity stable in patients who are unable to perform exercise and/or sports activities independently due to very high vulnerability. See B.5 'Patient profiles' for a definition of the very vulnerable patient.

Supervision frequency
The literature review identified two RCTs in which exercise therapy (three sessions per week) was performed. The studies compared twice per week supervision (and once without supervision) to once per week supervision (and twice without supervision) (Lidell 2010; O'Neil 2007).

- Both studies showed no clinically relevant difference in quality of life between the groups who received once weekly and twice weekly supervision immediately after the intervention. The quality of evidence is low.
- No clinically relevant difference was found between de groups regarding physical capacity either. The quality of evidence is low.
- None of the studies reported on physical activity (by means of an activity meter) or undesirable effects.

In the two identified studies, supervision once or twice per week was offered in the treatment periods lasting six and eight weeks, respectively, during which exercise therapy was done three times per week. However, a supervision frequency of two to three times per week is maintained for eight to 12 weeks in studies that demonstrate the effectiveness of exercise therapy in COPD patients (McCarthy 2015). Additionally, the drop-out rate in the two identified studies is very high (27-33%) and also selective (patients with worse baseline scores dropped out at higher rates). This makes it impossible to determine the optimal supervision frequency with which the desirable effects could be achieved with exercise therapy based on these two studies (McCarthy 2015).
Frequent supervision is especially desirable during the first two weeks of a treatment course for facilitating physical capacity. With supervision the patient obtains disease insight and knowledge of the training principles more quickly. Additionally, the expectation is that frequent supervision decreases the chance of early drop-out. If the aim is solely to facilitate physical activity, supervision is needed less frequently than for facilitation of physical capacity, given that the patient should primarily work on their goals independently during daily life activities. After an intensive treatment phase – which is aimed at achieving the treatment goal – the patient can work towards independently maintaining the achieved results. The supervision frequency can be decreased during this scale-down phase.

Optimal supervision duration and frequency
Based on the literature and other considerations, it is not possible to recommend an optimal supervision duration and frequency. This decision is highly patient-dependent, and as a rule it should be left up to the therapist's clinical expertise to determine how long and how frequent the supervision should be in order to achieve and maintain the treatment goals. However, it is possible to provide an example of the supervision for a COPD patient per profile. This is elaborated in the following table (Spruit 2020).

Number of treatment sessions
However, maximum numbers of treatment sessions are recommended per profile in order to facilitate targeted care. (Spruit 2020). These numbers are based on the maximum supervision that is required according to physical therapists and exercise therapists C/M in the great majority of cases in order to achieve and maintain the treatment goals in the areas of treatable traits, physical capacity, physical activity and the respiratory system:

Profile 1 → 0 sessions (no indication for physiotherapy and/or exercise therapy C/M)
Profile 2 → at most 6 sessions
Profile 3 → at most 42 sessions
Profile 4 → at most 62 sessions
Profile 5 → at most 70 sessions
Profiel 6 → n/a (secondary or tertiary pulmonary rehabilitation)

Example of supervision duration and frequency in order to achieve and maintain the treatment goal in COPD patients (Spruit 2020).

	Profile 1		**Profile 2**		**Profile 3**		**Profile 4**		**Profile 5**		**Profile 6**	
	no treatment		no or short-term treatment		facilitation of physical activity		facilitation of physical capacity		facilitation of physical capacity and activity		interdisciplinary pulmonary rehabilitation	
	duration	frequency	duration	frequency	duration	frequency	duration	frequency	duration	frequency	duration	frequency
	no referral		primary care intake		primary care intake		primary care intake		primary care intake		secondary or tertiary pulmonary rehabilitation intake	
intensive treatment phase			2 weeks	1x/week	6 weeks	2x/week	12 weeks	3x/week	12 weeks	3x/week	duration and frequency is variable	
					6 weeks	1x/week						
			conclusion		*interim evaluation*		*interim evaluation*		*interim evaluation*		*transfer to primary care*	
scale-down phase[1]					18 weeks	1x/2 weeks	14 weeks	1x/week	14 weeks	1x/week		
					12 weeks	1x/4 weeks			18 weeks	1x/2 weeks		
									12 weeks	1x/4 weeks		
					conclusion		*conclusion*		*conclusion*			
maintenance phase	regular exercise and/or sports activities or CLI		regular exercise and/or sports activities or CLI		regular exercise and/or sports activities or maintenance treatment		regular exercise and/or sports activities or maintenance treatment		regular exercise and/or sports activities or maintenance treatment		maintenance treatment	
					2-3x per year evaluation		2-3x per year evaluation		2-3x per year evaluation		2-3x per year evaluation	

1 This phase does not apply for very vulnerable patients whereby maintenance treatment is required.
CLI = combined lifestyle intervention.

The maximum recommended number of sessions applies to patients who are capable of independently maintaining stable physical functioning after the treatment period and hence are not eligible for maintenance treatment. For patients who are eligible for maintenance treatment (see B.5 'Patient profiles'), a treatment frequency of once per week should be considered. The maintenance treatment can be stopped if the patient is able to perform exercise and/or sports activities independently.

See the Justification for this module for more information.

Note C.5.2 Group exercise therapy

Clinical question
When (and for whom) should you choose group training and when should you opt for individual training, and what criteria does group training need to fulfil (e.g. group size)?

Reason
Exercise therapy for COPD is often given in a group setting. Before being able to provide specific advice about the type of therapy, it must be clear whether there is a difference in effect on clinical outcome measures between the two types of training.

Literature

No specific studies are available that compare group therapy with individual therapy on clinical outcome measures in COPD patients. Such studies have, however, been conducted for the therapeutic setting for other patient populations.

A systematic review of the effect on clinical outcome measures for urinary incontinence and lower back pain shows the same results for group physiotherapy as for individual therapy with the same physiotherapeutic content (Robertson 2014) A randomised controlled trial on the treatment form for physiotherapy for osteoarthritis of the knee does not show any difference in results either (Allen 2016). For pulmonary rehabilitation in COPD patients, it has been demonstrated that a multi-faceted approach to self-management skills and behaviour both in a group as well as based on individual therapy can be facilitated (Lacasse 2006).

The difference between the group approach and individual approach has also been examined in disciplines outside of physiotherapy and exercise therapy, primarily in mental healthcare. For example, a review in which cognitive behavioural therapy in a group was compared to individual cognitive behavioural therapy. This review found no difference in effect on clinical outcome measures, but also no difference in drop-out and follow-up (Pozza 2017).

Sometimes additional benefits have been reported for group therapy compared to individual therapy. Patients who have had positive experiences with pulmonary rehabilitation in the past and who are willing to share these positive experiences can have a strong formative effect on other COPD patients (Lorig 1993).

Another study showed that group therapy supports patients because experiences are shared, learning experiences are reinforced, the self-image of patients changes and passivity is discouraged (ATS/ERS 2013). In some studies within and outside the discipline of physiotherapy or exercise therapy, drop-out is lower for group therapy compared to individual therapy or the follow-up after participation in group therapy is better after the intervention has ended, which may indicate that aspects of group therapy result in a lower drop-out rate (Doussoulin 2018; Minniti 2007). Exercising in a group setting can increase social support (KNGF 2014).

It is not possible to extrapolate the conclusions from the above-mentioned studies to other populations where rehabilitation is offered (Robertson 2014), including COPD. Other aspects play an important role for assessing whether it is better for a patient to train in a group or individual setting and/or whether it is better to receive counselling and advice.

The patient's level of knowledge (about the impact of negative thinking, inactivity, approaches to symptom management and barriers to therapy compliance) and how a patient experiences the group (individual comfort) can be important factors for optimising the counselling and having a successful exercise programme (Lee 2014; Graves 2010).

The content and type of supervision also play a role. It is also possible to train in a group with a customised programme and under intensive professional supervision (LAN 2016). Application of other support methods, such as continuous peer support in group form after the end of the pulmonary rehabilitation, has not been sufficiently studied (Spruit 2013). However, qualitative research shows that patients do value such group activities after the end of the pulmonary rehabilitation with patients who have the same needs and experiences (Rodgers 2007).

There is no evidence for the optimal group size (McCarthy 2015). Patients often train in small groups (LAN 2016). The American Association of Cardiovascular and Pulmonary Rehabilitation recommends a ratio of four patients per therapist (AACVPR 2011) and the British Thoracic Society recommends a ratio of eight patients per therapist (British Thoracic Society 2001).

Considerations

Although group therapy is preferable for pulmonary rehabilitation, individual treatment is also possible (LAN 2016) if treatment needs to take place at home or if the patient has specific treatment goals that cannot be achieved in a group setting. A combination can also be selected, with group therapy on the one hand and individual advice, counselling or specific exercises on the other hand. The individual treatment can then be a part of the treatment in a group setting. The practical benefits of group therapy are the satisfaction the patient experiences during the training as well as the support obtained through contact with fellow patients, for example, through the sharing of experiences. A disadvantage can be that patients might find large groups 'too busy'.

The therapist determines the optimal ratio based on patient factors (symptom burden, patient characteristics), therapist factors (skills) and organisational factors (facilities). The guideline panel believes that six patients per therapist is the maximum feasible number in order to offer sufficient individual supervision. Three or four patients per therapist can sometimes be more realistic in practice, depending on the above-mentioned factors. Counselling and advice can be provided in larger groups (see C.1 'Counselling and advice').

Note C.6 Therapeutic actions for sub-groups

Note C.6.1 Therapeutic actions in the presence of co-morbidity

Clinical question
How are therapeutic actions defined if a COPD patient has a common co-morbidity (and takes the related medication) that impacts their physical functioning?

The response to this clinical question is based on the recommendations for regular therapeutic actions (C.1 through C.5). The recommendations in this module are supplemental.

Reason
To date, little scientific research has been done on the impact of co-morbidity on the effects of therapy in COPD patients. Most scientific studies never actively screened for the possible presence of co-morbidity, or COPD patients with known co-morbidity were excluded from participating in scientific studies (McCarthy 2015).
The basic principle applied is that recommendations regarding therapeutic actions can be followed even for COPD patients with co-morbidity, unless there is a specific reason for not following the recommendation.
The co-morbidity can, however, be a reason for intensively monitoring specific parameters or for adapting therapeutic interventions. In order to adapt exercise therapy interventions, the therapist must have sufficient knowledge and skills regarding COPD and the respective co-morbidity. The general principle of 'unskilled is unauthorised' applies here. If the treating therapist does not have the required knowledge and skills, then the therapist should refer the patient to a therapist who does.
Since it is impossible to list all types of co-morbidity, this guideline limits itself to the most common co-morbidities (see B.7.1 'Diagnostic actions in the presence of co-morbidity'), specifically: 1) cardiovascular disease, 2) disorders of the musculoskeletal system, 3) symptoms of anxiety and depression, and 4) abnormal body composition.

Focus areas for co-morbidity

Cardiovascular disease
- During exercise therapy, the therapist should be extra alert to symptoms of cardiovascular risk, such as chest pain (Beekman 2013; Neder 2018). See B.4.1 'Red flags'.
- The heart rate of patients who use beta blockers is anomalous (Beekman 2013; Horowitz 1996; Neder 2018; ZiNL 2019).

Musculoskeletal system disorders
- The therapist should be alert to pain in the musculoskeletal system during physical training and assess whether this pain inhibits the physical activities.
- In order to train the functional exercise capacity with adequate intensity or increase physical activity, exercises and activities that are easier on the joints can be chosen, such as cycling and/or hydrotherapy, instead of walking.
- Offering specific exercises can be considered for combating musculoskeletal system symptoms if these symptoms inhibit the facilitation of physical training or the facilitation of physical activity.

Symptoms of anxiety and depression
- The risk of interim drop-out is increased for patients with symptoms of anxiety and depression and is something that must be watched out for (Garrod 2006; Harrison 2012; Trappenburg 2005). However, supervised exercise therapy can have a positive effect on symptoms of anxiety and depression, especially for patients with increased anxiety and/or depression at the beginning of the treatment (Harrison 2012).
- Symptoms of anxiety and depression should be addressed, and the patient should be shown understanding.
- It is important to understand the reason for the anxiety in order to determine treatable traits for the treatment. For anxiety that is related to the pulmonary disease, such as fear of dyspnoea or fear of movement due to dyspnoea, the therapist can focus on advice, trust and having the patient gain experience by exercising in a safe environment.
- If the symptoms of anxiety and depression inhibit the treatment, or if the therapist has insufficient impact on the symptoms, the referring physician should be contacted. There may be an indication for a referral to a psychologist.

Abnormal body composition

- If there is (an increased risk of) malnutrition and/or sarcopenia, there may be an indication for referral to a dietician (see B.4.2 'Referral to other healthcare providers'). The referring physician must be contacted in this case.
- For obese patients, the therapist should always be alert to potential obesity-related pain in the lower extremities. The therapy can be adapted, when necessary, as described in the 'Musculoskeletal system disorders' section above.

Focus areas in general

- The therapist should be alert to detecting unknown and potential new forms of co-morbidity, worsening of existing co-morbidity and/or red flags regarding co-morbidity.
- The exercises should be adapted if symptoms caused by the co-morbidity inhibit the training.

Note C.6.2 Therapeutic actions in the presence of an exacerbation

Clinical question

How is the therapeutic process for COPD patients with an exacerbation defined?

The response to this clinical question is based on the recommendations for regular therapeutic actions (C.1 through C.5). The recommendations in this module are supplemental.

Reason

In the presence of an exacerbation, it is important – if the patient's clinical status permits this – to immediately start, resume or continue the therapy, whether or not the patient was hospitalised (Puhan 2016). The therapy should be adapted to the patient's exercise tolerance, and it is important for the patient to be neither overloaded nor underloaded. Section B.7.2 'Diagnostic actions in the presence of an exacerbation' describes the symptoms that should be watched out for and to which the therapy should be adapted.

Exacerbation with hospitalisation

The goal of therapeutic treatment in the hospital is to render the patient ADL-independent as quickly as possible, work on functionality and create the framework conditions necessary for the patient to be discharged and function independently and safely at home (if necessary and depending on the status praesens prior to hospitalisation). Some examples are independent transfer, walking with or without aids and climbing stairs. The most common therapeutic treatment goals in the hospital are as follows:

- decreasing dyspnoea;
- early mobilisation;
- improving mucus clearance;
- improving confidence in performing activities.

It is important for the therapist to pay attention to the following issues with regard to the therapeutic process during hospitalisation:

- Dyspnoea and sputum clearance. Breathing techniques and mucus clearance techniques can be used to this end (see C.4.2 'Breathing techniques' and C.4.5 'Mucus clearance').
- It is preferable for mobilisation to be started as soon as possible, either with or without an aid and oxygen supplementation. If the usual exercise therapy cannot be administered to a patient during an exacerbation with sufficient intensity based on symptom burden in order to achieve the physical capacity goals, strategies are applied that make fewer demands on the patient's ventilation and gas exchange, such as strength training and NMES.
- After long-term inactivity, (supervised) active exercises/muscle strength exercises can be started, if needed supported with neuromuscular electrical stimulation (NMES; C.3.5 'Neuromuscular electrical stimulation').
- The relationship between workload and load-bearing capacity. These aspects are discussed with the patient if there are problems in this area.
- Collaboration with a dietician may be considered in order to coordinate training and nutrition.
- After hospitalisation due to an exacerbation, as soon as the patient is medically stable a multidisciplinary decision is made as to whether the patient should be referred for interdisciplinary pulmonary rehabilitation (screening) or primary care.
- When a patient is discharged, it is important for a transfer (to pulmonary rehabilitation or primary care therapy) to be drafted prior to the physiotherapeutic/exercise therapeutic follow-up which lists the (influencable) focus areas.

The therapy should be focused on maintaining physical capacity as well as on optimising physical activity. It is important to recognise factors that inhibit physical activity and to discuss these with the patient. In addition, insight into the inhibiting factors and the patient's perspective can be used to counter some inhibiting factors after hospitalisation (Thorpe 2014). The therapist can encourage the patient to start moving and go outside again.
Inhibiting factors for performing activities of daily life can be: older age, a need for recovery time after the exacerbation and the lack of oxygen therapy after hospital discharge although the patient feels that such support is needed (Thorpe 2014). See also C.2 'Optimisation of physical activity'.

Exacerbation without hospitalisation
It is preferable for the therapy not to be interrupted in the event of an exacerbation, and if the therapy is interrupted, for it to be resumed as soon as the clinical status permits this (Puhan 2016).
The following focus areas are important for the therapeutic process for the primary care therapist with regard to an exacerbation:

- It is preferable for mobilisation to be started as soon as possible. If the usual exercise therapy cannot be administered to a patient during an exacerbation with sufficient intensity based on symptom burden in order to achieve the physical capacity goals, strategies are applied that make fewer demands on the patient's ventilation and gas exchange.
- Dyspnoea and problems with sputum clearance. Breathing techniques and mucus clearance techniques can be used for this. See C.4.2 'Breathing techniques' and C.4.5 'Mucus clearance'.
- A decrease in physical activity. If necessary, interventions can be implemented to optimise physical activity. See C.2 'Optimisation of physical activity'.
- Undesired weight loss and other red flags. See B.4.1 'Red flags'.

Note C.6.3 Therapeutic actions in the palliative phase

Clinical question
How are the therapist's therapeutic actions adapted for COPD patients in the palliative phase?

The response to this clinical question is based on the recommendations for regular therapeutic actions (C.1 through C.5). The recommendations in this module are supplemental.

Reason
There are no known studies on the effect of therapeutic interventions in the palliative phase of COPD. However, therapeutic interventions can be effective for decreasing dyspnoea and improving quality of life even in an advanced stage of COPD (IKNL 2015; LAN 2011). The recommendations on therapeutic interventions in this guideline are therefore also considered applicable to COPD patients in the palliative phase.
Interventions should be aligned with the stages of palliative care and the associated goals that have been formulated together with the palliative patient (De Graeff 2017; Mathews 2017). See B.7.3 'Diagnostic actions in the palliative phase'.

Focus areas for the therapist

- The stages of palliative care and the needs, boundaries and wishes of the patient, caregivers and loved ones should be taken into account and the interventions adjusted accordingly. The interventions are aligned with this. It is important to ask the patient which type of care he/she needs at that moment.
- During the palliative phase the interventions should be gradually focused more and more on lessening symptoms such as fatigue, dyspnoea and depression/anxiety, and less on improving physical capacity. Physical training has, however, proven safe and effective for severely limited lung patients with dyspnoea who are on the waiting list for a lung transplantation (Gloeckl 2012). Physical training should therefore be considered in order to maintain physical capacity.
- The therapist should be alert to decreases in physical activity. Facilitating interventions can therefore be employed if the patient's physical capacity permits this. See C.2 'Optimisation of physical activity'.
- Information and advice should not only be aimed at the patient but also always at the patient's caregivers and loved ones. Information and advice can be focused on (lying) posture and doing transfers, for example. In consultation with the treating physician, involving an occupational therapist may be considered if the patient is unable to independently perform basal transfers (such as from the bed to a chair).
- Neuromuscular electrical stimulation may be considered to stabilise the muscle function of the muscle groups of the lower extremity if active exercise is not possible (Jones 2016). See C.3.5 'Neuromuscular electrical stimulation'.

- Teaching breathing techniques and relaxation exercises in order to combat dyspnoea and anxiety may be considered. See C.4.2 'Breathing techniques' and C.4.3 'Relaxation techniques'.
- The treatment may be continued if the interventions have a positive effect on the symptom burden. The treatment frequency is aligned with the individual situation. If none of the therapeutic interventions have an effect on the symptoms, the therapy is stopped – in consultation with the patient.

Note C.7 Evaluation and conclusion of the therapeutic process

Clinical questions

1. After how much time are the treatment goals evaluated?
2. Which stop criteria are employed for ending the treatment period?

Reason

The period during which the initial therapy is offered depends on the start and stop criteria. After the end of the initial therapy there is a follow-up period during which support is provided or at least the patient's health status is monitored. The start criteria are described in B.5 'Patient profiles'. This module describes when the treatment goals are evaluated and when the treatment can be stopped. See A.3.4 'Information exchange with referring physicians'.

1 After how much time are the treatment goals evaluated?

Literature and considerations

The valid KNGF Guideline on File-keeping and VvOCM Guideline on Reporting explain how evaluation and conclusion should take place (KNGF 2019; VvOCM 2018). Additionally, it is customary to document the relevant treatment data according to the SOAP system (subjective, objective, analysis and plan) for each therapist-patient contact. After 12 weeks of initial treatment, the recommendation is to perform an interim evaluation.
The COPD Healthcare Standard explains that evaluating the health status should take place at intake and then annually, as a rule (LAN 2016). The Standard indicates that the frequency of monitoring should be customised. It may therefore be relevant to evaluate the patient's health status more often. It is therefore recommended that, after conclusion of therapy or in the event of maintenance treatment, relevant parameters be evaluated (compared to the treatment goals) once every four to six months so that the therapy can be resumed on time if the patient's health status deteriorates. If there is a clinically relevant setback of the symptom burden (from none to mild/moderate or from mild/moderate to high), physical activity (a decrease of 1,500 steps per day or more) and/or physical capacity (a decrease in the 6-minute walking distance by 45 metres or more), restarting the treatment based on the profile classification is considered. It is judicious to redefine the parameters and treatment goals in the event of an exacerbation (with or without hospitalisation) as well.

2 Which stop criteria are employed for ending the treatment period?

No stop criteria were found in the literature that are applicable to the practical situation. The stop criteria formulated by the guideline panel are commensurate with the patient's context and are aligned with the therapy's goals.
The following stop criteria have been formulated:

- The patient's need for assistance has been resolved because the therapeutic treatment goals have been achieved (Lakerveld- Heyl 2007). The need for assistance can change during the therapy.
- The patient is able to continue training through regular exercise and/or sports activities (e.g., walking [with the dog], gardening, cycling [e-bike] or yoga) or by becoming involved in regional or national initiatives (such as in the regular sports sector, locally organised hiking groups and the National COPD Challenge). Various forms of exercise are good for keeping physical capacity stable (Lung Foundation 2019).
- Regardless of the symptom burden and the degree of physical capacity or activity, the patient cannot be motivated in any way to be or remain therapy-compliant (especially with regard to physical training and/or being physically active outside of the therapy setting).
- There is a red flag or contraindication for exercise therapy (see B.4.1 'Red flags' and B.4.2 'Referral to other healthcare providers').

Of course, there can be other reasons in addition to the reasons listed for therapy to be stopped, such as: personal reasons, reasons stemming from the patient's social context and financial reasons. If the therapy is stopped early, the therapist contacts the treating physician.

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