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REHABILITATION

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Executive Summary

Pulmonary Rehabilitation (PR) is defined as a comprehensive intervention based on a thorough patient assessment followed by patient tailored therapies. These therapies include but are not limited to exercise training, education and behaviour change, which are designed to improve the physical and psychological condition of people with chronic respiratory disease and to promote the long-term adherence to health enhancing behaviours. The Pulmonary Rehabilitation Model of Care (PR MOC) describes the evidence base, referral criteria and implementation of pulmonary rehabilitation. The PR MOC builds on the initial Pulmonary Rehabilitation Model of Care which was published in 2010 by the National Clinical Programme for COPD.

PR has been demonstrated to improve exercise capacity, health related quality of life and to reduce health care utilisation for patients with COPD. The UK National COPD Audit Programme has demonstrated that PR has been associated with reduced hospital admission rates and improved survival rates in patients who completed a Pulmonary Rehabilitation Programme (PRP) following a COPD exacerbation.

The PR MOC can be applied to all healthcare settings, in hospitals and in the community. The document sets out the essential elements to ensure delivery of a high quality, patient-centered service. Essential elements recommended in the MOC include:

Patient Referral:
Chapter 2 of the PR MOC sets out the referral criteria for PR. Key points include:

- PR should be available to all persons with chronic respiratory disease who consider themselves to be functionally disabled with dyspnoea (mMRC 1 - 4). Participants need to be optimally medically managed before commencing the PRP
- People admitted to hospital with Acute Exacerbations of COPD (AECOPD), should be referred for PR at discharge and enrolled within one month of leaving hospital. PR should not be initiated during hospitalisation, as it increases mortality. The initiation of a PRP is recommended within 3 weeks of hospital discharge and should consist of physical exercise and education
- When patients with stable COPD are referred to a PRP, they should be enrolled i.e. commence the programme within 3 months of receipt of the referral, where possible and depending on local resources
- Patients should be referred to a PRP by a Respiratory Physician, or in community settings by the GP. Referrals can also be made by other Healthcare Professionals (HCPs) such as Physiotherapists, NCHDs and Respiratory nurses. A standard referral should be available to be used by all PRPs, with adaptations for local use as deemed appropriate by the MDT
**Staffing Resources:**
The design and implementation of a PRP requires a Multidisciplinary Team (MDT) including:

- A nominated Consultant with an interest in respiratory care
- Physiotherapist
- Respiratory Nurse
- Dietitian
- Occupational Therapist
- Psychologist
- Pharmacist
- Speech and Language Therapist
- Smoking Cessation Officer
- Palliative Care professional
- Social Worker
- Respiratory Physiologist.

A programme co-ordinator - ideally a HCP who will run the PRP and is responsible for policies, referrals, patient selection, assessments, class supervision, outcome measures and audit is also required to implement a PRP. Administrative support is recommended to help manage the significant workload. The roles of the MDT are set out in Chapter 4 of the document.

**Location of a Pulmonary Rehabilitation Programme:**
A review of outcomes shows comparable results between the hospital and community based programmes. It is necessary to form partnerships between community and hospital settings to support and develop PR and to maintain benefits achieved. Home based programmes are also an option. Appropriate venues should be risk assessed with safety systems put in place to include procedures to deal with any adverse events arising.

**Pulmonary Rehabilitation Programme Group Size:**
Class size will depend upon the venue and staff available. Staff to patient ratios recommended are 1:8 (UK) and 1:4 (US) for exercise training and 1:16 (UK), 1:8 (US) for the education session. It is recommended that two staff members (one being the Physiotherapist) are always present during the exercise class for safety reasons. One senior member of staff must be present at all times.

**Duration:**
The recommendation of the National Clinical Programme for COPD is that PRPs (i.e. the exercise and education component) are of at least 6 to 8 weeks duration, with the pre and post programme assessments as additional to this.
Measuring Outcome and Data Collection:
In relation to the measuring outcomes and data collection the National Clinical Programme for COPD recommends that:

- All PRPs should record standardised measureable outcomes for every person graduating
- All PRP’s structure and process (including rates of commencement, adherence and completion), along with the outcome measures, and analysis of patient feedback should have an internal audit on an annual basis
- Follow up evaluation of hospital admissions and bed days for the year pre and post rehabilitation should be performed to assist in a cost analysis

Support Materials:
Support materials for the implementation of the PR MOC are provided in the Appendices of this MOC.

As Pulmonary Rehabilitation is part of a wider integrated respiratory pathway, the PR MOC is part of a suite of resources developed by the National Clinical Programme for COPD. More information can be found at www.hse.ie/eng/about/who/cspd/ncps/copd/resources/
1 Introduction

This document describes the Model of Care (MOC) for Pulmonary Rehabilitation (PR) for the National Clinical Programme for Chronic Obstructive Pulmonary Disease (COPD). The PR MOC follows international best practice and recommends the delivery of a PR Programme (PRP) within an integrated service approach. The model can be applied to all healthcare settings, in hospitals and in the community. The PR MOC identifies essential elements to ensure delivery of a high quality, patient-centered service.

A Pulmonary Rehabilitation Programme (PRP) is defined as “a comprehensive intervention based on a thorough patient assessment, followed by patient tailored therapies that include, but are not limited to, exercise training, education, and behaviour change, designed to improve the physical and psychological condition of people with chronic respiratory disease and to promote the long-term adherence to health-enhancing behaviours” (1).

1.1 Overview

Patients with COPD enrolled in a PRP have a chronic disease of which the most significant element is breathlessness. As delivery of a PRP is best done by a Multidisciplinary Team (MDT) integrated services, in both acute and community settings are beneficial. On the background of a definitive diagnosis of COPD (spirometry testing), the primary or secondary health care provider should refer the symptomatic patient to a PRP.

There is an onus on the individual patient to comply with the self-management component of the programme, to ensure continued improvement.

1.2 The Evidence Base for Pulmonary Rehabilitation

High levels of scientific evidence (IA, IIA, Cochrane Review) has demonstrated improved exercise capacity and health related quality of life including decreased breathlessness, fatigue and healthcare utilisation for patients following a PRP. Ongoing training is required for staff delivering such programmes to remain up-to date with the best evidence in this area (1-6, 60). PR programmes must meet current 2014 British Thoracic Society Quality Standards as outlined in Appendix 3 (7).

Economic analyses suggest PR is also cost-effective. In the UK this had been estimated at GBP 2000 to GBP 8000 per Quality-Adjusted Life Year (QALY), thus it is an essential component in the management of COPD (9). Hence, PR is a clinically effective and cost effective intervention that can reduce mortality and improve prognosis.
The UK National COPD Audit Programme demonstrated that PR is safe and that completion of a PRP is an indicator of a better prognosis (100). Completion of PR was associated with reduced hospital admission rates (i.e. at 180 days post PR assessment) in those who completed PR, 24% had at least one admission with a mean number of bed days of 4.8. In comparison, in those patients who did not complete PR, 38% had at least one admission, with a mean number of bed days of 9.6. The Audit also showed better survival rates, in that mortality at 180 days in those who did not complete PR was significantly higher than in those who completed it (3.2% vs 0.5%). (100).

A recent audit survey of Irish National Needs Assessment for Pulmonary Rehabilitation Services, confirmed that there was a considerable lack of PR provision in Ireland, with the capacity to meet only 11% of need for patients following an admission with an Acute Exacerbation of COPD (AECOPD). It concluded that if other internationally recognised eligibility criteria for referral to PR (e.g. patients with stable COPD) were included in the needs assessment, the deficits in the provision of PRPs would be even greater. The study made recommendations with regard to the expansion of capacity of PRPs, improvement of access, reduction of inequities in service provision together and improvement in quality of programmes being delivered (96).

The audit was carried out as part of the National Framework and Implementation Plan for Self-management Support for Chronic Conditions: COPD, Asthma, Diabetes and Cardiovascular Disease. The framework recommended that PR should be an integral part of the management of people with COPD. The standardisation and increased provision of PR has been prioritised for early implementation, based on the likelihood of maximum beneficial impact, and strongest evidence (97).

**Recommendations:**

1. Programme provision by a MDT, paying attention to the individual needs of patients and carers.
2. Inclusion of physical training, disease education, self-management, nutritional management, psychological, social and behavioural intervention.
3. Reduction in symptoms and disability aiming to improve function and quality of life.
4. Education and training of workforce to meet the needs of patients in the PRP
5. Continuous audit of effectiveness of the programme.
2 Referral Criteria for Pulmonary Rehabilitation

Pulmonary Rehabilitation should be available to all persons with chronic respiratory disease who consider themselves to be functionally disabled with dyspnoea (mMRC 1 - 4) (7, 60). Participants need to be optimally medically managed before commencing the PRP (9).

Table 1 Criteria for PR Programme Inclusion and Exclusion

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<tr>
<td>▪ confirmed diagnosis of chronic respiratory disease by spirometry</td>
<td>▪ uncontrolled cardiovascular conditions limiting participation in an exercise programme</td>
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<tr>
<td>▪ functionally limited by dyspnoea despite optimal management</td>
<td>▪ significant orthopaedic, psychological or neurological conditions that reduce mobility or cooperation with physical training.</td>
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<tr>
<td>▪ able to travel to venue</td>
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<tr>
<td>▪ motivated to participate and change lifestyle</td>
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<td>▪ ability to exercise independently</td>
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People admitted to hospital with AECOPD, should be referred for PR at discharge and are enrolled (i.e. commence the programme) within one month of leaving hospital (7). The initiation of a PRP is recommended within 3 weeks of hospital discharge and should consist of physical exercise and education (81). This has been proven to be beneficial in reducing the risk of readmission (12). Comprehensive PR can reduce mortality and hospital readmissions (by 66%) for patients following AECOPD and can reduce length of stay when readmissions do occur (by 3-4 days on average) (78, 79, 80).

For patients who are hospitalised with a COPD exacerbation, PR should not be initiated during hospitalisation, as it increases mortality (81).

When patients with stable COPD are referred to a PRP, they should be enrolled i.e. commence the programme within 3 months of receipt of the referral (13), where possible and depending on local resources.

These targets may be facilitated by the various PR services available, including COPD Outreach Teams and COPD Integrated Care Teams.

Programme Referrer

Patients should be referred to a PRP by a Respiratory or General Physician, or in community settings by the GP. In some instances, particularly in the acute hospital setting, referrals can be made by other Healthcare Professionals (HCPs) such as Physiotherapists, NCHDs and Respiratory nurses. A standard referral (see Appendix 1) should be available to be used by all PRPs, with adaptations for local use as deemed appropriate by the MDT (14).
3 Pulmonary Rehabilitation Model

“In practice, the details of programme construction and setting will vary with different cultures and healthcare systems.” (1)

To qualify as a PRP, the programme should include at a minimum:

- a structured and supervised exercise programme
- patient education and behavioural programme intended to foster health enhancing behaviours
- patient assessment and outcome measures
- provision of recommendations for home-based physical activity (13)

A PRP should strive to meet the ten Quality Standards for Pulmonary Rehabilitation as set out by the British Thoracic Society in 2014 (see Summary of Quality Statements in Appendix 3).

3.1 Components of Pulmonary Rehabilitation

3.1.1. Assessment

A comprehensive assessment is performed by the MDT using a standardised assessment sheet (see Appendix 1) with a list of current tools of assessment.

A review of past medical history with special regard for respiratory history and co-morbid conditions such as orthopaedic, neurological and cardiovascular conditions that may affect participation in the programme, and review of inhaled medications and pulmonary function tests is undertaken.

- Subjective assessment to include mMRC Dyspnoea Score
- Physiological baseline measures: heart rate, blood pressure, respiratory rate, Borg score, oxygen saturations, Body Mass Index (BMI)
- Agreed goals (when appropriate)
- Standardised validated and reliable tools for all measured areas must be used
- For exercise testing, at least one measure is required from measures of functional exercise capacity such as the Six-Minute Walk Test (6MWT) (x2) or the Incremental Shuttle Walk Test (ISWT) (x2) (15-21). Following the ISWT, an Endurance Shuttle Walk Test (ESWT) may be performed to measure exercise endurance
Health Related Quality of Life (HRQoL) measures are considered the primary outcome measures in PRPs (2). For Quality of life (QoL) measures, one generic and one disease specific questionnaire should be used from the following list: (22-26, 76)

- The COPD Assessment Test (CAT)
- The Chronic Respiratory Disease Questionnaire (four formats) (CRDQ)
- St. George’s Respiratory Questionnaire (SGRQ)
- The Hospital Anxiety and Depression scale (HADs)
- The EuroQol (EQ-5D).
- The COPD Clinical Questionnaire (CCQ)

For minimum clinically important difference figures for the assessment tools see Appendix 2.

- A measure of symptoms and mood such as Hospital Anxiety and Depression Scale (HADS) is essential (24).

3.1.2. Exercise

“Exercise training is widely regarded as the cornerstone of Pulmonary Rehabilitation.” (1)

Exercise training is the best available means of improving skeletal muscle function in COPD and these improvements lead to gains in exercise capacity despite the absence of changes in lung function.

Exertional dyspnoea experienced by COPD patients is multifactorial in origin, partly reflecting peripheral muscle dysfunction, the consequences of dynamic hyperinflation, increased respiratory load or defective gas exchange. These limitations are aggravated by an age-related decline in function, the effects of physical deconditioning and compounded by the presence of co-morbidities (1).

Optimising medical treatment before exercise training with bronchodilator therapy, long-term oxygen therapy and the treatment of co-morbidities may maximise the effectiveness of the exercise training intervention (1).

A PRP should include supervised, individually tailored and prescribed progressive exercise training including both aerobic and resistance training (7). Upper limb and lower limb strength and endurance training are recommended and also opportunities for physical activity should be encouraged. As per American Heart Association guidelines, the recommendation is for 5
sessions of 30 minutes of moderate – intensity aerobic activity per week or 3 sessions of 25 minutes of vigorous-intensity aerobic activity as per standard healthy living advice (65).

3.1.2.1. Intensity of Training

The intensity of training is predetermined from the assessment and modified through the programme. The cardiopulmonary exercise test (CPET) is the gold standard in assessing maximum aerobic exercise capacity, however access to a CPET is limited. Thus, field tests such as a symptom limited walk test (6MWT) or a submaximal incremental externally paced walking test (ISWT) are used to assess and prescribe exercise programmes (16). It is recommended that the ISWT which reliably estimates VO2peak, an objective standard for exercise prescription should be promoted as an alternative to the 6MWT when a CPET is unavailable (101).

During endurance exercise training, a high level of intensity of continuous exercise at a VO2 max of 60-80% is recommended for 20 to 60 minutes per session and for 3 to 5 times per week to maximise physiological benefits (27). If no VO2 max figure is available, intensity can be monitored using the Borg Score with a target level of dyspnoea of 4 to 6 (moderate to (very) severe) as per the ATS/ERS or a Rating of Perceived Exertion of 12 to 14 (somewhat hard) considered a target training intensity (1, 26). Care is advised as dyspnoea and level of oxygen saturation should not be used as the primary methods of determining exercise intensity, but should be used anchored to heart rate or work rate for accurate exercise intensity prescription and monitoring (101).

3.1.2.2. Strength and Endurance Training of Upper and Lower Limbs

Muscle atrophy is common in chronic respiratory disease. A reduction in peripheral muscle mass compared to normal subjects has been demonstrated and is predominantly in the quadriceps and distal lower limbs with the upper limbs relatively preserved from these structural changes in patients with COPD (27, 28). Low intensity peripheral muscle strength training has been found to improve muscle bulk and strength and may also assist with maintaining or improving bone mineral density (1). The prevalence of osteoporosis and osteopaenia is increased in COPD and because the prevalence of osteoporosis is associated with a low fat free muscle mass (FFM), it can be speculated that loss of bone and muscle mass share common mechanisms (27).

Assessment of limb muscle function and body composition can identify COPD patients at risk of exercise intolerance and premature mortality. BMI is insufficient to identify impact on muscle mass in COPD and so body composition (muscle mass) can be assessed using dual-energy X-ray absorptiometry (DEXA), or bioelectrical impedance (BIA) (27).

Muscle strength assessment can be measured in different ways; manual muscle testing, the one-repetition measurement (1RM), and the isometric maximal volitional limb muscle strength
assessment (e.g. Cybex or Biodex which are specifically built computerised dynamometers) (27).

The optimal resistance training prescription is not determined but the American College of Sports Medicine recommends that to enhance muscle strength in adults, 1 to 3 sets of 8 to 12 repetitions should be undertaken on 2 to 3 days each week. Initial loads equivalent to 60 to 70% of the one repetition maximum (1RM) or one that evokes fatigue after 8 to 12 repetitions are appropriate.

The exercise dosage must increase over time (the overload principle) to facilitate improvements and can be modulated by increasing the resistance, the repetitions per set, increasing the number of sets per exercise and/or the rest period between sets or exercises (FITT principle-frequency, intensity, time and type). The increase should occur when the patient can perform the current workload for 1 or 2 reps over the desired number of 8 to 12, on 2 consecutive training sessions. Resistance training elicits a reduced cardiorespiratory response compared with endurance training and so may be a feasible option for patients with advanced disease as it evokes less dyspnoea (1, 30, 31).

Endurance training aims to condition the muscles of ambulation and improve cardiorespiratory fitness to allow an increase in physical activity that is associated with a reduction in breathlessness and fatigue. Training in the form of cycling or walking is the most commonly applied exercise modality in PRPs. The recommended intensity is as described above in 3.1.2.1. Walking training is a functional exercise that will lead to an increase in walking endurance. Cycling exercise places a greater specific load on the quadriceps muscles than walking and results in less exercise-induced oxygen desaturation (1, 29).

The combination of constant load/interval and strength training improves outcome (i.e. exercise capacity and muscle strength) to a greater degree than either strategy alone in COPD patients (1,27). It is recommended that resistance training should be incorporated with endurance training, as a combination of both significantly increased leg muscle strength (82). Evidence indicates that upper limb training improves dyspnoea but not HRQOL in COPD but further studies are needed to compare types of training (endurance, resistance and combination of both) on patient-relevant outcomes such as dyspnoea, HRQOL and arm activity levels (84).

3.1.2.3. Flexibility and Stretches

Brief periods (5-10 minutes) of upper and lower body flexibility exercises are recommended to maintain muscle length and prevent injury and soreness (14). Flexibility training should also focus on improving thoracic mobility and posture to help increase the vital capacity in patients with chronic respiratory disease (1).

3.1.2.4. Interval Training

Interval and continuous training are safe and equally effective modes of training to improve endurance performance in patients with COPD (7). Interval training is a modification of
endurance training. Interval training may be useful in promoting higher levels of exercise training in the more symptomatic patients. This is recommended as it allows smaller bouts of high intensity work rate to be achieved with lower symptoms i.e. smaller bouts (typically lasting 30s – 180s) of high-intensity exercise (80-120% peak capacity) separated by lower-intensity exercise bouts (50-80% peak capacity) (27, 32 - 34).

3.1.2.5. Frequency

Two supervised exercise sessions of 1 hour duration should be provided. A third session of unsupervised exercise (at home) should also be incorporated. Five sessions of 30 minutes of moderate-intensity physical activity are recommended by the American Heart Association to maintain a healthy living standard (1, 3, 4, 7, 32, 35, 65).

3.1.2.6. Safety During Exercise

During exercise testing and training sessions, measures of heart rate, oxygen saturations and dyspnoea at rest scores should be recorded (14). Consider stopping or resting if:

- Increased heart rate such that it approaches age predicted maximum
- SaO2 < 80% or as per local Respiratory Leads’ clinical recommendation.
- Marked wheeze

Advise patients to bring short-acting bronchodilators and also Glycerol Trinitrate spray to every session if prescribed. If diabetic, patients should be advised to bring their glucometers and a glucose supplement to encourage independent management of any hypoglycemic events.

3.1.2.7. Impacts of Co-morbidities on Exercise Training

**Osteoporosis and Osteoarthritis:** Exercise may exacerbate pain in these patients. Modify exercises on initial prescription to address these problems and progress only after 2 supervised sessions if there is no increase in pain.

**Body composition abnormalities:** Special attention during assessment may be necessary for both under-and over-weight patients (1).

**Intermittent Claudication:** To gain optimal improvement patients should be advised to walk beyond the onset of their pain for as long as tolerated (14).

3.1.3. Physical Activity

Increasing physical activity is one of the main aims of a PRP (1). Physical activity can be defined as any bodily movement produced by skeletal muscles which results in energy expenditure. Exercise is a subset of physical activity i.e. it is planned, structured, repetitive and purposeful (67).
Physical inactivity appears to be more common in patients with COPD compared to age-matched healthy individuals. Physical inactivity is not only a feature of advanced COPD, it is already reduced in subjects with a new spirometry based diagnosis of mild or moderate COPD, even preceding the onset of breathlessness. Lower levels of physical activity are associated with a higher risk of an exacerbation-related hospitalisation, with an increased risk of all cause mortality and a decline in physical activity over time also predicts mortality (68).

For PR to have its greatest long term impact, the increases in exercise capacity demonstrated in the PR centre would ideally translate into increased physical activity in home and community settings. However, this translation does not occur naturally, as physical activity is a complex behaviour influenced by a combination of individual, sociocultural and environmental factors. Changes in physical activity behaviour in COPD need an interdisciplinary approach, bringing together respiratory medicine, rehabilitation sciences, social sciences and behavioural sciences (68). This was supported by an Irish study which demonstrated that PR did not significantly change physical activity and freeliving values, with the recommendation for alternative methods to alter/affect behavioural change (69).

The choice of physical activity outcome assessment may determine the success or failure of a programme’s demonstrable effect on physical activity. Preferably physical activity should be measured in free living conditions before and after a PRP (not during), which should increase the validity of the findings. Patients with COPD do not appear to increase the amount of time in moderate to vigorous intensity activity after PR but can adopt a more active lifestyle through engaging in leisure activities or doing more domestic household activities. Therefore we need to transition our thinking from ‘physical activity’ to ‘active living’ i.e. leisure, occupational and household activities as well as active transportation (walking and cycling). A reduction of sedentary time and increase in light activity may prove more realistic and pave the way to more intense exercise in older adults than just focusing on moderate to vigorous intensity physical activity (68). The eventual aim would be to build up in bouts of 10 to 15 minutes of physical activity in order to achieve the American Heart Association and American College of Sports Medicine recommendation for engagement in 30 minutes of moderate intensity physical activity on at least 5 days per week in order to improve and maintain health (65).

Levels of physical activity cannot be reliably measured by 6MWD on a 6MWT, nor can be predicted from resting lung function parameters. In COPD, physical inactivity is more strongly associated with the presence of co-morbidities than with airflow obstruction. Quadriceps strength is predictive of physical activity independently of FEV1, but hand grip strength is not predictive (67). There is a strong inverse relationship between daily physical activity and dynamic hyperinflation, which correlates strongly with exertional dyspnoea in COPD (68).

The methodology to measure physical activity needs further research and could rely on objective and accurate assessment of physical activity, patient reported assessment of physical activity or a combination thereof (67).

Objective measurement of physical activity can be measured via pedometry, accelerometry and multisensory monitoring but all of these devices may not accurately estimate energy
expenditure in chronic lung disease. The criterion standards for measuring energy expenditure are doubly labeled water and indirect calorimetry but both are prohibitively expensive (70).

Two multisensor monitors which use physiological sensor data (skin temperature, electrolyte level, anthropometrics) and accelerometry (can be uni-, bi-, or tri-axial accelerometers measuring accelerations of body segments in multi-dimensions) in combination to measure physical activity have been proven to be accurate in patients with COPD. They are the SenseWear Armband, which provides accurate energy expenditure estimation in COPD (but in those with less severe lung disease) and the ActiReg Multisensor which has been proven to be accurate when monitoring free living activities over long periods of time in patients with COPD (70). The Digi-Walker pedometer had the poorest accuracy, with underestimation of energy expenditure (70). However, a pedometer can give reliable feedback on physical activity measured in step counts. A step count <7500 steps/day is too low to maintain good health in the long term, with the goal being to achieve 10,000 steps/day. The recommended 30 min walk per day would increase step counts by approximately 3000 steps/day (71). The Actigraph and Dynaport accelerometers are not useful in predicting energy expenditure but are appropriate for monitoring the movement dimensions of physical activity in chronic lung disease (70).

For reliable measurements of physical activity that aim to assess longitudinal changes, 4 days of monitoring were shown to be sufficient to demonstrate treatment effects following PR in moderate to severe COPD, when the weekend is excluded from the analysis (proven that physical activity declines over the weekend in patients with COPD) (67).

An activity monitor cannot fully capture the patient’s experience of physical activity. This can only be measured through a patient-reported outcome (PRO) questionnaire. This fits with the hypothesis, that items generated from patient experience in combination with an activity monitor would capture all relevant dimensions of physical activity in COPD patients. The PROactive instruments were developed and provide a simple, valid and reliable measure of physical activity in COPD patients. They are comprised of a daily version of PROactive (patient recall), the D-PPAC and the clinical visit version of PROactive, the C-PPAC. Two domains were identified in COPD with regard to the concept of physical activity, the amount of physical activity (covered by a combination of the PROactive and activity monitors) and difficulty with physical activity (covered by the PROactive). The ‘PROactive physical activity in COPD’ (PPAC) is a measure of physical activity and not exercise capacity or health status (72).

The amount of regular physical activity needed to obtain a significant effect on admissions due to COPD is relatively small, equivalent to walking or cycling for 2 hours per week (67). It is important to promote physical activity in the earliest stages of COPD (68). It is unknown whether bronchodilator therapies or oxygen therapy will either improve physical activity or prevent deterioration of physical activity over time in COPD (67).

3.1.4. Education

Patient education remains a core component of a comprehensive PRP. Information related to the patient’s condition and his or her therapy is necessary, but development of self-
management skills that emphasise illness control through health behaviour modification is mandatory (1). Education should cover relevant topics associated with chronic lung disease. Psychological and social support must be provided in the Pulmonary Rehabilitation setting to address the issues of anxiety and depression (1, 7, 36, and 37). MDT members with the appropriate expertise to address these issues are essential to the success of PR. Education sessions should be supported by written information and key topics recommended by guidelines are;

- Anatomy, physiology, pathology, nutritional advice, disease education, breathing retraining techniques, psychological and behavioural intervention, pharmacology, symptom management, incontinence management, chest clearance techniques, energy conservation, anxiety management, goal setting, relaxation, exacerbation management, end of life issues. Smoking cessation should also be included.

The COPD Communication Card, the COPD and Me; Patient Information Booklet and the COPD Self-Management Plan (all in draft stages) (66) developed by the Irish National Clinical Programme for COPD may be valuable additions for education.

### 3.1.5. Self-management and Behaviour Change

Self-management ‘refers to an individual’s ability to manage symptoms, treatment, physical and psychological consequences and lifestyle changes inherent in living with a chronic condition’ (73). Patient self-management would be one outcome within a disease-management programme for patients with COPD to facilitate and support long term behaviour change to help improve quality of life and condition management (73).

Self-management programmes should be designed using behaviour change theory e.g. using the self-efficacy theory, a major component of the sociocognitive theory (SCT). The effects of self-management are achieved by building self-efficacy through the processes of performance mastery (practicing skills through use of action plans), modelling (emulating others), social persuasion, and interpretation of symptoms leading to the adoption of core self-management skills; problem solving, action planning, decision making, utilising resources effectively, and forming effective partnerships with healthcare providers (73).

HCPs should acknowledge the patients’ central role in their care and the sense of responsibility for their own health. There is a need for a collaborative approach, with providers and patients working together to define problems, set priorities, establish goals, create treatment plans, and solve problems along the way (1). Guiding patients through this health behaviour change process is a vital component of the HCPs work in PR (74).

Factors impeding progress during PR appeared to be non-acceptance of having COPD, lack of knowledge of COPD and difficulty to set specific goals and self-manage the disease. Factors advancing progress during PR were found to be support by HCPs, family and friends, shifting towards qualitatively better types of motivation regarding lifestyle changes, acquiring self-management skills, and support in finding (new) suitable daily activities (73). PR in a group
setting is useful in helping patients learn explicitly through a sharing of experiences, reinforce learning, change self-image and discourage passivity (1).

A common reason for behaviours not being changed or implemented is that the intention-behaviour gap has to be bridged. Collaborative goal setting with patients is one of the most commonly reported strategies that assist patients to achieve their desired treatment outcomes. For goals to be effective they need to be specific, measurable, achievable, realistic and timed for successful completion (SMART) (75). Use goal diaries to set, monitor, reward success and overcome difficulties. Motivational interviewing training can aid skills of goal setting (76). Setting 2 - 3 important treatment goals provides patients with incentives to follow their rehabilitation but neither they nor education alone provide the skills necessary for bridging the intention-behaviour gap. Behaviour change strategies can bridge the gap and are useful in improving adherence and strengthening self-efficacy. Successful behaviour change strategies are verbal feedback, reinforcement, exercise testing, decision balance sheets, self-regulation, relapse prevention, progressed graded activities and booster sessions and action and coping plans (especially for disease exacerbations) (75).

Patients and HCPs can access an online self-management education programme for COPD through the Canadian website www.livingwellwithCOPD.com. HCPs can also access the HSE ‘Living Well with a Chronic Condition’, the National Framework and Implementation Plan for Self-management Support for Chronic Conditions: COPD, Asthma, Diabetes and Cardiovascular Disease’ document. This Framework provides an overview of the rationale for self-management support and provides recommendations for self-management support for the four major diseases, along with a plan for implementation. The document is available on the HSE website at www.hse.ie/self-management (97).

On completion of the PRP all patients should be provided with information regarding existing voluntary groups/networks which they can contact for ongoing support and social interaction, e.g. COPD Support Ireland. Support groups allow the patient to take an active role in their health management. Patients also need information on local venues where they can continue to exercise. Links with community centres, and local gyms may be beneficial. These can facilitate long-term maintenance of lifestyle changes.

3.2 Adjuncts to Pulmonary Rehabilitation

3.2.1. Inspiratory Muscle Training (IMT)

Inspiratory Muscle Training (IMT) does not appear to augment the beneficial effects of general exercise training in COPD patients (3). Routine use is not recommended. However, IMT can be an adjunct to the exercise training component of PR in patients with poor baseline inspiratory muscle strength, as defined on pulmonary function tests (PFTs). It is recommended that combinations of respiratory muscle strength tests are performed to increase diagnostic precision (38).
3.2.2. Non-invasive Ventilation (NIV)

Non-invasive Ventilation (NIV) may be used as an adjunct to exercise training in selected patients with severe chronic respiratory disease and suboptimal response to exercise, in patients who already receive long term domiciliary NIV (7). It may allow for greater training intensity. Careful consideration should be given to the use of NIV as an adjunct to exercise training as it is difficult and labour-intensive (3, 39 - 41). There is no clear evidence that HRQOL is better or worse with NIV during training and therefore unknown whether the demonstrated benefits of NIV during exercise training are clinically worthwhile or cost-effective (83).

3.2.3. Oxygen Therapy

Patients who are receiving long-term oxygen therapy and ambulatory oxygen should have this continued during exercise training, but may need increased flow rates (42). For exercise testing, supplementary oxygen therapy should be available if a patient desaturates on testing ≤90% or as per local Respiratory Lead’s clinical recommendation (77). The test should be repeated on 2 – 4 litres oxygen as necessary to maintain oxygen saturations ≥ 88% (43). Arterial blood gas analysis is necessary to determine the need for long term oxygen therapy (3).

Oxygen supplementation as an adjunct to exercise training cannot be widely recommended as the research is equivocal. However, the hypothesis is that oxygen supplementation during training may help patients reach higher training intensities and possibly enhance limb muscle adaptation by reducing ventilation, dynamic hyperinflation and the perception of dyspnoea (27).

3.2.4. Neuromuscular Electrical Stimulation (NMES)

There is no role for routine use of Neuromuscular Electrical Stimulation (NMES) as an adjunct to a PRP, as further trials are needed to clarify its optimal use (3, 27). NMES has been proven to increase exercise tolerance and peripheral muscle strength after 6 weeks of a home programme to the quadriceps muscles. It may be beneficial to those severe COPD patients, with low BMI and evidence of quadriceps muscle weakness who are unable to leave their homes and with poor tolerance of whole-body training (27, 44 - 47).

3.2.5. Hormones and Nutritional Supplements

Additional general nutritional supplementation, creatine supplementation or testosterone and other anabolic steroid use do not augment exercise capacity gains resulting from PR and therefore routine use of these is not recommended (3, 27).
3.3 Delivery of Pulmonary Rehabilitation

Quality standards for PR should be consistent across programmes, but solutions to achieve these standards must be appropriate to the locale, to ensure the best care of patients, in a cost effective manner.

In order to ensure safe delivery of a PRP, there should be agreed standard operating procedures, risk assessments and critical incident reporting (13).

3.4 Staffing Resources

The design and implementation of a PRP requires the following:

- A nominated consultant with an interest in respiratory care should be responsible for the programme
- A programme co-ordinator ideally a HCP is responsible for the broader organization of the service.
- A multidisciplinary team with appropriate training and resources which may include:
  - Physiotherapist, Doctor, Respiratory Nurse, Dietitian, Occupational Therapist, Psychologist, Pharmacist, Speech and Language Therapist, Smoking cessation officer, Palliative Care professional, Social Worker and Respiratory Physiologist.
- Administrative support is recommended to help manage the significant workload.

Other MDT role profiles can be found in Section 4.

In order to deliver a quality programme, providers of PR services must be competent in understanding and meeting the patient’s needs and goals. Training programmes should focus on meeting the learning needs of HCPs in order that professional competence is achieved in the areas of clinical skills and reasoning, knowledge and communication skills. The American Association of Cardiovascular and Pulmonary Rehabilitation developed a revised list of core competencies for PR professionals, which could be used as a template for training programmes and professional/personal development programmes (64).

If the PRP does not have formal input into the education sessions from members of the MDT, the Respiratory Physiotherapist or Respiratory Nurse can provide the education sessions in lieu, by using the Pulmonary Rehabilitation Manual ‘Information for Participants and Facilitators as part of Pulmonary Rehabilitation Programme’ devised by the National Clinical Programme for COPD in 2011 (63).
3.5 Location Resources

Pulmonary Rehabilitation can have varied settings which each have pros and cons (1, 3, 13, 50).

A review of outcomes shows comparable results between the hospital and community based programmes. It is necessary to form partnerships between community and hospital settings to support and develop PR and to maintain benefits achieved (5, 30, 35, 51). Home based programmes have been found to show improvements in walking distance but patient selection, supervision, education and equipment needs need to be considered for these programmes (3). There is low to moderate evidence that outpatient and home-based exercise training programmes are equally effective at improving HRQOL and exercise capacity (95). Appropriate venues should be risk assessed with safety systems put in place to include procedures to deal with any adverse events arising (7).
3.5.1 Facility and Equipment

The clinical space must be adequate in relation to the number of patients being treated and the types of treatment and interventions being performed. The PRP venue should have space of either a level corridor or walking track suitable to carry out a field walking test (10, 21, 52). Table 2 below includes equipment for PRP.

Table 2 Equipment for PR Programme

<table>
<thead>
<tr>
<th></th>
<th>Minimum Required</th>
<th>Optimal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulse Oximetry</td>
<td></td>
<td>Weights machine</td>
</tr>
<tr>
<td>Blood Pressure Monitor</td>
<td></td>
<td>Static bike</td>
</tr>
<tr>
<td>Stopwatch</td>
<td></td>
<td>Spirometry</td>
</tr>
<tr>
<td>Walking track/corridor</td>
<td></td>
<td>Glucometer</td>
</tr>
<tr>
<td>Stairs/step</td>
<td></td>
<td>Inspiratory muscle trainers</td>
</tr>
<tr>
<td>Hand weights / Theraband</td>
<td></td>
<td>Rollators</td>
</tr>
<tr>
<td>Portable oxygen, nasal prongs</td>
<td></td>
<td>Measuring tape, weighing scales, Body Analysis Machine</td>
</tr>
<tr>
<td>Access to an AED</td>
<td></td>
<td>treadmill</td>
</tr>
</tbody>
</table>

3.5.2 Emergency Equipment

A first aid kit with a CPR mask, gloves and rescue medications is recommended. All staff should be up to date with Basic Life Support training (3).

3.6. Group Size

Class size will depend upon the venue and staff available. Staff to patient ratios recommended are 1:8 (UK) and 1:4 (US) for exercise training and 1:16 (UK), 1:8 (US) for the education session. It is recommended that two staff members (one being the Physiotherapist) are always present during the exercise class for safety reasons. One senior member of staff must be
present at all times. (1, 3, 53). Patient safety and disease severity are the most important factors to consider when determining this ratio.

Cohort or rolling programmes are acceptable forms of delivery depending on local considerations.

### 3.7. Duration

The large variation in the design of PRPs makes it difficult to identify their optimal format, duration and intensity (13).

The minimum duration of exercise training in PR has been extensively investigated and longer programmes yield larger, more reliable training effects. The recommendation of the National Clinical Programme for COPD is that programmes (i.e. the exercise and education component) are of at least 6 to 8 weeks duration, with the pre and post programme assessments as additional to this.

Programmes should include a minimum of twice-weekly supervised sessions (at least 12 sessions). A third session per week of prescribed exercise is recommended and can be unsupervised (7). Other opportunities for physical activity are encouraged, as per the American Heart Association guidelines i.e. 30 minutes of physical activity 5 days per week (65). Promotion of increased physical activity may in turn reduce the risk of hospitalisation (13).

### 3.8. Maintenance and Repeat Programmes

At present there is no substantial evidence that prolonged maintenance treatment is beneficial (3). The benefits of 8 - 12 weeks of a PRP typically last up to 12 months (13). By following a PRP, patients should be provided with individualised structured, written plans for ongoing exercise maintenance. It should include aerobic and strength exercises alongside giving information about local gyms, walking clubs and local amenities. The onus is on the patient to adhere to the plan (7). Consider referral to local pulmonary rehab maintenance programme where available.

Repeat PRPs should be considered in patients who have completed a course of PR more than 1 year previously (3). Increasing patient’s access to repeated courses where clinically indicated (e.g. post acute COPD exacerbation) has the potential to improve patient’s health over the course of their lives and to reduce healthcare costs (13). Repeat PRP is also indicated for patients awaiting lung transplantation and procedures such as lung volume reduction surgery.

### 3.9. Measurable Outcomes resulting from Pulmonary Rehabilitation

The collection of data will help to track and plan care, identify additional care, facilitate performance monitoring and quality improvement efforts.
As a minimum, measures of exercise capacity, dyspnoea and health status are assessed (7).

The HCPs should also ensure that measurements to assess other elements of PR are accommodated if possible e.g. muscle strength, psychological status, ADLs, physical activity, self-efficacy and nutritional status (7).

The aim of the PRP is that the majority of people are expected to achieve the MCID in the chosen exercise test, dyspnoea score and health status score (see Appendix 2).

On completion of a PRP, a summary of results should be provided to the patient and to the referral source.

### 3.9.1 Outcomes

Patient Outcomes may include:

- Exercise improvement - Repeated exercise tests as per initial assessment.
- Health related Quality of Life improvement - repeated outcome measures as per initial assessment
- Dyspnoea, anxiety, depression improvements - Repeated QoL questionnaires as per initial assessment.
- Improved knowledge of disease and capacity to self-manage
- Reduced exacerbations and hospital admissions benefitting both patient and cost to health service.
- Patient feedback.

Programme outcomes may include the following:

- Number of patients referred for PR
- Number of patients with confirmed diagnosis of COPD
- Number of patients assessed
- Number of patients enrolled in PR
- Number of patients who have completed PR
3.10 Data Collection

All PRPs should collect data to facilitate audit and research. Patient consent should be obtained for collection of data. Included should be the following:

<table>
<thead>
<tr>
<th>Waiting list and capacity for the site</th>
<th>Number of supervised sessions per week and length of programme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Referral source</td>
<td>Exercise tests and questionnaires used</td>
</tr>
<tr>
<td>Referral numbers and compliance data</td>
<td>Education provided</td>
</tr>
<tr>
<td>Number GP and ED visits and hospital adm. pre/post/during PRP related to exacerbation</td>
<td>Onward referral to support group and exercise facilities post rehabilitation</td>
</tr>
</tbody>
</table>

**Recommendations**

1. All PRPs should record standardised measurable outcomes for every person graduating.

2. All PRP's structure and process (including rates of commencement, adherence and completion), along with the outcome measures, and analysis of patient feedback should have an internal audit on an annual basis.

3. Follow up evaluation of hospital admissions and bed days for the year pre and post rehabilitation should be performed to assist in a cost analysis.
4. Multidisciplinary Team Roles in Pulmonary Rehabilitation

4.1. Programme Co-ordinator

The co-ordinator ideally a HCP should have an understanding of the medical, physical and emotional condition of respiratory patients attending the PRP. The co-ordinator is responsible for the broader organization of the service: development of PPG, organizing venue timetable etc, outcome measures and audit, the co-ordinator may also be responsible for patient referrals, selection, assessment and class supervision.

4.2. Physiotherapist

4.2.1. Role of the Physiotherapist

The physiotherapist is most often the MDT member responsible for delivery of PRP. Physiotherapists are involved in all processes of the PRP from recruitment of patients, assessment and identification of problems, delivery of the rehabilitation and liaison with community services to enhance lifelong behavioural change. With their background in exercise prescription and evidence-based practice, physiotherapists are ideally placed to play a major role in the provision of PRPs. Physiotherapists are often the main providers of the service.

4.2.2. Patient Selection

A clear referral process is required irrespective of which HCP makes the referral. Physiotherapists can advise regarding the selection of patients for PR with reference to the patient’s ability to exercise and compliance with same as demonstrated during previous hospital admissions. Where lung function testing by a Respiratory Physiologist is not available on site, physiotherapists who have completed a training programme in Spirometry (details found at www.iars.ie/spirometrycourse) may confirm the patient’s diagnosis of COPD using Spirometry pre-enrollment on a PRP.

4.2.3. Exercise Testing

The HCP (ideally a Physiotherapist) responsible for exercise testing should have a good knowledge of the principles of exercise testing, and the limitations to same, including hypoxaemia and musculo-skeletal problems. Physiotherapists are experts in these areas.

4.2.4. Assessment of Supplemental Oxygen Needs

Patients often desaturate during exercise testing and may need supplemental oxygen in the form of portable or long term oxygen therapy (LTOT). In many institutions physiotherapists are
working as advanced scope practitioners in this area, and can be trained to take Arterial Blood Gas samples in order to facilitate the prescription of LTOT.

4.2.5. Quality of Life (QoL) Assessment

The assessment of QoL may be performed by any member of the MDT including physiotherapists. It is important that the HCP performing this function can establish a good rapport with the patient so that an accurate assessment in this area is made.

4.2.6. Supervision of Exercise Programme and Prescription of Home Exercise

The supervisor of an exercise programme should be able to make the necessary changes to the individual patient’s exercise prescription, with reference to the FITT principle (Frequency, Intensity, Time, Type). Physiotherapists are ideally placed to adapt the programme to each individual as necessary.

4.2.7. Breathing Retraining and Airway Clearance

This includes techniques such as pursed lip breathing, positions of ease, Active Cycle of Breathing Technique (ACBT) and the use of adjuncts such as PEP, Acapella or Flutter devices. These are techniques which are taught by physiotherapists on a daily basis.

Incorporation of breathing training and coping strategies taught by a physiotherapist for recognition and management of anxiety/panic has the potential to reduce such events and improve patient outcomes (27). Inhaled device selection and education in correct inhaler technique – may be assessed by a physiotherapist or respiratory nurse.

Relaxation therapy – may be delivered by a physiotherapist or occupational therapist

4.2.8. Continence

Patients with COPD should always be questioned about their continence status and if problems of leakage are identified, patients should be referred to a physiotherapist specialising in continence or public health nurse with specialised training in continence management.

4.2.9. Re-assessment

If possible the re-assessments should be carried out by the HCP who performed the initial assessment.
4.3. Respiratory Nurse

The role of the respiratory CNS may differ according to individual services and may include some or all of the following:

- Identification of patients suitable for referral to PRP and the review of referrals for patient suitability and selection.
- Assessment of patients pre and post a PR programme
- Education can be delivered in group or individual sessions and includes
  - disease education,
  - medication management including inhaler technique,
  - managing LTOT, NIV
  - lifestyle changes including smoking cessation and healthy eating
  - self management strategies
  - end of life care
  - incontinence management and continence promotion
- Provide psychological support and further referral as required
- Provide a review of respiratory medication ensuring medication is adequate and that the patient has effective use of, and adherence to, prescribed medicines. If the nurse is a prescriber they can also commence new treatments according to their collaborative practice agreement and GOLD guidelines.
- The assessment and monitoring of patients for LTOT, in conjunction with the Medical team
- Perform spirometry¹ for patients pre and post participation in a training programme. The nurse can order CXR² if needed as part of pre assessment work
- Assess and arrange referral to other health care professional colleagues as needed

¹suitable qualified/skilled, accredited spirometry training
²registered ionizing radiation nurse.

4.4. Dietitian

4.4.1. Role of the Dietitian
Dietitians are the only qualified HCPs that assess, diagnose and treat dietary and nutritional problems at an individual and wider public health level. Dietitians apply knowledge of food, nutrition and other related disciplines such as biochemistry, physiology and social science to promote health, prevent disease and aid in the management of illness, including COPD.

It has been estimated that greater than 20% of individuals with COPD are at risk of malnutrition (85). Nutrition support interventions may include food first strategies and oral nutritional supplements. Improvements have been demonstrated in respiratory muscle function, non-respiratory muscle strength, exercise tolerance, quality of life and improved survival rates (86). Consideration should be given to optimising nutritional status during PR as energy requirements may increase with increased physical activity.

Over 20% of people with COPD are obese (BMI>30kg/m²) (87). Individuals with obesity many experience a poorer exercise performance, greater degree of functional impairment and higher level of fatigue than individuals who are a healthy weight (88).

The role of the Dietitian in PR includes:

- Provision of nutrition education component of the PRP
- Provision of individualised tailored nutrition intervention, as required
- Education and training of other HCPs on:
  - the role of nutrition in optimising PR
  - the use of nutrition screening tools, with referral to dietitian as indicated

4.4.2. Who Should be Referred to the Dietitian?

Patients who have COPD and are identified as being at risk of malnutrition (NICE,2006)(89) i.e.:

- BMI of less than 20 kg/m² (NICE, 2010)
- Unintentional weight loss of 5–10 % over the previous 3–6 months
- Little or nothing eaten for more than 5 days, or likely to eat little or nothing for the next 5 days or more

In addition to those at risk of malnutrition, the following patient groups should also be referred for Dietetic assessment:

- Individuals with a BMI > 30kg/m²
- Individuals who have any other diagnosis that requires dietetic advice e.g. newly diagnosed diabetes, nutritional deficiencies or Coeliac disease etc.
- Individuals who require enteral or parenteral feeding.
4.5. Speech and Language Therapist (SLT)

Speech and Language Therapists (SLTs) assess, diagnose and treat swallowing, voice and communication disorders. SLTs play an important role in the management of COPD due to the prevalence of swallowing, reflux, vocal and oral hygiene issues associated with the disease.

SLTs assess and manage dysphagia. There is a correlation between dysphagia and COPD and dysphagia and increased exacerbations. The high prevalence of gastro-oesophageal reflux in COPD may contribute to dysphagia. The most common voice problems (dysphonia) associated with COPD are hoarseness and decreased volume. Oral health problems can also have a negative impact on both swallowing and voice.

SLTs should provide input into PRPs to provide education sessions on swallowing, voice, oral care and health promotion and disease prevention.

4.6. Occupational Therapist

4.6.1. Pre-assessment

If available, the Occupational Therapist (OT) should be involved in the pre-assessment phase of PR. There have been significant advances in the development of assessment tools in the last decade including:

- Pulmonary Function Status Scale (PFSS)
- London Chest Activity of Daily Living Scale (LCADL)
- Manchester Respiratory Activities of Daily Living Questionnaire
- Canadian Occupational Performance Measurement (COPM)

4.6.2. Pulmonary Rehabilitation Programme

The role of the OT during the PRP can include providing sessions in the following areas:

- Instruction in energy conservation techniques
- Prescription of adaptive equipment to aid energy conservation and facilitation of independence in activities of daily living
- Facilitating independence in personal and domestic activities of daily living and the use of graded therapy programmes to increase activity tolerance/endurance
- Instruction in Stress Management techniques
- Instruction in relaxation techniques
- Assessment of the home environment to ensure safe discharge home
- Recommendations regarding vocational abilities
The OT can provide vocational assessment and advice regarding workplace adaptations and work routine modification.

4.6.3. Post-Programme

The OT should be present at re-assessment phase to re-administer and compare the ADL scale results and to identify any ongoing areas of difficulty for the patient if they were involved in pre-assessment. Review of the COPM and the goals set at pre-assessment phase is a useful outcome measure.

4.7. Respiratory Physiologist

Respiratory Physiologists provide a wide range of diagnostic lung function tests to patients with respiratory disease and/or respiratory symptoms. Respiratory Physiologists are also trained in specialised areas such as cardiopulmonary exercise testing (CPET) which is considered the gold standard test for assessing exercise limitation and capacity (54). Oxygen assessments for air travel, as well as sleep assessment including NIV therapy intervention can also be provided by a Respiratory Physiologist with expertise in these areas.

If available, Respiratory Physiologists can provide pulmonary function tests including spirometry, respiratory muscle strength tests and CPET to patients in the Pulmonary Rehabilitation programme. In the absence of Respiratory Physiologist support, the spirometry test can be carried out by appropriately trained HCPs (respiratory physiotherapists or respiratory nurses) outside of the Respiratory Laboratory. An accredited certificate programme (CPD Certificate in Spirometry for Health Care Professionals) is available to train HCPs who wish to perform spirometry tests. More details can be found on www.iars.ie/Spirometry course.

4.8. Consultant Respiratory Physician

The Consultant Respiratory Physician should be responsible for the development of integrated care for COPD patients. This would encompass appropriate inpatient care including supervision of non-invasive ventilation. They would need to supervise the provision of diagnostic facilities in the community as well as the hospital. They would need to facilitate the development of PR both in hospital and in the community settings.

The treatment goal of the Respiratory Physician should be to optimise medical therapy for the respiratory patient and any existing co-morbidities before the commencement of a PRP.

The Respiratory Physician has a role in oxygen prescription, NIV prescription, smoking cessation and referral to palliative care services as appropriate.

They also have a role in patient education during the PRP and in encouraging long term maintenance during follow up reviews.
The Respiratory Physician should act as a resource for advice on the management of COPD patients for other referrers to the PRP e.g. GP’s, other physicians, physiotherapists and nurses.

4.9. General Practitioner

The GP is the key health professional for the majority of patients with COPD. They provide the clinical lead in the diagnosis, assessment, treatment and ongoing monitoring of the majority of the patients with COPD. They can refer to specialist respiratory services such as PR as indicated. They are best placed along with practice nurses to identify and refer patients suitable for pulmonary rehabilitation.
5. **Education to Facilitate End of Life Choices**

Advance care planning (ACP) is the process of communication between individuals and professional caregivers that includes but is not limited to options for end-of-life care and the completion of advanced care directives (1). PRPs should offer an education session aiming at the facilitation of choices at end-of-life (13). While discussing advance care planning and end of life decision making are challenging topics to discuss with patient groups of varying ages, backgrounds, respiratory conditions and severity, research has demonstrated that respiratory patient groups in Ireland value such information provision (90,91). Furthermore, 45% of all hospital based PRPs in Ireland include ACP education in their education component (92). ACP is not a once-off interaction but is based on discussions over time between individuals, their families and healthcare providers (93). PRPs are considered opportune places to promote and facilitate ACP education as patients are in a stable condition and able to fully participate (94). The aim of this session is to inform the patient of available choices and allow them to be involved in decision making. All too often, these decisions are not made until the patient may be critically ill or in the ICU, a place that is not conducive to such discussions. Acknowledgement of the disease progression, exploration of individual concerns, discussion of the options and re-assurance helps the patient to make an informed autonomous decision, should they and their families wish to do so.

HCPs working in respiratory care are all well placed to provide ACP education. Services may utilise the expertise of colleagues working in Specialist Palliative Care for the dual purpose of patient and staff education. In the absence of large studies on the implementation of the ACP education component in PRP, we rely on studies within the local context (91, 92) and experience from the Australian model of ACP in PRP (93). Appendix 4A describes the three phases of ACP education delivery at a PRP in a large teaching hospital (91) which was developed in collaboration with PRP patients and is assessed at each session and amended accordingly. Similarly, the content of the ACP session has been amended in this PRP over the past 3 years in line with patient preferences, legislative changes and healthcare governance (Appendix 4B).

PRP staff wishing to deliver these sessions should identify and respond to their training needs (see appendix 4C for resources) and aim to develop the session in collaboration with colleagues in the respiratory department. Patients who receive ACP education as part of their PRP need to be able to continue the conversation with any HCP of their choosing and therefore staff across respiratory services need to acquire the competence and confidence to engage with patients proactively about this topic.

ACP education during the PRP may be the first time that patients are formally introduced to this topic. It therefore should be presented in a safe space and respectful manner acknowledging the life experience of patients in terms of living with their illness but also as members of our civil society. In contrast to other education sessions, the presenter should not aim to be an expert in this field. While being versed in theoretical ACP and advance healthcare directives knowledge and perhaps practical experience, the ability to facilitate a conversation among the PRP patients about this topic is priority. It has been the experience of longer established groups (91, 92) that the value in ACP education at PRP is based on: introduction of the topic, commencement of a discussion
amongst patients with similar health experiences and the offer/signposting of patients to discuss ACP with their healthcare provider when they are ready to do so. While completion of an ACP or advance healthcare directive is a desired outcome, the discussion around preferences and choices at end of life are of immense value.
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- Linda Kearns, Programme Manager, National Clinical Programme for COPD
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- Dr John Connaughton - Consultant Respiratory Physician, Midland Regional Hospital, Portlaoise
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- Dr Máire O’Connor, Public Health Specialist, HSE
- Dr Rory O’Donnell - Consultant Respiratory Physician, St. James’s Hospital
- Dr Colm Quigley - Consultant Respiratory Physician, Wexford General Hospital
- Dr Robert Rutherford - Consultant Respiratory Physician, University Hospital Galway
- Dr Mark Sheehy – Consultant Respiratory Physician, Regional Hospital Mullingar
9. References


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Appendix 1. Sample Referral and Assessment Forms

### Pulmonary Rehabilitation Referral Form

**Health Service LOGO**  **Pulmonary Rehabilitation Referral**

<table>
<thead>
<tr>
<th>Date of Referral:</th>
<th>Consultant:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<table>
<thead>
<tr>
<th>Name</th>
<th>DOB:</th>
<th>MRN:</th>
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<tr>
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<table>
<thead>
<tr>
<th>Address:</th>
<th>Phone Number:</th>
</tr>
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<tbody>
<tr>
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</table>

<table>
<thead>
<tr>
<th>Diagnosis:</th>
<th>Date:</th>
</tr>
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<tbody>
<tr>
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</table>

<table>
<thead>
<tr>
<th>FEV1:</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Inclusion Criteria</th>
<th>(Please Tick)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Dx chronic respiratory disease (e.g. COPD, bronchiectasis, lung transplant candidates)</td>
<td>✓</td>
</tr>
<tr>
<td>2. No evidence of unstable asthma, ischaemic heart disease, decompensate/unstable heart failure, severe or uncontrolled systemic arterial hypertension, neuromuscular or musculoskeletal disorders or other disabling diseases that could resist exercise training.</td>
<td></td>
</tr>
<tr>
<td>3. No suspected underlying malignancy</td>
<td></td>
</tr>
<tr>
<td>4. Motivated to attend an 8 week outpatient exercise and education programme in a group setting.</td>
<td></td>
</tr>
<tr>
<td>5. Has the ability to exercise independently with supervision.</td>
<td></td>
</tr>
</tbody>
</table>

### Relevant Investigations.

- CXR
- ABG
- ECG
- ECHO EF_____% PAP’s____mmHg

### Optimization of respiratory medication per ITS/ICGP guidelines

- Yes □  No □

Please List medications:
Have you discussed pulmonary rehabilitation with patient?  □ Yes  □ No

Will transport be required?  □ Yes  □ No

Smoking status:  □ Current Smoker  □ Ex-smoker (≥12mths)  □ Never Smoked

If smoker has patient been referred to Smoking Cessation Officer?  □ Yes  □ No

LTOT: □ Yes □ No ___L 16 / 24 hr/day  Portable Oxygen □ Yes □ No ___L

**Referring Health Professional**

Name: __________________________  Signature: __________________________

Phone: ______________ Fax: ______________ Email: ____________________
### Pulmonary Rehabilitation Assessment Form

<table>
<thead>
<tr>
<th>Name:</th>
<th>Date of Assessment:</th>
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<tbody>
<tr>
<td>DOB:</td>
<td>Hospital No:</td>
</tr>
<tr>
<td>Address:</td>
<td>Medical Card No:</td>
</tr>
<tr>
<td></td>
<td>Tel No:</td>
</tr>
<tr>
<td></td>
<td>Mobile No:</td>
</tr>
<tr>
<td></td>
<td>Consultant:</td>
</tr>
<tr>
<td></td>
<td>GP:</td>
</tr>
</tbody>
</table>

**Respiratory Diagnosis:**

**Other/Past Medical History:**

**Social History**

- Occupation:
- Mobility:
- Transportation:

**Medications:**

**Baseline Respiratory Function:**

- Mob Distance
- Stairs
- Uphill
- Orthopnoea
- Cough
- Sputum
- Wheeze
- Stress Incontinence
- Other

<table>
<thead>
<tr>
<th>Home O2:</th>
<th>Y</th>
<th>N</th>
<th>L/min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portable O2</td>
<td>Y</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>L/min</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| BiPAP: | Y | N |
| Make: | |
| IPAP: | |
| EPAP: | |

| Home Nebs: | Y | N |
| Smoking History: | Y | N | Ex | Pack Years |

<p>| BMI: | BORG: |
| HEART RATE: | SaO2: |
| CXR Report: | |</p>
<table>
<thead>
<tr>
<th>Name</th>
<th>Hospital No:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Date</th>
<th>Initial</th>
<th>8/52 Re-ax</th>
<th>6/12 Re-ax</th>
<th>12/12 Re-ax</th>
</tr>
</thead>
</table>

| Spirometry |          |            |            |             |
| FEV1       |          |            |            |             |
| FVC        |          |            |            |             |
| Ratio      |          |            |            |             |
| % Predicted|          |            |            |             |
| DLCO       |          |            |            |             |
| SNIP       |          |            |            |             |
| PMax       |          |            |            |             |
| IC/TLC     |          |            |            |             |

The above PFT’s are a guide only and are adapted to requirements at a local level. If tests have been performed within 6 months of PRP repeat may not be necessary. A decision should be made at a local level.

| 6MWT / ISWT |          |            |            |             |
| Distance    |          |            |            |             |
| Borg        |          |            |            |             |
| Heart Rate post |      |            |            |             |
| O2 Sats post |          |            |            |             |

| ESWT / Treadmill |          |            |            |             |
| Level / Speed   |          |            |            |             |
| Minutes          |          |            |            |             |
| Borg             |          |            |            |             |
| Heart Rate post  |          |            |            |             |
| O2 Sats post     |          |            |            |             |

| CRDQ       |          |            |            |             |
| Dyspnoea   |          |            |            |             |
| Fatigue    |          |            |            |             |
| Emotional Function | |            |            |             |
| Mastery    |          |            |            |             |

| SGRQ |          |            |            |             |
| Symptoms |      |            |            |             |
| Activity  |          |            |            |             |
| Impacts   |          |            |            |             |
| Total     |          |            |            |             |

| CAT (total) |          |            |            |             |

| HADS  |          |            |            |             |
| Anxiety |          |            |            |             |
| Depression |          |            |            |             |

| MRC  |          |            |            |             |
| 1 year pre prog |      |            |            |             |
| 1 year post prog |          |            |            |             |

| No of Admissions |          |            |            |             |

| No of Hospital Days |          |            |            |             |
Appendix 2. Minimal Clinically Important Difference (MCID) Scores

**Incremental Shuttle Walk Test (ISWT)**

The minimum clinically significant improvement for the Incremental Shuttle Walking Test (ISWT) is 47.5 meters \((21, 52)\). In addition, patients were able to distinguish an additional benefit at 78.7 meters \((17)\).

**Outcome Measure**

- Improvement 47.5 meters means “slightly better”
- Improvement 78.7 meters represents “better” \((17)\)
- ATS/ERS (2014) consensus was that ISWT should be discontinued if \(\text{SaO}_2\) falls below 80\% \((21, 52)\)
- ATS/ ERS (2014) recommend 2 ISWT’s be performed and best distance should be recorded pre programme and one ISWT distance should be sufficient post PRP \((21, 52)\)

**6 Minute Walking Test (6MWT)**

The 6 minute walking distance \((6 \text{ MWD})\) is the primary outcome of the 6MWT.

A MCID value for 6MWD has been identified as 30 meters for adult patients with chronic respiratory disease \((21, 52)\). This is a change from the previous MCID of 35 -54m \((61)\).

**Outcome Measure**

- Minimal improvement estimated at 25 to 33 meters \((21, 52)\)
- 6 MWT stopped if \(\text{SaO}_2\) falls below 80\%
- 2 6MWT’s should be performed and best 6 MWD recorded pre programme and one 6 MWT, with recording of one 6MWD recommended after PRP \((21,52)\).

**Hospital Anxiety and Depression Scale (HADS)**

MCID is around 1.5 in COPD patients corresponding to a change in baseline of around 20\% \((62)\).

**Chronic Respiratory Disease Questionnaire (CRQ)**

MCID of 0.5 units per item on a 7-point scale for each of the domains (dyspnoea, fatigue, emotional function and mastery). Therefore, if all the questions within a domain are answered then the MCID for each domain is as follows:

- Dyspnoea 2.5; Fatigue 2; Emotional Function 3.5; Mastery 2, with the magnitude of change in the Total score for CRQ that represents an important difference is 10 points \((2, 62)\).
St George’s Respiratory Questionnaire (SGRQ)

Scores from the SGRQ are reported on a 100-point scale, with MCID of 4 units a significant change (22).

Euroqual /EuroQol

EQ-5D is a standardised instrument for use as a measure of health outcome. EQ-5D is a descriptive system of Health-Related Quality of Life states consisting of five dimensions (mobility, self-care, usual activities, pain/discomfort, anxiety/depression) each of which can take one of three responses. The responses record three levels of severity (no problems/some or moderate problems/extreme problems) within a particular EQ-5D dimension.

Licensing fees are determined by the EuroQol Executive Office on the basis of the user information provided on the registration form. The amount is dependent upon the type of study, funding source, sample size and number of requested languages. You are not obligated to purchase by registering.

How to use EQ-5D

The EQ-5D self-report questionnaire (EQ-5D) essentially consists of two pages comprising the EQ-5D descriptive system (page 2) and the EQ VAS (page 3). There is also an optional page of demographic questions. There is also an extended version of EQ-5D that incorporates the valuation task but this is only used for valuation studies and is not relevant for clinical users.

EuroQoL in assessment of the effect of pulmonary rehabilitation COPD patients:

Contact information

EuroQol Group Executive Office
Marten Meesweg 107
3068 AV Rotterdam
The Netherlands

E-mail: EuroQol User Information Service
KvK-nummer: 41121799

www.euroqol.org/

Authors

By: Ringbaek, T., Brondum, E., Martinez, G., Lange, P.

Published

31-10-08
COPD Assessment Test (CAT)

As COPD Assessment Test (CAT) is closely related to SGRQ and in clinically stable COPD patients, a 2 point change in CAT is clinically significant, based on MCID of 4 in SGRQ.

Reference:

Clinical COPD Questionnaire (CCQ)

The CCQ is a self-administered, easy to complete questionnaire with ten items that are categorized into 3 domains, namely, symptoms, functional state and mental state with the MCID of the total CCQ score being 0.4 (76)
Appendix 3. Summary of Quality Statements BTS 2014

<table>
<thead>
<tr>
<th>No.</th>
<th>Quality Statement</th>
</tr>
</thead>
</table>
| 1   | Referral for pulmonary rehabilitation:  
|     | a. People with COPD and self-reported exercise limitation (MRC dyspnoea 3-5) are offered pulmonary rehabilitation.  
|     | b. If accepted, people referred for pulmonary rehabilitation are enrolled to commence within 3 months of receipt of referral. |
| 2   | Pulmonary rehabilitation programmes accept and enrol patients with functional limitation due to other chronic respiratory diseases (for example bronchiectasis, ILD and asthma) or COPD MRC dyspnoea 2 if referred. |
| 3   | Referral for pulmonary rehabilitation after hospitalisation for acute exacerbations of COPD:  
|     | a. People admitted to hospital with acute exacerbations of COPD (AECOPD) are referred for pulmonary rehabilitation at discharge.  
|     | b. People referred for pulmonary rehabilitation following admission with AECOPD are enrolled within one month of leaving hospital. |
| 4   | Pulmonary rehabilitation programmes are of at least 6 weeks duration and include a minimum of twice-weekly supervised sessions. |
| 5   | Pulmonary rehabilitation programmes include supervised, individually tailored and prescribed, progressive exercise training including both aerobic and resistance training. |
| 6   | Pulmonary rehabilitation programmes include a defined, structured education programme. |
| 7   | People completing pulmonary rehabilitation are provided with an individualised structured, written plan for ongoing exercise maintenance. |
| 8   | People attending pulmonary rehabilitation have the outcome of treatment assessed using as a minimum, measures of exercise capacity, dyspnoea and health status. |
| 9   | Pulmonary rehabilitation programmes conduct an annual audit of individual outcomes and process. |
| 10  | Pulmonary rehabilitation programmes produce an agreed standard operating procedure. |

Note: The British Thoracic Society use the MRC score whereas this document uses the mMRC to maintain consistency with the overarching Model of Care for COPD.
Appendix 4A: Suggested set up of an ACP Education session

Preparation phase:

- Participants should be enrolled for at least 2 sessions, so that ACP is not their 1st education session
- Verbal and written information provided to PRP participants during previous session about the nature of the ACP education session.
- Written and verbal invitation includes family/friends/significant others

Session delivery:

- Set in a comfortable surrounding e.g. semi-circle or around a table; tea, coffee & biscuits
- Provide a safe atmosphere where people are invited to share their stories and encouraged to contribute based on confidentiality, mutual respect and recognition that this can be a difficult topic to discuss
- Session should be delivered by 2 people e.g. nurse and physiotherapist or other
- Aim for 30-45 minutes slot including 5-6 PowerPoint slides (as a framework, non-didactic) and Q&A; should be informal, engaging and allow for discussion of all concerns and queries; slides available on request
- Provide written information e.g. PP slides, Think Ahead forms
- Ask participants to complete a feedback form about the session

Follow up:

- Review ACP education session at each occurrence with PRP team e.g. what went well, what didn’t go so well, what will we do different the next time?
- Follow up with any participant who shows signs of being affected by the session
- Check in with each participant at the next PRP day about the session e.g. ‘Is there anything you like to speak with me about after the ACP session last week?’
- Include ACP education session in the Post PRP Assessment process feedback
- Communicate participant’s attendance at ACP education session to GP and Respiratory Physician e.g. Post Rehab letter/communication
- Respond to individual feedback on feedback form and incorporate suggestions following discussion with PRP team
Appendix 4B: Suggested content of an ACP education session

- Inform participants that this is an ACP information session, not an individual ACP; lay people seem to prefer term ‘planning for your future healthcare’ vs ACP (medical terminology).

- Frame the session in that this is an important issue for everybody to think about independently of age or illness but it is particularly relevant to people with chronic illness. Some patients are also carers of others and may find this information helpful in this context.

- It might be helpful to stress that people with chronic illness may have to make many choices along their journey and that they are not always aware of their choices. This session is about opening the conversation about the choices that we may or may not face at some stage.

- Frame the question of ‘what would happen if I became seriously unwell and too sick to talk to my doctor about my treatment?’/ ‘Who would make the decisions for me/How would they know what I want & would they be in agreement?’ (Here a personal story can be helpful to illuminate this or patients may volunteer with a story to share).

- Inform participants what ACP is, definition and address misconceptions.

- Inform participants what is involved in completing an ACP document. Make reference to Think Ahead document or other ACP documentation perhaps available within your hospital. ACP involves: Thinking what I would want & value, talking about it with someone and tell them what I wish and writing it down. Important to recognise and discuss that people can change their mind any time. Discuss opt in and opt out & allow for discussion.

- It may be of importance to spell out (in a general tone) what type of treatment may potentially available to people with respiratory conditions e.g. places of care, medications, medical treatments & equipment, involvement of other professions (Specialist Palliative Care).

- Summarise that HCP will always do their best to support a person to live their life as best as possible. ACP can help HCP to understand what the patient values and what is important to him/her. When HCP are aware of the patient’s wishes and their choices they are better able to support them and adhere to their preferences.

- Reiterate with patients that:
ACP only comes into action when patient is unable to communicate their wishes with their HCP and that their decisions may vary and change over time. It is therefore important to review ACP regularly, so that they are up to date.

Encourage people to start the conversation with a person they trust and once they spoke with their significant other discuss with their GP or respiratory HCP. Encourage them to take away a Think Ahead Form/information and use other information resources available.

Appendix 4C: Education and training resources for staff

- Hospice Friendly Hospitals Programmes are available in most hospitals/hospital groups. These programmes offer education sessions entitled Final Journeys and Dealing/delivering bad news.

- Local hospices run a variety of communication training programmes.

- Irish Hospice Foundation offers ACP training and education session. See: http://hospicefoundation.ie/

- Connect with your resident Specialist Palliative Care team & seek their advice

- Information Resources:
  - Alfred Health Advance Care Planning (Australia) www.alfredhealth.org.au
  - The Conversation Project: www.theconversationproject.org/starter-kits/
  - University College Cork Advance Care Planning Module: https://www.ucc.ie/en/mh6016/
  - UK General Medical Council. End of Life Care, medical professionalism. Hoping, coping and planning ahead 'just in case': text and Video resources available at: https://gmcuk.wordpress.com/2016/05/06/hoping-coping-and-talking-about-planning-ahead-just-in-case/
  - St. James's Hospital PRP Programme
Appendix 5. Reviewer Statement

**Policy, Procedure, Protocol or Guidance Reviewer Statement**

Reviewer: The purpose of this statement is to ensure that a Policy, Procedure, Protocol or Guideline (PPPG) proposed for implementation in the HSE is circulated to people who have a stake in the PPPG, in advance of approval of the PPPG. You are asked to sign this form to confirm to the committee developing this Policy or Procedure or Protocol or Guideline that you have seen and agree to the following Policy, Procedure, Protocol or Guideline:

**Pulmonary Rehabilitation Model of Care**

I acknowledge the following:

- I have been provided with a copy of the Policy, Procedure, Protocol or Guideline described above.
- I have read the Policy, Procedure, Protocol or Guideline document.
- I agree with the Policy, Procedure, Protocol or Guideline and recommend its approval by the committee developing the PPPG.

<table>
<thead>
<tr>
<th>Print Name</th>
<th>Signature</th>
<th>Area of Work</th>
<th>Date</th>
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### Appendix 6. Glossary of Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>1RM</td>
<td>One Repetition Management</td>
</tr>
<tr>
<td>6MWT</td>
<td>Six Minute Walk Test</td>
</tr>
<tr>
<td>ACBT</td>
<td>Active Cycle of Breathing Technique</td>
</tr>
<tr>
<td>AECOPD</td>
<td>Acute Exacerbation of COPD</td>
</tr>
<tr>
<td>BIA</td>
<td>Bioelectrical Impedance</td>
</tr>
<tr>
<td>BMI</td>
<td>Body Mass Index</td>
</tr>
<tr>
<td>CAT</td>
<td>COPD Assessment Test</td>
</tr>
<tr>
<td>CNSp</td>
<td>Clinical Nurse Specialist</td>
</tr>
<tr>
<td>COPD</td>
<td>Chronic Obstructive Pulmonary Disease</td>
</tr>
<tr>
<td>CPD</td>
<td>Continuous Professional Development</td>
</tr>
<tr>
<td>CPET</td>
<td>Cardiopulmonary Exercise Testing</td>
</tr>
<tr>
<td>CPR</td>
<td>Cardiopulmonary Resuscitation</td>
</tr>
<tr>
<td>CRDQ</td>
<td>Chronic Respiratory Disease Questionnaire</td>
</tr>
<tr>
<td>DALY</td>
<td>Disability-Adjusted Life Years</td>
</tr>
<tr>
<td>DEXA</td>
<td>Dual-energy X-ray absorptiometry</td>
</tr>
<tr>
<td>ESWT</td>
<td>Endurance Shuttle Walk Test</td>
</tr>
<tr>
<td>EQ-5D</td>
<td>EuroQol</td>
</tr>
<tr>
<td>FEV1</td>
<td>Forced Expiratory Volume</td>
</tr>
<tr>
<td>FFM</td>
<td>Fat Free Muscle</td>
</tr>
<tr>
<td>FITT</td>
<td>Frequency, Intensity, Time, Type</td>
</tr>
<tr>
<td>GOLD</td>
<td>Global Initiative for Chronic Obstructive Lung Disease</td>
</tr>
<tr>
<td>HADS</td>
<td>Hospital Anxiety and Depression Scale</td>
</tr>
<tr>
<td>HCP</td>
<td>Health Care Professional</td>
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<td>HRQoL</td>
<td>Health Related Quality of Life</td>
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<td>Abbreviation</td>
<td>Description</td>
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<tr>
<td>HSE</td>
<td>Health Service Executive</td>
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<tr>
<td>IARS</td>
<td>Irish Association of Respiratory Scientists</td>
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<tr>
<td>ICU</td>
<td>Intensive Care Unit</td>
</tr>
<tr>
<td>IMT</td>
<td>Inspiratory Muscle Training</td>
</tr>
<tr>
<td>ISMT</td>
<td>Incremental Shuttle Walk Test</td>
</tr>
<tr>
<td>LTOT</td>
<td>Long Term Oxygen Therapy</td>
</tr>
<tr>
<td>MCID</td>
<td>Minimal Clinical Importance Difference</td>
</tr>
<tr>
<td>MDI</td>
<td>Metered Dose Inhaler</td>
</tr>
<tr>
<td>MDT</td>
<td>Multi-Disciplinary Team</td>
</tr>
<tr>
<td>MOC</td>
<td>Model of Care</td>
</tr>
<tr>
<td>MRC</td>
<td>Medical Research Council Scale</td>
</tr>
<tr>
<td>mMRC</td>
<td>modified Medical Research Council</td>
</tr>
<tr>
<td>NMES</td>
<td>Neuromuscular Electrical Stimulation</td>
</tr>
<tr>
<td>NIV</td>
<td>Non-Invasive Ventilation</td>
</tr>
<tr>
<td>PEP</td>
<td>Positive Expiratory Pressure</td>
</tr>
<tr>
<td>PFT</td>
<td>Pulmonary Function Test</td>
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<td>PRP</td>
<td>Pulmonary Rehabilitation Programme</td>
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<td>pMDI</td>
<td>pressurised Metered Dose Inhaler</td>
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<td>Quality of Life</td>
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<td>Sociocognitive Theory</td>
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<td>Maximal Oxygen Consumption</td>
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