Pulmonary rehabilitation in Chronic respiratory diseases
What, Who, How, Why and When

Annemarie Lee
26th October 2016
Outline of presentation

• Define pulmonary rehabilitation, key components and populations targeted

• Evidence for Pulmonary rehabilitation - COPD

• Considerations in other respiratory populations
  • Bronchiectasis
  • Interstitial lung disease
  • Pulmonary hypertension
  • Asthma
What is Pulmonary rehabilitation?

“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...”\(^1\)

Aims of PR:

- ↑ Exercise capacity and exercise motivation
- ↓ Symptoms, especially dyspnoea
- ↑ Optimise functional capabilities / status
- ↑ Self-assessment & management of disease
- ↓ Frequency and severity of exacerbations

Skeletal muscle dysfunction

- Weakness
- Atrophy
- Mitochondrial dysfunction
- Shift in fiber-type
- Poor oxidative capacity

La Trobe University
Maltais et al Am J Respir Crit Care Med 2014
Systemic consequences of chronic respiratory conditions

- Respiratory muscle dysfunction
- Nutritional abnormalities
  - (obesity, ▲ lean body mass)
- Cardiac impairment (cor pulmonale, pulmonary hypertension)
- Skeletal disease (osteoporosis)

Downward cycle of deconditioning

- Dyspnoea on exertion
- Avoidance of physical activity
- Deconditioning of the cardiorespiratory system
- Psychological impairment (depression, anxiety, preoccupation with symptoms)
- Deconditioning of skeletal muscles
Rationale for PR

- Peripheral muscle dysfunction
- Fatigue and dyspnoea
- Altered respiratory mechanics and haemodynamics
- Exercise intolerance and functional state
- Peripheral muscle dysfunction
- Impaired QOL
- Circulatory limitations
- Psychological symptoms
- Exercise intolerance and functional state

- Fatigue and dyspnoea
- Altered respiratory mechanics and haemodynamics
- Exercise intolerance and functional state
- Peripheral muscle dysfunction
- Impaired QOL
- Circulatory limitations
- Psychological symptoms
Selection criteria for PR

- No selection criteria which identify responders
  - Not related to disease severity
- Main criteria: dyspnoea on exertion
- Stable medical therapy
- Optimal nutrition
- Adequate motivation
  - Commit to program twice weekly for 6-8 weeks
Selection criteria

- Lung volume reduction surgery
- Lung transplantation
- Interstitial Lung Disease
- Cystic fibrosis
- Asthma
- COPD
- Bronchiectasis
- Lung surgery - cancer
- Thoracic cage abnormalities
- Neuromuscular disorders
Key Components of a PR program

- Patient assessment
  - Baseline level of exercise function (6MWT, ISWT, ESWT), QOL, symptoms, strength, comorbidities (influence ex prescription)
- Exercise training
- Education
- Nutritional support
- Psychosocial support
- Re-assessment
- Maintenance
Exercise training

Essential, mandatory component of PR

Nici et al, Am J Respir Crit Care Med 2006

A comprehensive program should include:

- LL endurance training
- UL endurance training
- LL strength training
- Home exercise program
- Flexibility & stretching exercises (pre/post)
- Exercise prescription progressed every 2nd session
Exercise training

Individualised prescription

Frequency

- (Ideal) 3x weekly (supervised), 2x weekly (unsupervised)
- (Usual) 2x weekly (supervised), 3x weekly (unsupervised)

Intensity - 60% to 70% VO$_2$peak

- ↑ benefits from higher intensity training
- Lower intensity may ↑ adherence
- Interval training as effective as continuous if same work rate is achieved

Duration – Up to 60 mins exercise, minimum 6 weeks

Lower limb endurance training

• Mode
  • Walking (ground-based or treadmill)
  • Stationary cycling

• Intensity
  • Dependent on exercise capacity test results
  • Symptom based – modified Borg measure 3 (moderate) – 4 (somewhat severe)
  • Continuous vs interval

• Duration
  • ≈ 30 mins in total (3 x 10 if debilitated)
Upper limb exercise training

• Endurance vs strength
• Important for everyday tasks
• Mode
  • Unsupported arm exercises
  • Up to 3 x 15 repetitions
• Add weight (based on Borg scale)
• Standing vs seated
• Equipment
Lower limb strength training

- Prescription: based on 10-12 RM
  - Aim for 10-15 reps x 3, then ↑ wt

- Equipment / delivery mode
  - Specialist equipment
  - Functional tasks (step, sit-stand)
Home program and maintenance

- Twice a week insufficient for a training effect
- Exercise guidelines:
  - most days of the week (4 - 5 days)
- Effects of PR dissipate after 12 months
  - Maintenance programs
  - Encourage patients to join local gyms, exercise groups (community health centres)
Multidisciplinary team: Education topics

- Lung anatomy & physiology
- Pathology of lung disease
- Breathing strategies
- Energy conservation & work simplification
- Medications
- Benefits of exercise
- Stress management
- Airway clearance techniques
- Smoking cessation
- Nutrition
- Oxygen therapy
- End of life planning
- Self management skills
- Oxygen therapy
Evidence for PR
Analysis 1.9. Comparison 1 Rehabilitation versus usual care, Outcome 9 Maximal Exercise (Incremental shuttle walk test).

Review: Pulmonary rehabilitation for chronic obstructive pulmonary disease

Comparison: 1 Rehabilitation versus usual care

Outcome: 9 Maximal Exercise (Incremental shuttle walk test)

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Pulmonary rehab</th>
<th>Usual care</th>
<th>Mean Difference</th>
<th>Weight</th>
<th>Mean Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Casey 2013</td>
<td>148 29 (152)</td>
<td>145 27 (162)</td>
<td>15.2 %</td>
<td>2.00 [ -33.99, 37.99 ]</td>
<td></td>
</tr>
<tr>
<td>Deering 2011</td>
<td>11 41.82 (50.56)</td>
<td>14 -1.43 (51.12)</td>
<td>13.1 %</td>
<td>43.25 [ 313, 83.37 ]</td>
<td></td>
</tr>
<tr>
<td>Faulkner 2010</td>
<td>6 -5 (172)</td>
<td>8 12 (125)</td>
<td>1.1 %</td>
<td>-17.00 [ -179.62, 145.62 ]</td>
<td></td>
</tr>
<tr>
<td>Griffiths 2000</td>
<td>93 71 (118)</td>
<td>91 -2 (99)</td>
<td>17.9 %</td>
<td>73.00 [ 41.55, 104.45 ]</td>
<td></td>
</tr>
<tr>
<td>Gurgun 2013</td>
<td>30 56.3 (64.9)</td>
<td>16 8.13 (49.2)</td>
<td>16.6 %</td>
<td>48.17 [ 14.70, 81.64 ]</td>
<td></td>
</tr>
<tr>
<td>Hernandez 2000</td>
<td>20 9.5 (138.6)</td>
<td>17 -22.9 (167.6)</td>
<td>2.8 %</td>
<td>32.40 [ -67.79, 132.59 ]</td>
<td></td>
</tr>
<tr>
<td>McNamara 2013</td>
<td>30 31 (50.7407)</td>
<td>15 -1 (1.81)</td>
<td>29.4 %</td>
<td>32.00 [ 13.82, 50.18 ]</td>
<td></td>
</tr>
<tr>
<td>Xie 2003</td>
<td>25 70 (138)</td>
<td>25 3 (167)</td>
<td>3.8 %</td>
<td>67.00 [ -179.2, 151.92 ]</td>
<td></td>
</tr>
</tbody>
</table>

Total (95% CI) 363 331 100.0 % 39.77 [ 22.38, 57.15 ]

Heterogeneity: Tau^2 = 181.56; Chi^2 = 10.34, df = 7 (P = 0.17); I^2 = 32%
Test for overall effect: Z = 4.48 (P < 0.00001)
Test for subgroup differences: Not applicable
**Analysis 1.10. Comparison 1 Rehabilitation versus usual care, Outcome 10 Maximal Exercise Capacity (cycle ergometer).**

Review: Pulmonary rehabilitation for chronic obstructive pulmonary disease

Comparison: Rehabilitation versus usual care

Outcome: 10 Maximal Exercise Capacity (cycle ergometer)

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Pulmonary rehab</th>
<th>Usual care</th>
<th>Mean Difference</th>
<th>Weight</th>
</tr>
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<tbody>
<tr>
<td>N</td>
<td>Mean(SD)</td>
<td>N</td>
<td>Mean(SD)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baumann 2012</td>
<td>37 4.1 (12.4)</td>
<td>44 -3.3 (0.2)</td>
<td>13.7 %</td>
<td>7.40 [3.40, 11.40]</td>
</tr>
<tr>
<td>Casaburi 2004</td>
<td>12 -0.3 (38.1)</td>
<td>12 3.2 (32.8)</td>
<td>2.5 %</td>
<td>-3.50 [-31.94, 24.94]</td>
</tr>
<tr>
<td>Emery 1998</td>
<td>25 11.3 (34.8)</td>
<td>25 -0.1 (27.7)</td>
<td>5.2 %</td>
<td>11.40 [-6.04, 28.84]</td>
</tr>
<tr>
<td>Engstrom 1999</td>
<td>26 9.4 (25.5)</td>
<td>24 0.8 (24)</td>
<td>6.9 %</td>
<td>8.60 [5.12, 22.32]</td>
</tr>
<tr>
<td>Goldstein 1994</td>
<td>27 -2 (17)</td>
<td>30 -2 (17)</td>
<td>10.1 %</td>
<td>0.0 [8.84, 8.84]</td>
</tr>
<tr>
<td>Gosselink 2000</td>
<td>34 11 (36)</td>
<td>28 0 (37)</td>
<td>4.8 %</td>
<td>11.00 [-7.28, 29.28]</td>
</tr>
<tr>
<td>Goell 1995</td>
<td>29 58 (240)</td>
<td>27 19 (240)</td>
<td>0.1 %</td>
<td>39.00 [-86.80, 164.80]</td>
</tr>
<tr>
<td>Hernandez 2000</td>
<td>20 -2.8 (26.1)</td>
<td>17 2.9 (28.5)</td>
<td>5.0 %</td>
<td>-5.70 [-23.43, 12.03]</td>
</tr>
<tr>
<td>Hoff 2007</td>
<td>6 -3 (0.9)</td>
<td>6 -0.5 (1.1)</td>
<td>15.0 %</td>
<td>-2.50 [-3.36, -1.36]</td>
</tr>
<tr>
<td>Jones 1985</td>
<td>8 157 (245.7)</td>
<td>6 130 (129)</td>
<td>0.1 %</td>
<td>27.00 [-172.10, 226.10]</td>
</tr>
<tr>
<td>Lake 1990</td>
<td>7 15 (73)</td>
<td>7 -40 (90)</td>
<td>0.3 %</td>
<td>55.00 [-30.85, 140.85]</td>
</tr>
<tr>
<td>McGavin 1977</td>
<td>12 14.4 (26.7)</td>
<td>12 -2.6 (15.7)</td>
<td>5.1 %</td>
<td>17.00 [-0.52, 34.52]</td>
</tr>
<tr>
<td>Strijbos 1996</td>
<td>15 14 (18)</td>
<td>15 1.3 (20)</td>
<td>6.9 %</td>
<td>12.70 [-9.26, 26.32]</td>
</tr>
<tr>
<td>Van Wetering 2010</td>
<td>87 5.2 (149238)</td>
<td>88 -0.4 (159474)</td>
<td>13.3 %</td>
<td>5.60 [1.02, 10.18]</td>
</tr>
<tr>
<td>Wijstra 1994</td>
<td>28 8 (31)</td>
<td>15 -8 (28)</td>
<td>4.9 %</td>
<td>16.00 [-2.24, 34.24]</td>
</tr>
<tr>
<td>Xie 2003</td>
<td>25 23 (266)</td>
<td>25 2 (288)</td>
<td>6.0 %</td>
<td>21.00 [5.63, 36.37]</td>
</tr>
</tbody>
</table>

**Total (95% CI)** 398 381

Heterogeneity: Tau² = 40.97; Chi² = 58.69, df = 15 (P<0.00001); I² = 74%

Test for overall effect: Z = 2.72 (P = 0.0065)

Test for subgroup differences: Not applicable
## Analysis 1.5. Comparison of Rehabilitation versus usual care, Outcome 5 QoL - Change in SGRQ (Total)

**Review:** Pulmonary rehabilitation for chronic obstructive pulmonary disease

**Comparison:** Rehabilitation versus usual care

**Outcome:** QoL - Change in SGRQ (Total)

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Pulmonary rehab</th>
<th>Usual care</th>
<th>Mean Difference</th>
<th>Weight</th>
<th>Mean Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baumann 2012</td>
<td>37</td>
<td>44</td>
<td>-7 (10.5)</td>
<td>8.3%</td>
<td>-6.00 [-10.16, -1.84]</td>
</tr>
<tr>
<td>Boxall 2005</td>
<td>23</td>
<td>23</td>
<td>-5.8 (11.8)</td>
<td>5.4%</td>
<td>-4.40 [-11.67, 2.87]</td>
</tr>
<tr>
<td>Chan 2011</td>
<td>69</td>
<td>67</td>
<td>3.4 (16.1)</td>
<td>7.2%</td>
<td>-0.60 [-5.80, 4.60]</td>
</tr>
<tr>
<td>Chlumsky 2001</td>
<td>13</td>
<td>6</td>
<td>-4.07 (19.76)</td>
<td>1.4%</td>
<td>0.15 [-18.60, 18.90]</td>
</tr>
<tr>
<td>Deering 2011</td>
<td>11</td>
<td>13</td>
<td>-6.18 (8.64)</td>
<td>5.5%</td>
<td>-10.03 [-17.27, -2.79]</td>
</tr>
<tr>
<td>Eki 2008</td>
<td>39</td>
<td>39</td>
<td>-14.39 (11.61)</td>
<td>6.0%</td>
<td>-18.20 [-24.76, -11.64]</td>
</tr>
<tr>
<td>Engstrom 1999</td>
<td>26</td>
<td>24</td>
<td>0.3 (17.3)</td>
<td>4.1%</td>
<td>-0.20 [-9.49, 9.09]</td>
</tr>
<tr>
<td>Fernandez 2009</td>
<td>27</td>
<td>14</td>
<td>-14.7 (13.8)</td>
<td>4.6%</td>
<td>-12.20 [-20.65, -3.75]</td>
</tr>
<tr>
<td>Finnerty 2001</td>
<td>24</td>
<td>25</td>
<td>-9.3 (12.2)</td>
<td>5.2%</td>
<td>-7.10 [-14.74, 0.54]</td>
</tr>
<tr>
<td>Gohl 2006</td>
<td>10</td>
<td>9</td>
<td>-7.3 (25)</td>
<td>1.0%</td>
<td>-9.30 [-31.34, 12.74]</td>
</tr>
<tr>
<td>Gottlieb 2011</td>
<td>17</td>
<td>18</td>
<td>-5.2 (14.2)</td>
<td>4.6%</td>
<td>-5.62 [-14.15, 2.91]</td>
</tr>
<tr>
<td>Griffiths 2000</td>
<td>93</td>
<td>91</td>
<td>-7.1 (15.5)</td>
<td>8.5%</td>
<td>-8.40 [-13.36, -4.44]</td>
</tr>
<tr>
<td>Gurgun 2013</td>
<td>30</td>
<td>16</td>
<td>-6.45 (8.0638)</td>
<td>9.5%</td>
<td>-6.27 [-9.18, -3.36]</td>
</tr>
<tr>
<td>Karapolat 2007</td>
<td>26</td>
<td>19</td>
<td>-16.8 (15.2)</td>
<td>3.9%</td>
<td>-13.10 [-22.83, -3.37]</td>
</tr>
<tr>
<td>Paz-Diaz 2007</td>
<td>10</td>
<td>14</td>
<td>-7 (12)</td>
<td>3.2%</td>
<td>-10.00 [-21.21, 1.21]</td>
</tr>
<tr>
<td>Ringbaek 2000</td>
<td>17</td>
<td>19</td>
<td>-2.1 (19)</td>
<td>2.9%</td>
<td>0.10 [-11.73, 11.93]</td>
</tr>
<tr>
<td>Theander 2009</td>
<td>12</td>
<td>14</td>
<td>7.6 (10.8)</td>
<td>4.4%</td>
<td>5.00 [-3.84, 13.84]</td>
</tr>
<tr>
<td>Van Wetering 2010</td>
<td>87</td>
<td>88</td>
<td>-3.9 (10.2601)</td>
<td>9.5%</td>
<td>-4.20 [-7.11, -1.29]</td>
</tr>
</tbody>
</table>

**Total (95% CI):** 592 \[554\] 100.0% \[-6.89 \[-9.26, -4.52\] \]

**Heterogeneity:** $\tau^2 = 13.17$, $\chi^2 = 43.39$, df = 18 ($P = 0.0007$); $\hat{\tau}^2 = 59$

**Test for overall effect:** $Z = 5.70$ ($P < 0.00001$)

**Test for subgroup differences:** Not applicable
Evidence for PR

UK data

- ↓ hospital bed days (10.4 vs 21.0)
- ↓ hospital admissions

Griffiths et al, *Thorax* 2001

Australian data

- ↓ hospital admissions
- ↓ # scripts for resp meds
- Saving of over $12,000 per pt

McCann et al, *J Physio* 2011
Timing of PR in COPD

- When stable
- Post exacerbation (at least 4 weeks)
- Pre and post transplantation (any condition)
- Peri PR or immediately post acute exacerbation
  - Comprehensive program (ex, education, twice weekly, supervised,
  - Improvements in exercise capacity, QOL
  - Practical considerations

Puhan et al 2015, Lacasse et al 2009, Cochrane Database SR
Environment for PR

- Hospital outpatient

- Community outpatient program
  - Superior outcomes in hospital-based program but still clinically significant
  - McCarthy et al, Cochrane Database SR 2015

- Home-based rehabilitation
  - Equivalent benefits in exercise capacity and QOL
  - Holland et al, Thorax 2016
Other Respiratory conditions
Bronchiectasis: exercise capacity

- ISWD: after 8 weeks of training

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Experimental Mean [m]</th>
<th>SD [m]</th>
<th>Total</th>
<th>Control Mean [m]</th>
<th>SD [m]</th>
<th>Total</th>
<th>Weight</th>
<th>Mean Difference IV, Fixed, 95% CI [m]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lee 2014</td>
<td>62</td>
<td>68</td>
<td>37</td>
<td>2</td>
<td>64</td>
<td>39</td>
<td>25.7%</td>
<td>60.00 [30.28, 89.72]</td>
</tr>
<tr>
<td>Mandal 2012</td>
<td>56.7</td>
<td>31</td>
<td>12</td>
<td>-4.7</td>
<td>16.6</td>
<td>15</td>
<td>60.0%</td>
<td>61.40 [41.95, 80.85]</td>
</tr>
<tr>
<td>Newall 2008</td>
<td>96.7</td>
<td>51.7</td>
<td>10</td>
<td>11</td>
<td>36.3</td>
<td>9</td>
<td>14.3%</td>
<td>85.70 [45.84, 125.56]</td>
</tr>
</tbody>
</table>

Total (95% CI) 59

Heterogeneity: Chi² = 1.27, df = 2 (P = 0.53); I² = 0%
Test for overall effect: Z = 8.39 (P < 0.00001)

- Effect size: 0.41 – 0.77
- Clinically significant: MCID of 35 to 37m,¹ (47.5m in COPD)²

¹Lee et al, Arch Phys Med Rehabil 2016, ²Singh, Thorax 2008
Bronchiectasis: HRQOL

- SGRQ: after 8 weeks of training

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Experimental Mean [points]</th>
<th>SD [points]</th>
<th>Total</th>
<th>Control Mean [points]</th>
<th>SD [points]</th>
<th>Total</th>
<th>Weight</th>
<th>Mean Difference IV, Fixed, 95% CI [points]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lee 2014</td>
<td>-3.1</td>
<td>4.6</td>
<td>32</td>
<td>0.7</td>
<td>5.4</td>
<td>32</td>
<td>69.7%</td>
<td>-3.80 [-6.26, -1.34]</td>
</tr>
<tr>
<td>Mandai 2012</td>
<td>-8</td>
<td>5.7</td>
<td>12</td>
<td>-1.4</td>
<td>3.7</td>
<td>15</td>
<td>30.3%</td>
<td>-6.60 [-10.33, -2.87]</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td></td>
<td></td>
<td>44</td>
<td>47</td>
<td>100.0%</td>
<td></td>
<td></td>
<td>-4.85 [-6.70, -2.60]</td>
</tr>
</tbody>
</table>

Heterogeneity: Chi² = 1.51, df = 1 (P = 0.22); I² = 34%
Test for overall effect: Z = 4.44 (P < 0.00001)

- Effect size: 0.35 - 0.56
- Clinically significant: MCID = 4 units

¹Jones et al, *COPD* 2005
Bronchiectasis: cough-related QOL

- LCQ: after 8 weeks of training

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Experimental Mean [points]</th>
<th>SD [points]</th>
<th>Total</th>
<th>Control Mean [points]</th>
<th>SD [points]</th>
<th>Total</th>
<th>Weight</th>
<th>Mean Difference IV, Fixed, 95% CI [points]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lee 2014</td>
<td>0.2</td>
<td>2.9</td>
<td>37</td>
<td>0</td>
<td>3.1</td>
<td>39</td>
<td>56.6%</td>
<td>0.20 [-1.15, 1.55]</td>
</tr>
<tr>
<td>Mandal 2012</td>
<td>2.6</td>
<td>2.7</td>
<td>12</td>
<td>0.2</td>
<td>0.4</td>
<td>15</td>
<td>43.4%</td>
<td>2.40 [0.88, 3.94]</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td></td>
<td></td>
<td>49</td>
<td>54</td>
<td></td>
<td>100.0%</td>
<td>1.15 [0.14, 2.17]</td>
<td></td>
</tr>
</tbody>
</table>

Heterogeneity: Chi² = 4.43, df = 1 (P = 0.04); I² = 77%
Test for overall effect: Z = 2.23 (P = 0.03)

- Effect size: 0.03 – 0.52
- Not clinically significant: MCID = 1.3 units

¹Raj et al, *Handb Exp Pharmacol* 2009
Bronchiectasis: considerations

• Similar exercise prescription as COPD
• Consider ACT options prior to / during PR\textsuperscript{1,2}

• Degree of peripheral muscle change and ventilatory limitation?
• Is education important?

\textsuperscript{1}Pasteur et al, \textit{Thorax} 2010, \textsuperscript{2}Chang et al, \textit{Med J Aust} 2015
Interstitial lung disease: Evidence

- Significant improvement in exercise capacity, symptoms & PA
- Moderate effects size for all outcomes

Dowman et al, *Cochrane Database* 2015, Gaunaurd et al, *Respir Care* 2014
Idiopathic pulmonary fibrosis: Evidence

- Significant improvement in exercise capacity, symptoms & PA
- Moderate effect size for all outcomes

Dowman et al, Cochrane Database 2015, Gaunaurd et al, Respir Care 2014
Optimal timing of PR in ILD

Best response in more severely impaired

Best response in less impaired
Holland et al, *Thorax* 2008

$r = 0.49, p = 0.02$
ILD: considerations

- Exercise induced hypoxaemia (larger than COPD)
- Pulmonary hypertension: induced by exercise
  - In Trials: no adverse events
- Monitor SpO₂ (finger vs forehead)
- Supplemental oxygen therapy during training
- Provided for intolerable symptoms¹,²
  - If meet criteria for ambulatory O₂: use in training

ILD: considerations

- Arthropathy – joint pain and limitations
- Minimise weight-bearing exercise, avoid exercises aggravating pain
  - Weightless activities – pool activity
- Education component\(^1\)
- Patients are clear about what they want to know
  - Prognosis, end of life planning, managing cough, managing, medications and side effects, limiting disease progression

\(^1\)Holland et al, *Chronic Resp Dis* 2014
Pulmonary Hypertension: exercise capacity

- 6MWD immediately after training\(^1\)

- Clinically significant (MID for PAH: 31 – 39m)\(^2,3\)

Pulmonary hypertension: other outcomes

- PAH with CTEPH (n=87)\(^1\)
- Significant ↑ peak VO\(_2\)/kg, CI, ↓ mean PAP, PVR
- Reduction in NYHA class\(^2\)
- Improvement in HRQOL\(^3-6\)

### Classification of disease

<table>
<thead>
<tr>
<th>Classification of disease</th>
<th>Number of participants</th>
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<tbody>
<tr>
<td>Idiopathic PAH</td>
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<td>Hereditary PAH</td>
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<tr>
<td>Congenital heart disease PAH</td>
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<tr>
<td>Connective tissue disease PAH</td>
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<td>Portal hypertension PAH</td>
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<tr>
<td>Drug induced PAH</td>
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<tr>
<td>Not identified</td>
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<td>Chronic thromboembolic PH</td>
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### NYHA Class

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<td>Class I</td>
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<td>Class II</td>
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<td>Class III</td>
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<td>Class IV</td>
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</tbody>
</table>

### Mean PAP (mmHg)

| Mean PAP (mmHg) | 47 – 49mmHg |

### Baseline 6MWD (m)

| Baseline 6MWD (m) | 401 – 408m |
Pulmonary hypertension: considerations

• Lack of adverse effects during exercise training

• Those with syncopal episodes, chest pain and cardiac arrhythmias
  • Exercise considered a contraindication

• Use of diuretics
  • Exercise may exacerbate intravascular volume depletion, lead to exertional or orthostatic pre-syncope
Asthma: Evidence

• Fear of triggering symptoms and avoidance of exercise

• Trials:
  • Improvement in symptoms and OL and maximal strength

• Additional skills:
  • Self management skills in asthma control, written action plan, self monitoring

Turner et al, *Respiration* 2011
Lung Cancer: Evidence

- Non-small cell carcinoma, post lung resection within 12 months
- Training commenced post resection or within 3-4 weeks, 12 weeks as outpatient

Cavalheri et al, Cochrane Database SR 2013
Figure 5. Forest plot of comparison: 1 Exercise group versus control group, outcome: 1.2 Health-related quality of life.

Cavalheri et al, Cochrane Database SR 2013
Summary

• Pulmonary rehabilitation is an essential component of management for COPD

• Level 1 evidence for improvement in exercise capacity, strength, symptoms, QOL

• Mix of exercise and education, including exercise at home

• Common environment: outpatient hospital/community

• Effective for other disease groups – should be referred