Optimising Exercise Routines in People with Chronic Respiratory Disease

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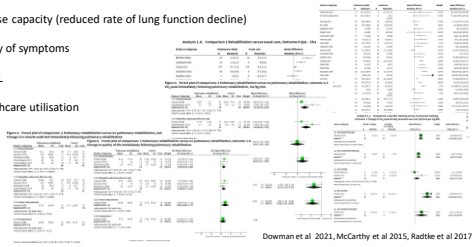
Exercise training

Exercise training is important in the management of people with chronic respiratory conditions:

- Increase exercise capacity (reduced rate of lung function decline)
- Reduce severity of symptoms
- Improve HRQoL
- Mitigates healthcare utilisation



Dowman et al 2021, McCarthy et al 2015, Radtke et al 2017

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Exercise training

Load/effort during exercise > load/effort during daily life

Generally similar exercise principals to the healthy population – **overload principal**

Higher intensity exercise > lower intensity exercise

Armstrong et al 2019, Garber et al 2011

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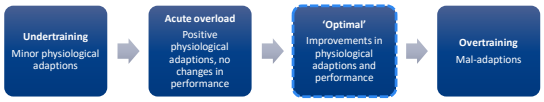

What ***type*** of exercise in which ***patient*** and ***when***?

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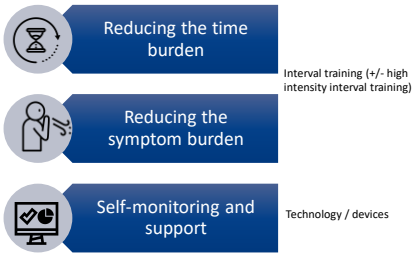

Owen et al 2016, Calthorpe et al 2020

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Interval training

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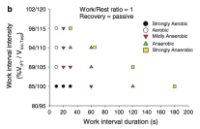
Interval training

Benefits from 2 weeks

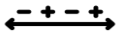
Repeated cycles of 'work' interrupted by 'rest'

- Wingate test (30 sec sprint, 4 min recovery)
- Short (<45 sec) to long (2 to 4 min)
- 5 to ~45 mins (all inclusive)



Useful for people with chronic respiratory disease

- Reduced work of breathing and muscle fatigue
- Opportunity to maximise training intensity and prolonged exposure of peripheral muscles prior to engaging anaerobic metabolism



Buchheit et al 2013, Burgomaster et al 2005, Gibala et al 2006 & 2012, Vogiatzis et al 2002

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To synthesise the data that have reported the effects of land-based (walking, cycling etc.) high intensity interval training (HIIT) on exercise capacity in adults living with chronic respiratory conditions

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COPD (RCTs)

HIIT vs. no exercise

- 2 studies
- Embedded within a pulmonary rehabilitation program

HIIT vs. moderate intensity continuous exercise

- 2 previous systematic reviews
- 10 studies

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Table 1 Description of high intensity interval training compared to continuous exercise training studies in people with chronic obstructive pulmonary disease

	Study	Type of exercise and population	Interval exercise	Continuous exercise	Frequency
Previous review	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Additional studies	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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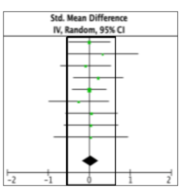
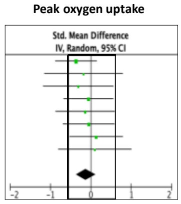
COPD

Maximal work rate



Peak oxygen uptake



Beauchamp 2010, Sawyer 2020

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Cystic fibrosis

n = 1 RCT (HIIT vs. no exercise)

Non

Inter

Asth

Lung cancer

n = 0 RCT (HIIT vs. continuous)

Table 2 Training modalities for patients with different chronic respiratory disease entities

	COPD	Cystic fibrosis	Pulmonary hypertension	ILD	Asthma
Modality	Aerobic (continuous or interval) and resistance	Aerobic or anaerobic or a combination of both	Aerobic (interval) and peripheral muscle training	Aerobic and resistance training	Aerobic conditioning using treadmill/bicycle ergometer or swimming
Intensity	60–80% of Peak work capacity for continuous exercise and 100–120% of peak work capacity for interval exercise	55–65% Maximum heart rate	<120 bpm, SpO_2 > 85% and Borg score < 5/10	60–80% of Peak work capacity for continuous exercise	50–75% VO_2 max aerobic exercise
Length	8–12 weeks	Minimum of 6 weeks	6–8 weeks	8–12 weeks	8–12 weeks
Duration	20–60 min	20–30 min	30–60 min	20–60 min	30–40 min
Frequency	3–5 days per week	3–5 days per week	2–3 Supervised exercise	3–5 days per week	2–3 Sessions per week
Outcomes	Improvements in exercise capacity, strength and QoL	Improvements in exercise capacity, strength and QoL; slower rate of decline in lung function	Improved exercise endurance, QoL, peak VO_2, increased peak workload and increased peripheral muscle function	Improved 6MWD, dyspnoea and QoL	Improved physical fitness, asthma symptoms, anxiety, depression and QoL

Indicative content of training modalities commonly implemented in patients with lung disease as part of pulmonary rehabilitation. 6MWD, 6-min walk distance; bpm, beats per minute; COPD, chronic obstructive pulmonary disease; ILD, interstitial lung disease; QoL, quality of life; SpO_2, peripheral capillary oxygen saturation; VO_2, oxygen uptake.

Armstrong & Vogiatzis 2019, Beauchamp et al 2010, Sawyer et al 2020

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(ANZCTR: 12617001271392)

Cystic fibrosis

Single-blinded randomised controlled trial

- ≥ 15 years
- BMI > 16 kg/m²
- Stable respiratory disease
- Not already undertaking a supervised exercise program >2/7
- No contraindications to undertaking a maximal cycle ergometry test

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RCT

Cycling-based HIIT

2 to 3 times per week for 8 weeks

60% W_{max} (week 1) → 80% W_{max} (week 2)→ symptom-based

2 min warm up → 6 x 30 s work 30 s rest → 2 min cool down

10 minutes

1: Maximal incremental

2: Constant work rate

Breath-by-breath analysis, ECG, BP, SpO_2 and symptoms

Primary outcome: Time to symptom limitation (T_{lim})

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Results

Attendance: 93% [83, 95]

Completion: 100% [100, 100]

Mild, single occasion post-exercise soreness (n = 4)

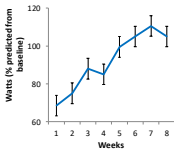
No adverse events

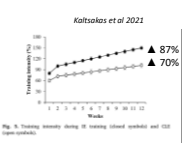
Improved physical function (self-reported)

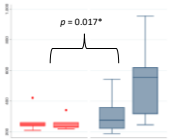
End-exercise

Control

HIIT







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CF

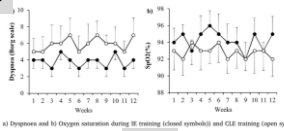
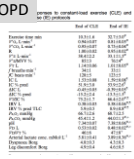


Fig. 4. a) Dyspnoea and b) Oxygen saturation during IE training (closed symbols)) and CLE training (open symbols)

ILD

COPD



↓ ventilation requirements
↓ dynamic hyperinflation
↓ lactate concentration

Kaltsakas et al 2021, Vogiatzis et al 2004, Wickerson et al 2019

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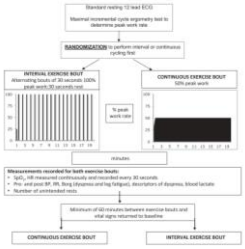

ILD

More unintended breaks during continuous exercise due to dyspnea (no breaks during interval exercise)

Greater leg fatigue with continuous exercise – 78%

Greater dyspnea with continuous exercise – 67%

Preference for interval exercise – 89%

Wickerson et al 2019

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ORIGINAL ARTICLE

Short-Term Preoperative High-Intensity Interval Training in Patients Awaiting Lung Cancer Surgery: A Randomized Controlled Trial

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Lower post-op pulmonary complications in the HIIT group compared to usual care 23% versus 44%

Lower atelectasis 12% versus 36%

Shorter high-dependency stay post-op

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Symptoms

↑

Matched-work
versus
Low volume

↓

Efficiency

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Self-monitoring and support

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How can we incorporate technology?

Wootton S et al 2018 *Respirol*
Steele BG et al 2008 *Arch Phys Med Rehabil*
Nguyen HQ et al 2009 *Int J Chron Obstruct Pulmon Dis*

Zanaboni P et al 2013 Telemed Telecare
Vasilopoulou M et al 2009 ERJ
'Beam-CF'

Monitor / record: Symptoms, activity, respiratory function, observations (SpO_2/HR) etc.

Bourne 2017, Chaplin 2017, Hang 2019, Spencer 2019

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Willingness to use technology

Theme	Example statements
Technically not possible	• *I don't understand how to operate computers* (Female, 85 yrs) • *No internet at home* (Female, 55 yrs) • *Too complicated for me* (Male, 72 yrs)
Preference for group exercise class	• *I would need the motivation to attend a class; if left to own devices I would probably procrastinate* (Female, 75 yrs) • *I enjoy being part of the group and like to mix with people* (Female, 85 yrs)
Prefer physical interaction with therapist	• *I prefer 'in-person' contact with physio* (Female, 77 yrs) • *Can't replace experts* (Male, 80 yrs)
Convenience	• *Convenient – time, location, flexibility* (Male, 64 yrs) • *Avoid transport inconvenience* (Male, 84 yrs)
Enhance therapy	• *Seems a useful way of having regular supervised exercise* (Male, 84 yrs) • *Direction/guidance for continued exercise after rehab* (Female, 64 yrs) • *Good if can't come to class* (Female, 64 yrs)
Desire to use technology	• *I can definitely use Skype to participate* (Male, 72 yr) • *I enjoy using technology* (Female, 67 yrs)

Seidman 2017

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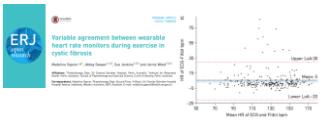
Considerations for self-monitoring



Poor peripheral circulation

Clubbing – fingers

Misuse

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Conclusions

Individualised

- A personalised and comprehensive approach → aiming to reduce patient barriers and emphasise enablers to exercise
- Interval training can **reduce symptoms** and **reduce time burden** of exercise
- Other forms of exercise training: resistance/strength, upper limb, flexibility, water-based, tai chi, yoga, whole-body vibration - outside of today's scope
- Smart watches, apps, web-based platforms can optimise access to exercise routines → ongoing robust evidence required, no evidence not to use
- Challenges – accuracy of self-recording, evidence-based practice, growth of development can overtake ability to undertake trials in a timely manner

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