OFFICIAL-I2-A1

Exercise vs airway clearance techniques

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with world-class care and world-class research

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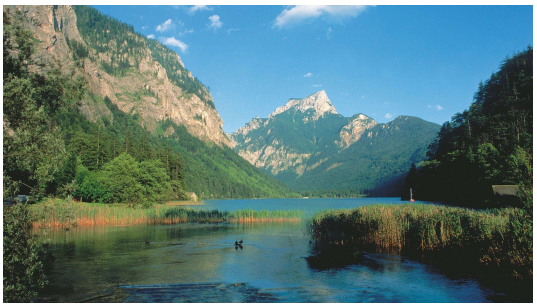
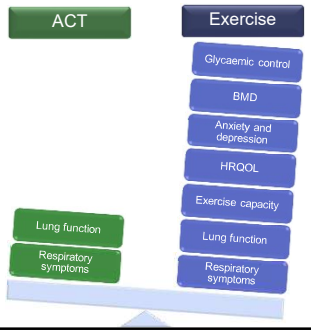


Zach et al, Arch Dis Childhood 1982; 57:587-589
Andreasson et al, Acta Pediatr Scand 1987; 76:70-75

2

Proposed benefits



Ward et al, Exp Rev Resp Med, 2019; 13: 449-458.
Warnock & Gates, Cochrane Database of systematic Rev 2015, Issue 12: CD001401.
Wilson et al , Cochrane Database of systematic Rev 2019, Issue 1: CD011231

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Reducing treatment burden

4

Adherence

O'Donohoe & Fullen, Respir Care 2014; 59: 1731-1746

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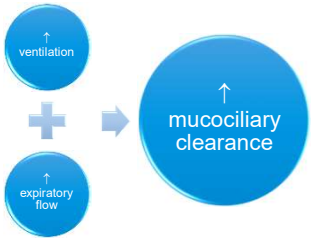
Mechanisms of increased secretion clearance



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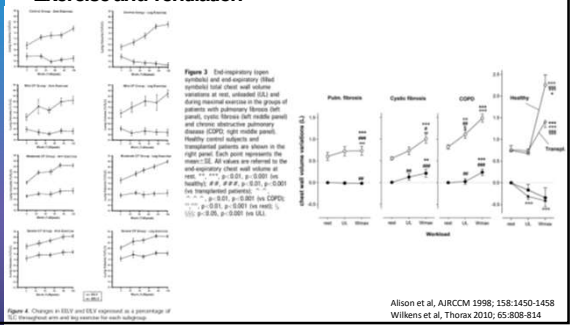
Exercise and ventilation



Alison et al, AJRCCM 1998; 158:1450-1458
Wilkens et al, Thorax 2010; 65:808-814

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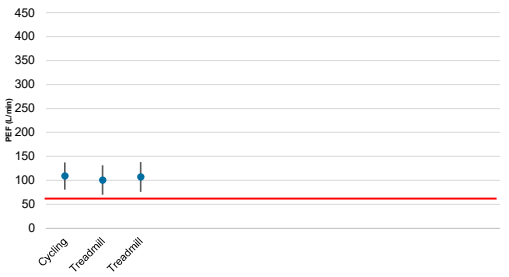
Peak expiratory flow



Data are mean (SD). Dwyer et al, Chest. 2011;139(4):870-7. Dwyer et al, BMC Pulm Med. 2017;17:14. McCarren and Alison, Eur Respir J. 2006;27:1204-9. McIlwaine et al, J Cyst Fibros. 2014;13(suppl 2):S29. O'Sullivan et al, Respir Care. 2019;64(4):398-405

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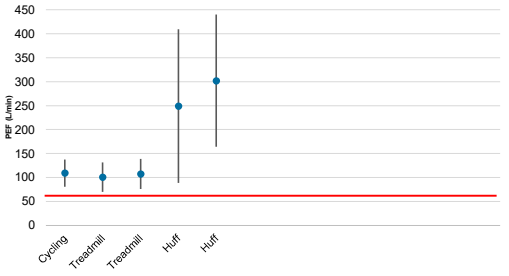
Peak expiratory flow



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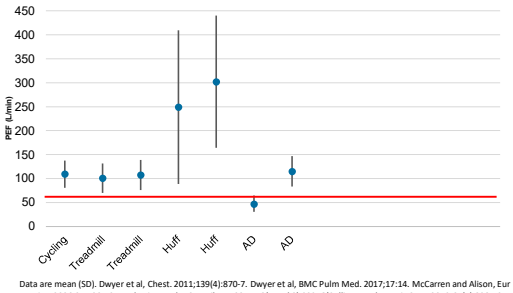
Peak expiratory flow



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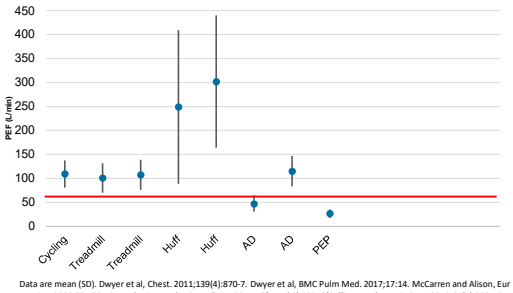
Peak expiratory flow



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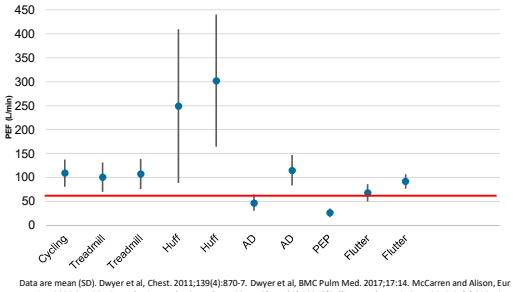
Peak expiratory flow



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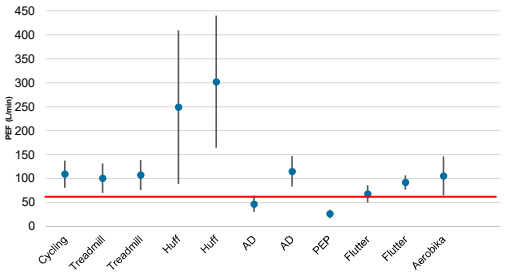
Peak expiratory flow



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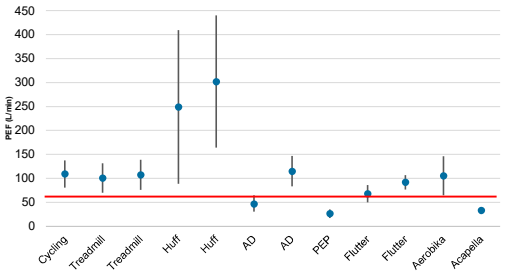
Peak expiratory flow



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PEF bias

Intervention	n	PEFR (L/min)	PEFR:PIFR
Cycling	14	109.2 ± 28.2	0.93 ± 0.08
Treadmill	14	107.4 ± 31.2	0.92 ± 0.11
	24	100.8 ± 30.6	0.90 ± 0.10
Huff	17	302 ± 138	2.80
	14	249 ± 160	-
AD	14	47.7 ± 17 to 115 ± 31.7	-
PEP	18	26.4 ± 9	0.47
Flutter®	24	91.8 ± 15	1.13 ± 0.37
	17	67.8 ± 18	1.15
Aerobika®	21	105.2 ± 40.8	-
Acapella	18	35.4 ± 4.8	0.64

Dwyer et al, Chest. 2011;139(4):870-7. Dwyer et al, BMC Pulm Med. 2017;17:14. McCarren and Alison, Eur Respir J. 2006;27:1204-9. McIlwaine et al, J Cyst Fibros. 2014;13(suppl 2):S29. O'Sullivan et al, Respir Care. 2019;64(4):398-405

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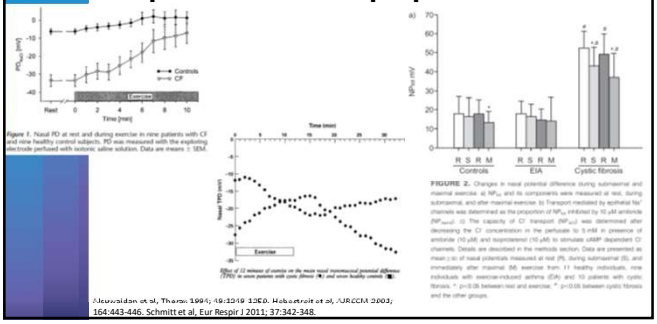
Improved secretion properties



Nouvaldon et al, Thorax 1994; 49:1249-1250. Hebestreit et al, AJRCCM 2003; 164:443-446. Schmitt et al, Eur Respir J 2011; 37:342-348.

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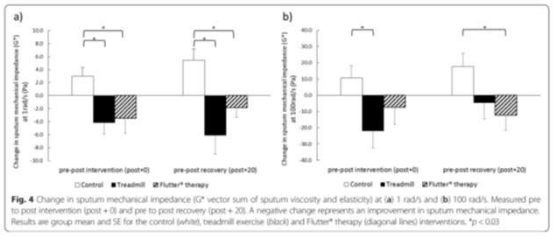
Improved secretion properties



Dwyer et al, Pulm Med 2017; 17:14

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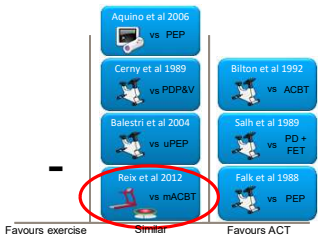
Sputum weight



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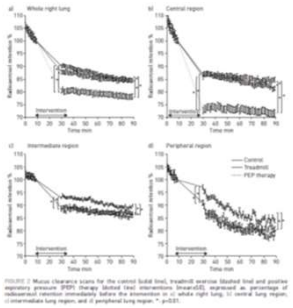
Mucociliary clearance



Dwyer et al, ERJ 2019; 53: 1801793

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Mucociliary clearance

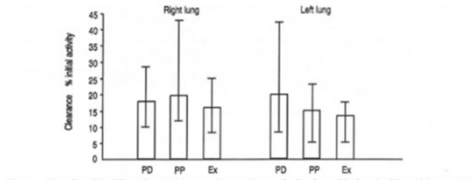

Fig. 1. – Mean effect of the different chest physiotherapy regimes on clearance of radioactive particles from the right and left lungs. The verticle lines represent range. PD: postural drainage with thoracic expansion exercises + forced expiration technique (FET); PP: positive expiratory pressure (PEP) + FET; Ex: physical exercise + FET.

Lannefors et al, ERJ 1992; 5: 748-753

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COPD

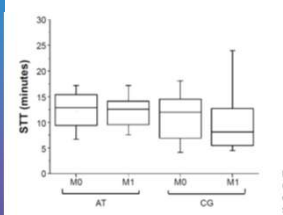

Figure 3 Box plot of saccharin transit time (STT) test of the aerobic training group (AT) and the no-training control group (CG), observed at baseline (M0) and after 12 weeks (M1).

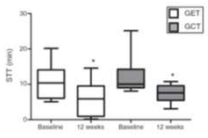

Figure 2 Comparison of the mucociliary transportability values before and after resistance training of 12 weeks. Data expressed as mean and standard deviation. STT: saccharin transit time; GET: training with elastic tubings; GCT: training with weight training equipment; *: significant difference between initial and final evaluation ($p = 0.03$).

Leite et al, Int J Chron Obstruct Pulmon Dis 2015; 10:2549-2557. Silva et al, Pulmonology 2019; 25:340-347

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Non-CF Bronchiectasis

- Limited data
- PR vs usual care
- Bronchiectasis n=30 (+30 healthy controls)
- 12 weeks of PR
- Outcomes
  - Saccherin transport time
  - Mucus adhesiveness and transport rate
  - Nasal lavage fluid
  - Exhaled breath condesate
  - Nasal fractional exhaled nitric oxide
  - PFTs and IOS
  - HRQOL


Medicine

Effects of exercise on secretion transport, inflammation, and quality of life in patients with noncystic fibrosis bronchiectasis
Protocol for a randomized controlled trial

Dos Santos et al, Med 2018; 97:7

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Respiratory symptom benefits

Table 2
Participant-reported respiratory symptom benefits from performing airway clearance techniques and exercise over the preceding 3 months.

Reported benefits	Airway clearance techniques (n = 691)	Exercise (n = 682)
Identified respiratory symptom benefits, n yes (%)		
yes	574 (83)	533 (78)
no	73 (11)	130 (19)
not applicable	44 (6)	19 (3)
Symptom benefits, n (%)		
less coughing	318 (46)	272 (40)
less chest congestion	405 (59)	355 (52)
less likely to cough up sputum	227 (33)	170 (25)
less short of breath	223 (32)	223 (33)
less chest pain	61 (9)	74 (11)
less chest tightness	211 (31)	212 (31)
less wheeze	178 (26)	136 (20)
other	26 (4)	60 (9)
Time to onset, n (%)		
within a few minutes of starting	89 (13)	66 (10)
by end of treatment	224 (32)	189 (28)
within 30 minutes of finishing	157 (23)	143 (21)
> 30 minutes after finishing	61 (9)	80 (12)
other	13 (2)	13 (2)
unsure	13 (2)	23 (3)
Duration of benefits, n (%)		
< 30 minutes	10 (1)	6 (1)
30 to 59 minutes	16 (2)	21 (3)
1 to 2 hours	74 (11)	71 (10)
3 to 12 hours	263 (38)	201 (29)
> 12 hours	87 (13)	127 (19)
unsure	103 (15)	95 (14)

Ward et al, J Physiother 2019; 65: 43-50.

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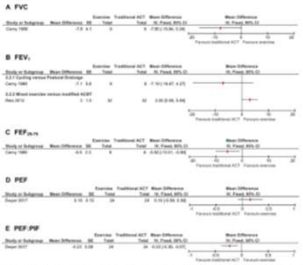
PFTs



Ward et al, Thorax 2020, epub ahead of print

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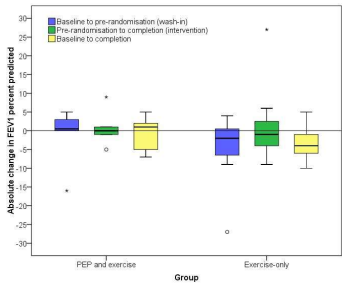
Long-term evidence



Ward et al, Resp Med 2018; 142: 23-28

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The present and the future

Ivacaftor

Ivacaftor/lumacaftor

Ivacaftor/tezacaftor

IVACAFTOR/TEZACAFTOR /ELEXACAFTOR

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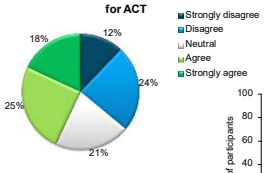
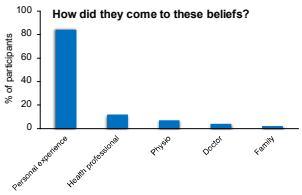
Beliefs of adults with CF

Believe that exercise can be used as a substitute for ACT



44-48% had used exercise as an alternative

How did they come to these beliefs?



Rowbotham et al, J Cyst Fibros 2020: e19-e24; Ward et al, J Physiother 2019; 65: 43-50.

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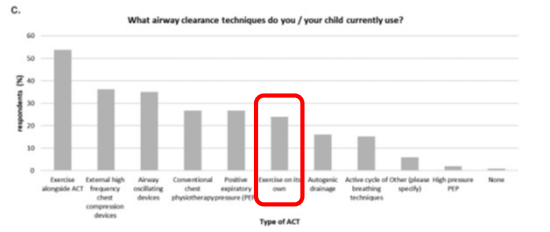
Current practice



Rowbotham et al, J Cyst Fibros 2020: e19-e24

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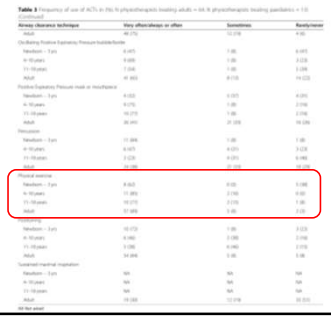
Current practice



Phillips et al, Physiother Theor Prac 2021; 11:3

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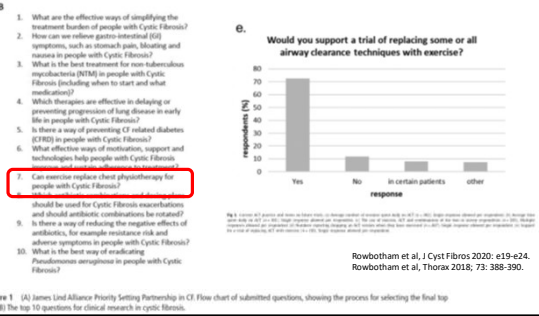
We need the trials



Rowbotham et al, J Cyst Fibros 2020: e19-e24.
Rowbotham et al, Thorax 2018; 73: 388-390.

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Recommendations for clinical practice

- Exercise as an adjunct to ACT
- Individualised basis -> informed decision
  - Stability
    - PFTs
    - Exacerbations
  - Symptoms
    - Cough
    - Chest congestion
    - Sputum load
  - Adherence
- Intensity matters
- Not all forms of exercise are equal
- Must incorporate huffing/FET
- Need to consider:
  - Non-exercise days
  - Exacerbations

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In summary

- Rationale exists for using exercise as a standalone form of airway clearance
  - Expiratory flow
  - Mucus properties
- We need the longer terms trials
  - equipoise
  - patient support
  - clinician support

- Interested in being part of a multi-centre trial:
  - nathan.ward2@sa.gov.au
  - anne.holland@monash.edu

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Government of South Australia

SA Health

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