Efficacy of unsupervised exercise in adults with obstructive lung disease: a systematic review and meta-analysis

Daniel Taylor[1#], Alex R. Jenkins[2#], Kate Parrott[3], Alex Benham[4], Samantha Targett[5] and Arwel W. Jones[6#]

[1]School of Sport and Exercise Science, University of Lincoln, UK.

[2]Division of Respiratory Medicine, University of Nottingham, UK.

[3]Physiotherapy Department, Lincoln County Hospital, UK.

[4]School of Human and Health Sciences, University of Huddersfield, UK.

[5]School of Health and Social Care, University of Lincoln, UK.

[6]Department of Allergy, Immunology and Respiratory Medicine, Monash University, Melbourne, Australia.

[#]Authors contributed equally and should be considered co-first authors

Supplementary material

Table S1. Example search strategy of a bibliographic database (CINAHL)

No.	Search Term	Field
1	Lung Diseases, Obstructive	MH
2	Bronchiectasis	MH
3	bronchiect*	TX
4	bronchoect*	TX
5	non$cystic fibrosis	TX
6	non$CF	TX
7	Asthma	MH, TX
8	Bronchoconstriction	MH
9	Bronchial Spasm	MH
10	Respiratory Hypersensitivity	MH
11	Bronchitis, Chronic	MH
12	Emphysema	MH, TX
13	chronic N3 bronchi*	TX
14	COPD	TX
15	COAD	TX
16	COBD	TX
17	AECB	TX
18	AECOPD	TX
19	1 OR 2 OR 3 OR 4 OR 5 OR 6 OR 7 OR 8 OR 9 OR 10 OR 11 OR 12 OR 13 OR 14 OR 15 OR 16 OR 17 OR 18	
20	Exercise	MH
21	Therapeutic Exercise	MH
22	Exertion	MH
23	Physical Fitness	MH
24	Activities of Daily Living	MH
25	Telerehabilitation	MH
26	Exerc* N4 (train* OR fitness OR physi* OR condition* OR strength* OR resist* OR aerobic* OR intervent* OR therap* OR unsupervi* OR program*)	TI, AB
27	Self$manage*	TI, AB
28	physical activit*	TI, AB
29	Rehabilitat*	TI, AB
30	Home$rehab*	TI, AB
31	Home$based	TI, AB
32	Home N4 based	TI, AB
33	20 OR 21 OR 22 OR 23 OR 24 OR 25 OR 26 OR 27 OR 28 OR 29 OR 30 OR 31 OR 32	
34	Clinical trials	MH
35	Randomised Controlled Trials	MH
36	Random assignment	MH
37	Randomised OR randomized	TI, AB
38	Randomly	TI, AB
39	Trial	TI, AB
40	allocated N2 random*	TI, AB
41	34 OR 35 OR 36 OR 37 OR 38 OR 39 OR 40	
42	19 AND 33 AND 41	

Notes: *Truncation operator.

Table S2. List of extracted data and study characteristics

Data extraction	
Study details	- Date of study - Title - Author - Study aim(s) - Total study duration
Methods	- Study design - Intervention - Primary outcome(s) - Secondary outcome(s)
Participants	- Population demographics (age, gender, diagnosis/condition, disease severity, comorbidities) - Inclusion/Exclusion criteria - Total number randomised and randomisation ratio
Intervention/Comparators	- Number randomised to groups - Description of intervention and comparator (setting, method of delivery/support, content, frequency, intensity, time, type, duration) - Details of any 'run-in' session
Outcomes	- Outcome name and definition - Outcome type - Method of outcome measurement and reporting - Missing data and reasoning

Table S3. Characteristics of all included studies

Study (Country)	Sample size, Gender, Age	Inclusion/ Exclusion criteria	Respiratory diagnosis & disease characteristics	Study aim, Design, Unit of allocation	Exercise intervention (setting, components, duration, frequency)	Primary outcome (1) Other outcomes & follow up (2)
Booker, 1984 (1) (UK)	103 participants* Ex: n=32 Con: n=37 Phys: n=34 Age & Gender data not available	Not reported	COPD Disease characteristics not reported	To investigate the effects of progressive exercise training and physiotherapy on patients which Chronic Airflow limitation and to see if these effects were maintained once hospital visits had ceased. RCT, individual	Daily stair climbing intervention with progressive targets for 9-weeks. Study included 3-, 6- & 12-month follow-ups. F: 1-2 times daily I: Not reported T: 2-15 mins T: Aerobic & Strength Run-in: N/A Support: Teaching of breathing control. Con: Usual care	(1) Lung function, blood gases, 6MWT (2) Anxiety & Depression, ADL
Bourbeau et al., 2003 (2) (Canada)	191 participants Int: n=96 Con: n=95 Males: n=106 Females: n=85 Age, mean ± SD Int: 70±7 Con: 69±7	Inclusion: Stable COPD, ≥ 50 years of age, current or previous smoker (≥10 pack-years), FEV_1 between 25%-70% of predicted & FEV_1/FVC < 70%, no previous diagnosis of asthma, left congestive heart failure, terminal disease, dementia, or uncontrolled psychiatric illness, no participation in a respiratory rehabilitation program in the past year, no long-term-care facility stays.	COPD Stable, moderate-severe	To evaluate the impact of a self-management program on the use of hospital services and health status. RCT, individual	Home-based exercise intervention for 1 year. Study included 4-month follow-up. F: 3 days/week I: Guided by Borg score T: 30-45 min T: Aerobic & Strength Run-in: Supervised session at home Support: Living Well with COPD booklet (supervised education component). Monthly telephone calls. Con: Same level of care without add-on management program	(1) Hospital admission (2) Exacerbations, healthcare utilisation, mortality, SGRQ, lung function, 6MWT
Boyd et al., 2012 (3) (USA)	16 participants Int: n=8 Con: n=8 Males: n=1 Females: n=15 Age, mean (range) Int: 53 (38-62) Con: 54 (33-78)	Inclusion: Asthma diagnosis, patients undertaking aerobic exercise ≥3 times a week 6-months prior to study enrolment. Exclusion: Reversible airflow obstruction was utilized to exclude patients with other causes of dyspnoea, current smokers (within 6-months) or with >10 pack-year smoking history, coronary artery disease, congestive heart failure, stroke, severe hypertension, immunodeficiency states, or other conditions that would have interfered with participation, unable or unwilling to provide consent, unable to	Asthma Mild-moderate	To determine feasibility for a larger, future study that will define the effect of moderate intensity aerobic exercise on cellular, molecular, and functional measures in adults with mild-moderate severity asthma. RCT, individual	Community centre walking program for 12-weeks. F: 3 days/week I: Steady state intensity that achieved 60-75% HRmax T: 40 min T: Aerobic Run-in: N/A Support: 3-month gym membership. Education component included. Con: Education only	(1) Serum ECP (2) ACQ, inflammatory markers, lung function, VO_2 peak

		perform the exercise protocol or provide pre- and post-study measurements or be contacted via telephone or who intended to move out of the area within 6-months.				
Cameron-Tucker et al., 2016 (4) (Australia)	65 participants Int: n=35 Con: n=30 Males: n=29 Females: n=36 Age, mean ± SD Int: 68±9.9 Con: 70±6.8	Inclusion: >18 years of age, COPD diagnosis, >2 months post exacerbation. Exclusion: Cognitive impairment, unable to consent, could not complete questionnaires, did not meet safety to exercise criteria, had attended PR in the previous 2 years.	COPD Stable, mild-very severe	To evaluate the effectiveness of tele-rehab followed by PR versus usual care, that is, a waiting period followed by the same PR. RCT, individual	Tele-rehab walking program for 8-weeks before supervised PR F: Daily I: Moderate T: 30min T: Aerobic Run-in: N/A Support: Weekly telephone calls. Con: Usual care	(1) 6MWT (2) CAT, SNAPPS
Chen et al., 2018 (5) (China)	47 participants Int: n=25 Con: n=22 Males: n=37 Females: n=10 Age, mean ± SD Int: 69±8 Con: 65±12	Inclusion: COPD diagnosis, voluntary participation and signed consent, spouse or child who supports the completion of the intervention and space time for the intervention, never attended PR. Exclusion: MSK or neurologic condition affecting exercise, symptomatic cardiac disease or previous lung surgery, AECOPD requiring change in medication within 2-months, mMRC score of 4.	COPD Stable, moderate-very severe	To evaluate the feasibility of home-based lower limb resistance training in COPD patients and assess the effect of the programme on muscle strength and functional status. RCT, individual	Home-based lower-limb exercise intervention for 12-weeks. Six exercises with 8-12 repetitions. F: 3 days/week I: Best effort, not exceeding Borg score of 5 T: 20-30 min T: Resistance Run-in: 1 study visit Support: Exercise supervised by family member Con: Usual care	(1) Muscle strength (2) FTSST, 6MWT, CAT
De Oliveira et al., 2010 (6) (Brazil)	62 participants Int: n=33 Con: n=29 Males: n=46 Females: n=16 Age, mean ± SD Int: 66±10 Con: 71±9	Inclusion: COPD diagnosis, clinically stable COPD for at least 8 weeks. Exclusion: Hospitalization, clinically unstable COPD, presence of neuromuscular disease, associated respiratory disease, orthopaedic or neurological disease that affected gait; recent impairment due to comorbidities.	COPD Stable, mild-severe	To carry out a comparative analysis of patients with COPD submitted to PR in a clinical setting and at home. RCT, individual	Home-based PR program for 12 weeks. Walking, upper and lower limb weight exercises (10 reps). F: 3 days/week I: 60-80% HRmax based on 6MWT (walking). Initial load of 50% of 1 rep max, increase of 0.5kg every 2-weeks until tolerance reached (weights) T: Not reported T: Aerobic & Strength Run-in: 1 study visit Support: Regular telephone calls to reinforce rehab and set new targets. Education also included. Con: Usual care	(1) 6MWT (2) BODE

Elci et al., 2008 (7) (Turkey)	78 participants Int: n=39 Con: n=39 Males: n=66 Females: n=12 Age, mean ± SD Int: 60±9 Con: 58±11	Inclusion: COPD diagnosis, absence of reversibility in lung function, absence of a diagnosis of any other respiratory disease such as tuberculosis or cancer, ability to understand the PR programme, residence within the Malatya city boundary, signing consent.	COPD GOLD stage I–IV	To assess the effectiveness of a short-term PR programme in stable COPD patients, when implemented by secondary-care community hospital nurses. RCT, individual	Home-based PR programme targeting lower (walking) and upper limbs (weights) with 24 sessions over 3 months. F: 2 days/week I: 75% of 6MWT speed (walking) T: 90 min T: Aerobic & Strength Run-in: 1 supervised session Support: Exercise supervised by family member and weekly telephone calls. Con: Usual care	(1) Lung function (2) SF-36, SGRQ, HADS, mMRC, 6MWT
Hernandez et al., 2000 (8) (Spain)	37 participants Int: n=20 Con: n=17 Gender not reported Age, mean ± SD Int: 64±8 Con: 63±7	Inclusion: Stable disease with optimal drug management, FEV_1 %pred <60%, ex-smoker. Exclusion: AECOPD during study, ischemic heart disease, severe or uncontrolled systemic arterial hypertension, alterations in the thoracic cage, neuromuscular disorders, intermittent claudication, osteoarticular lesions in the lower extremity that could affect normal ambulation.	COPD Stable, moderate	To investigate the effectiveness of a simple home-based program of exercise training of the muscles of ambulation, in which the training intensity was applied in standardized form, using the ISWT. RCT, individual	Home/outdoor-based walking exercise programme for 12 weeks. F: 6 days/week I: ≥70% of max speed of ISWT. T: 1 hour T: Aerobic Run-in: Home visit Support: 2-week reviews at hospital Con: Usual care & 2-week reviews at hospital	(1) Lung function (2) ISWT, VO_2 max, BDI/TDI, MRC, CRQ
Ho et al., 2012 (9) (Taiwan)	41 participants Int: n=20 Con: n=21 Males: n=39 Females: n=2 Age, mean ± SD Int: 73±11 Con: 75±10	Inclusion: COPD diagnosis and currently stable, no AECOPD within last month, do not use oxygen. Exclusion: Previous PR experience, GDS >10, cognitive deficits with SPMSQ <7, unstable heart disease, MSK disease, visual or hearing impairment, any other condition that could affect exercise participation.	COPD Stable FEV_1 %pred, mean ± SD Int: 61±19 Con: 61±26	To investigate the effects of paced walking to music at home with an 80% VO_2 peak for patients with COPD. RCT, individual	Home-based walking exercise programme paced to music for 12-weeks. F: 5 days/week I: 80% VO_2peak initially, increased gradually each month based on ISWT. T: 30 min T: Aerobic Run-in: 1 research visit Support: Monthly reviews and progression Con: Usual care	(1) ISWT (2) Lung function, SGRQ, healthcare utilisation
Jaakkola et al., 2019 (10) (Finland)	89 participants Int: n=44 Con: n=45 Males: n=19 Females: n=70 Age, mean ± SD Int: 40±14 Con: 33±11	Inclusion: 16-65 years of age, mild-moderate asthma diagnosis and/or to have received the reimbursement right for asthma medication in the case of newly diagnosed asthma. Exclusion: Severe asthma diagnosis (FEV_1 %pred <60% & PEF variability >30%), short-acting bronchodilator use >3 times daily and/or permanent daily oral steroid treatment, exercise	Asthma Mild-moderate	To test the hypothesis that regular exercise improves asthma control. RCT, individual	Home/outdoor-based exercise program (variety of exercises including sports) for 24 weeks. Study also included 12-week assessment. F: 3 days/week (aerobic), 2 days/week (strength) I: 70-80% HRmax T: 30 min T: Aerobic & Strength	(1) Asthma control (2) Exercise amount, muscle strength, 6MST, SGRQ

		>3 times a week, diagnosis of serious coronary heart disease, severe hypertension, severe heart failure, severe musculoskeletal disorder, dementia, and/or physician diagnosed chronic obstructive lung disease.			Run-in: 4-week phase to assess suitability and motivation Support: 12-week follow-up and reinforcement Con: Usual care	
Lahham et al., 2020 (11) (Australia)	58 participants Int: n=29 Con: n=29 Males: n=34 Females: n=24 Age, mean ± SD Int: 68±9 Con: 67±10	Inclusion: COPD diagnosis, ≥40 years of age, ≥10 pack-year smoking history, no hospitalizations or exacerbations 1 month prior to enrolment. Exclusion: Asthma diagnosis or co-morbidities that precluded exercise participation.	COPD Stable, mild	To test whether a home-based PR program would achieve significant improvements in exercise capacity in people with mild COPD compared to standard care. A secondary aim was to examine the impact of home-based rehabilitation on dyspnoea, health-related quality of life and physical activity levels. RCT, individual	Home-based aerobic (walking) and resistance (upper and lower limb) exercise training for 8 weeks with a 6-month follow-up. F: 5 days/week I: 80% of walking speed from 6MWT. Intensity gauged by Borg scale T: 30 min T: Aerobic & Resistance Run-in: Home visit Support: Weekly motivational interviewing. Better Living with COPD booklet Con: Usual care & weekly phone calls. Better Living with COPD booklet	(1) 6MWT (2) mMRC, CRQ, PAL
McGavin et al., 1977 (12) (UK)	24 participants Int: n=12 Con: n=12 Males: n=24 Females: n=0 Age, mean ± SD Int: 61±6 Con: 57±8	Inclusion: <70 years of age, male gender, chronic bronchitis diagnosis (MRC working party 1965 definitions), chest condition in a stable state. Exclusion: Reversible airway obstruction (↑30% FEV_1 post-bronchodilator), corticosteroid use, angina, intermittent claudication, disabling MSK conditions.	Chronic bronchitis Stable Disease characteristics not reported	To evaluate a training scheme which was simple to organise and which could be carried out by the patient unsupervised at home without recourse to hospital facilities. RCT, individual	Home-based stair climbing exercise program for 3 months F: 5 days/week I: Not reported T: 2-10 mins T: Aerobic & Strength Run-in: N/A Support: 2-week clinic follow-up and then monthly follow-ups thereafter Con: Usual care & monthly clinic check-up	(1) Lung function, blood gases, 12MWD, submaximal exercise capacity

Mitchell et al., 2014 (13) (UK)	184 participants Int: n=89 Con: n=95 Males: n=101 Females: n=83 Age, mean ± SD Int: 69±8 Con: 69±10	Inclusion: COPD diagnosis, mMRC dyspnoea grade 2-5, clinically stable for 4 weeks. Exclusion: Unable to undertake exercise due to neurological, musculoskeletal or cognitive comorbidities, unable to read English to the reading age of an 8-year-old, had completed PR within 12 months.	COPD Stable FEV_1 %pred, mean ± SD Int: 56±17 Con: 60±17	To establish the short- and medium-term effectiveness of SPACE FOR COPD on patient outcomes, compared with usual care alone. RCT, individual	Home-based manual incorporating education and exercise programme (walking, upper and lower limb resistance training using weights) for 6 weeks. Study also included 6-month follow-up. F: Daily (walking), 3 days/week (upper and lower limb training) I: Not reported T: 30 min/day (walking), not reported (upper and lower limb) T: Aerobic & Resistance Run-in: 1 study visit Support: Bi-weekly phone calls using motivational interviewing Con: Usual care	(1) CRQ (dyspnoea domain) (2) CRQ (fatigue, emotion, mastery domains), BCKQ, HADS, ISWT, ESWT, PRAISE, smoking status.
Moore et al., 2009 (14) (UK)	20 participants Int: n=10 Con: n=10 Males: n=10 Females: n=10 Age, median (IQR) Int: 70 (13) Con: 71 (58-79)	Inclusion: COPD diagnosis with FEV_1 %pred <60%, patients who had not previously attended PR and had access to a video or DVD player at home. Exclusion: Comorbidities that preclude safe exercise training.	COPD FEV_1 %pred, median (IQR) Int: 40 (37-49) Con: 42 (30-55)	To investigate whether a home exercise video programme could improve exercise tolerance and breathlessness in patients with moderate to severe COPD. RCT, individual	Home-based high intensity interval exercise video/DVD for 6 weeks. F: 4 days/week I: High intensity T: 30 min T: Aerobic & Resistance & Strength Run-in: 1 study visit Support: Education material Con: Usual care & education booklet	(1) ISWT (2) CRQ

Nguyen et al., 2013 (15) (USA)	125 participants* Int(1): n=43 Int(2): n=41 Con: n=41 Males: n=68 Females: n=57 Age, mean ± SD Int(1): 69±11 Int(2): 68±10 Con: 69±8	Inclusion: COPD diagnosis (classic criteria or FEV1/FVC <0.60 with FEV1>80% predicted or CT confirmed emphysema) & clinically stable for at least one month, activities limited by dyspnoea, use of the Internet, oxygen saturation >85% on room air on ≤6L/min of oxygen at the end of a 6MWT. Exclusion: Active symptomatic illness (e.g., cancer, heart failure), participated in PR <6-months ago, or currently participating in >2 days a week of supervised exercise.	COPD Stable, mild-very severe	To test the efficacy of two 12-month dyspnoea self-management programs, Internet-based and face-to-face, compared with a general health education control on the primary outcome of dyspnoea with activities. RCT, individual	Self-management program incorporating exercise intervention (online or face-to-face) for 12 months. Study included 3- & 6-month follow-ups. F: 4 days/week I: Gauged by Borg score T: 30 min T: Aerobic & Strength Run-in: Home visit Support: Bi-weekly reinforcement and feedback with motivational interviewing. Con: Usual care, bi-weekly phone calls & education	(1) CRQ (dyspnoea domain) (2) 6MWT, ITT, muscular endurance, CRQ (other domains), SF-36, self-efficacy
Pradella et al., 2015 (16) (Brazil)	44 participants Int: n=29 Con: n=15 Males: n=36 Females: n=8 Age, mean ± SD Int: 65±8 Con: 62±11	Inclusion: COPD diagnosis, 40-75 years of age, either gender, signed consent. Exclusion: PR participation within 12 months, regular physical activity ≥3 times a week in the past 12 months, other diseases which leads to exercise intolerance, exacerbations within past 4 weeks.	COPD Stable, mild-very severe	To develop an efficient, low-cost, home-based PR program. To evaluate the impact of the program on exercise as measured by the 6MWT and treadmill endurance test. To assess the effect on quality of life in subjects with COPD under partial supervision compared with a control group. RCT, individual	Home-based walking PR program for 24 sessions F: 3 days/week I: 60-70% HRmax T: 40 min T: Aerobic Run-in: 1-week run-in at rehab centre Support: Educational booklet & weekly phone call Con: Usual care & weekly phone call	(1) Lung function (2) 6MWT, SGRQ, lower-limb endurance test

*Contained 2 relevant intervention groups. AECOPD = acute exacerbation of chronic obstructive pulmonary disease, Int = Intervention group, Con = Control group, FEV_1 %pred = Forced expiratory volume in 1 second % of predicted, RCT = Randomised controlled trial, CRQ = Chronic respiratory disease questionnaire, PAL = Physical activity levels, NYHA = New York Heart Association, GOLD = Global initiative for chronic obstructive lung disease, FITT = Frequency, Intensity, Time, Type, N/A = Not applicable, 6MWT = 6 minute walk test, mMRC = Modified medical research council, PASE = Physical activity scale for the elderly, BARTHEL = Barthel index, CAT = COPD assessment tool, ADL = Activities of daily living, Ex = Exercise group, Phys = Exercise + physio group, SGRQ = St Georges respiratory questionnaire, FEV_1/FVC = Forced expiratory volume in 1 / forced vital capacity, ECP = Eosinophil cationic protein, ACQ = Asthma control questionnaire, HRmax = Maximum heart rate, PR = Pulmonary rehabilitation, SNAPPS = Smoking, nutrition, alcohol consumption, physical activity, psychological well-being, symptom management health behaviours, FTSST = 5 times sit to stand test, MSK = Musculoskeletal, BODE = Index for body mass index, airflow obstruction, dyspnoea and exercise, SF-36 = 36 item short form survey, HADS = Hospital anxiety and depression scale, LTOT = Long-term oxygen therapy, GLTEQ = Godin leisure time exercise questionnaire, ISWT = Incremental shuttle walk test, BDI/TDI = Baseline dyspnoea index / transition dyspnoea index, VO2max = maximal oxygen uptake, VO2peak = peak oxygen uptake, GDS = Geriatric depression scale, SPMSQ = Short portable mental status questionnaire, PEF = Peak expiratory flow, 6MST = 6 minute stepper test, 12MWD = 12 minute walk distance, BCKQ = Bristol COPD knowledge questionnaire, PRAISE = Pulmonary rehabilitation adapted index of self-efficacy, SPACE = Self-management programme of activity, coping and education, ESWT = Endurance shuttle walk test, IQR = Interquartile range, ITT = Incremental treadmill test.

Table S4. Risk of Bias Assessment

Study	Random sequence generation	Allocation concealment	Blind participants and personnel	Blind outcome assessment	Incomplete outcome data	Selective reporting (reporting bias)	Other bias	Overall risk
Booker 1984 (1)	Unclear	Unclear	High	Low	Unclear	High	Low	**High**
Bourbeau 2003 (2)	Low	Low	High	Low	Low	Low	Low	**Moderate**
Boyd 2012 (3)	Low	Low	High	Unclear	Low	Low	Low	**Moderate**
Cameron-Tucker 2016 (4)	Low	Low	High	Low	Low	High	Low	**High**
Chen 2018 (5)	Low	Unclear	High	Unclear	Low	Unclear	Low	**High**
De Oliveira 2010 (6)	Low	Unclear	High	Unclear	High	Unclear	Low	**High**
Elci 2008 (7)	Low	Unclear	High	Low	Unclear	Low	Unclear	**High**
Hernandez 2000 (8)	Unclear	Unclear	High	Unclear	High	Low	Low	**High**
Ho 2012 (9)	Low	Unclear	High	Low	Low	Low	Low	**Moderate**
Jaakkola 2019 (10)	Unclear	Unclear	High	Unclear	High	High	Low	**High**
McGavin 1977 (12)	Unclear	Unclear	High	Unclear	High	Low	Low	**High**
Mitchell 2014 (13)	Low	Low	High	Low	Low	Unclear	Low	**Moderate**
Moore 2009 (14)	Low	Low	High	High	High	Low	Low	**High**
Lahham 2020 (11)	Low	Low	High	Low	Low	Low	Low	**Moderate**
Nguyen 2013 (15)	Unclear	Unclear	High	Unclear	Low	High	Low	**High**
Pradella 2015 (16)	Unclear	Unclear	High	Unclear	Low	Low	Low	**High**

Table S5. Narrative summary of findings not included in the meta-analyses

Outcome	Study	Outcome measurement	Diagnosis	Duration of follow-up	Outcome reporting	Findings		
						Intervention	Control	Reported stats
Exercise performance / capacity	Mitchell 2014 (13)	ESWT	COPD	6 weeks	Change from baseline	Mean (95% CI) Time: +210 secs (122 to 297)	Mean (95% CI) Time: +92 secs (33 to 151)	Mean difference (95% CI) Time: 118 secs (17 to 219), p = 0.006
	McGavin 1977 (12)	12MWD	Chronic Bronchitis	3 months	Change from baseline	Mean (range) Distance: ↑64 metres (0 to 165)	Mean (range) Distance: ↓19 metres (-105 to 55)	Intervention: p < 0.001 Control: p > 0.05
	Pradella 2015 (16)	Endurance treadmill test	COPD	8 weeks	Change from baseline	Mean difference ± SD Distance: 317 ± 82 metres	Mean difference ± SD Distance: 31 ± 420 metres	Mean difference (95% CI): 285 metres (-7 to 564)
Health-related Quality of Life	Jaakkola 2019 (10)	SGRQ	Asthma	24 weeks	No data reported	No data reported	No data reported	No data reported
	Nguyen 2013 (15)	CRQ	COPD	12 months	Change from baseline	Mean difference Total: Group 1 (↑8.4 points), Group 2 (↑4.9 points) Dyspnoea: Group 1 (↑2.2 points), Group 2 (↑0.6 points)	Mean difference Total: ↑2.2 points Dyspnoea: ↑0.7 points	Group differences: Total (p = 0.28), Dyspnoea (p = 0.23) Time effect: Total (p < 0.01), Dyspnoea (p = 0.01) Group and time interaction: Total (p = 0.44), Dyspnoea (p = 0.48)
	Elci 2008 (7)	SF-36	COPD	3 months	Baseline data not reported	Baseline data not reported	Baseline data not reported	Baseline data not reported
	Nguyen 2013 (15)	SF-36	COPD	12 months	Change from baseline	Mean difference Physical: Group 1 (↑4.4 points), Group 2 (↑1.6 points) Mental: Group 1 (↓1.1 points), Group 2 (↑1.9 points)	Mean difference Physical: ↑1.5 points Mental: ↓1.0 points	Group differences: Physical (p = 0.68), Mental (p = 0.30) Time effect: Physical (p < 0.01), Mental (p = 0.84) Group and time interaction: Physical (p = 0.63), Mental (p = 0.54)
Subjective symptoms	Hernandez 2000 (8)	BDI/TDI	COPD	12 weeks	Change from baseline	Mean difference BDI: ↑1.6 points MT: ↑0.5 points FI: ↑0.6 points ME: ↑0.6 points	Mean difference BDI: ↓0.3 points MT: ↑0.2 points FI: ↓0.2 points ME: ↑0.2 points	BDI: Intervention (p = 0.03), Control (p > 0.05) MT: Intervention (p = 0.05), Control (p > 0.05) FI: Intervention (p = 0.03), Control (p > 0.05) ME: Intervention (p = 0.01), Control (p > 0.05)
Anxiety & Depression	Booker 1984 (1)	Mood disturbance questionnaire	COPD	9 weeks	Change from baseline	No data reported	No data reported	Significant ↓ in total score in exercise

								physiotherapy + exercise group. No significant changes in exercise alone or control groups.
	Mitchell 2014 (13)	HADS	COPD	6 weeks	Change from baseline	Mean (95% CI) Anxiety: -0.7 points (-1.3 to -1.8) Depression: - 0.5 points (-1.0 to 0.0)	Mean (95% CI) Anxiety: 0.1 points (-0.4 to 0.62) Depression: 0.2 points (-0.3 to 0.8)	Mean difference (95% CI) Anxiety: -0.9 points (-1.6 to -1.0), p = 0.04 Depression: -0.7 points (-1.5 to 0), p = 0.10
	Elci 2008 (7)	HADS	COPD	3 months	Change from baseline	Mean difference Total: ↓4.0 points	Mean difference Total: ↑0.8 points	Intervention: p < 0.01 Control: p = 0.07
Disease impact	Boyd 2012 (3)	ACQ	Asthma	12 weeks	Change from baseline	Mean difference Total: ↓0.22 points	Mean difference Total: ↓0.73 points	p > 0.05
	Jaakkola 2019 (10)	ACT	Asthma	24 weeks	Change from baseline (total number of participants)	Improved: n=26 No change: n=7 Worsened: n=9	Improved: n=17 No change: n=17 Worsened: n=10	Risk difference (95% CI): 0.233 (0.027 to 0.438), p = 0.032
	Cameron-Tucker 2016 (4)	CAT	COPD	8 weeks	Change from baseline	Median difference (IQR) Total: 0 (6)	Median difference (IQR) Total: 0 (6)	p = 0.48
	Chen 2018 (5)	CAT	COPD	12 weeks	Change from baseline	Mean difference Total: ↓3.2 points	Mean difference Total: ↓1.3 points	Intervention: p < 0.01 Control: p = 0.20 Between group: p = 0.98
Hospital admissions (respiratory)	Bourbeau 2003 (2)	Self-report	COPD	1 year	Total number of events during observation period	Total events: 78	Total events: 118	Treatment difference: -39.8% (p = 0.01)
	Ho 2012 (9)	Self-report and healthcare records	COPD	12 weeks	Total number of events during observation period	Data not interpretable	Data not interpretable	No significant differences between groups for hospital admission due to AECOPD
Mortality	Bourbeau 2003 (2)	Healthcare records	COPD	1 year	Total number of events during observation period	Total events: 5	Total events: 9	Statistics not reported
Exacerbations	Bourbeau 2003 (2)	Self-report	COPD	1 year	Total number of events during observation period	Total events: 299	Total events: 362	p = 0.06
Hospital admission (all-cause)	Ho 2012 (9)	Self-report and healthcare records	COPD	12 weeks	Total number of events during observation period	Data not interpretable	Data not interpretable	No data reported
Length of stay	Ho 2012 (9)	Self-report and healthcare records	COPD	12 weeks	Mean duration of stay during observation period	Mean ± SD LOS: 0.2 ± 1.4	Mean ± SD LOS: 0.3 ± 1.3	p = 0.64
Emergency department visits	Bourbeau 2003 (2)	Self-report	COPD	1 year	Total number of events during observation period	Total events AECOPD: 95 Other cause: 57	Total events AECOPD: 161 Other cause: 74	Treatment difference AECOPD: -41.0% (p = 0.02)

								Other cause: -23.0% (p = 0.34)
	Ho 2012 (9)	Self-report and healthcare records	COPD	12 weeks	Mean number of events during observation period	Mean ± SD ED visits: 0.0 ± 0.2	Mean ± SD ED visits: 0.0 ± 0.3	p = 0.52
Outpatient visits	Bourbeau 2003 (2)	Self-report	COPD	1 year	Mean number of events during observation period	Data not interpretable	Data not interpretable	Data not interpretable
Aerobic fitness / capacity	Boyd 2012 (3)	Graded treadmill test	Asthma	12 weeks	Change from baseline	Mean difference $VO_{2\ peak}$: ↑2.64 ml/min/kg Time: ↑1.39 min RER: ↑0.04	Not measured in control group	$VO_{2\ peak}$: p < 0.05 Time: p < 0.05 RER: p > 0.05
	Hernandez 2000 (8)	Incremental cycle ergometer test	COPD	12 weeks	Change from baseline	Mean difference Workload: ↓2.8 watts $VO_{2\ max}$: ↑0.1 $l.min^{-1}$ VO_2: ↑0.5 $l.min^{-1}$ VCO_2: ↓0.1 $l.min^{-1}$ V_E: ↓0.5 $l.min^{-1}$ Dyspnoea: ↓0.7 points Leg discomfort: ↓1.0 points	Mean difference Workload: ↑2.9 watts $VO_{2\ max}$: ↑0.1 $l.min^{-1}$ VO_2: ↑1.5 $l.min^{-1}$ VCO_2: 0 $l.min^{-1}$ V_E: ↑1.4 $l.min^{-1}$ Dyspnoea: ↓1.1 points Leg discomfort: ↑1.1 points	All, p > 0.05
	Jaakkola 2019 (10)	Spiroergometry	Asthma	24 weeks	No data reported	No data reported	No data reported	No data reported
	McGavin 1977 (12)	Incremental cycle ergometer test	Chronic Bronchitis	3 months	Change from baseline	Mean Workload: ↑14.4 watts VO_2: ↑1.3 $l.min^{-1}$ V_E: ↑4 $l.min^{-1}$	Mean Workload: ↓2.6 watts VO_2: ↓121 $ml.min^{-1}$ V_E: ↓2 $l.min^{-1}$	Workload: Intervention (p < 0.05), control (p > 0.05) VO_2: Intervention (p > 0.05), control (p < 0.05) V_E: Intervention (p > 0.05), control (p > 0.05)
	Nguyen 2013 (15)	Incremental treadmill test	COPD	12 months	Change from baseline	No data reported	No data reported	No differences among groups
Peripheral muscle strength	Chen 2018 (5)	CON-TREX leg extensor	COPD	12 weeks	Change from baseline	Mean difference Isometric: ↑17.1 Nm Isokinetic: ↑14.3 Nm	Mean difference Isometric: ↑11.8 Nm Isokinetic: ↑4.6 Nm	Isometric: Intervention (p < 0.01), Control (p = 0.02) Isokinetic: Intervention (p < 0.01), Control (p = 0.06) Between groups: Isometric (p = 0.78), Isokinetic (p = 0.87)
	Jaakkola 2019 (10)	Unclear	Asthma	24 weeks	No data reported	No data reported	No data reported	No data reported
	Nguyen 2013 (15)	Arm endurance	COPD	12 months	Change from baseline	Mean (pre vs post) Lifts per min: Group 1 (↑11.9 reps), Group 2 (↑11.1 reps)	Mean (pre vs post) Lifts per min: ↑1.7 reps	Group differences: p = 0.33 Time effect: p <0.01

								Group and time interaction: p = 0.04
Physical activity levels	Cameron-Tucker 2016 (4)	SNAPPS questionnaire and self-report diary	COPD	8 weeks	Change from baseline	Median difference (IQR) SNAPPS: 0 (4) Mins per day of walking: 14 (26)	Median difference (IQR) SNAPPS: 0 (4) Mins per day of walking: 16 (40)	SNAPPS: p = 0.40 Mins per day of walking: p = 0.10
	Lahham 2020 (11)	Accelerometer	COPD	8 weeks	Change from baseline	Mean difference (95% CI) Total EE: -4 (-1425 to 1418) Steps: 303 (-1607 to 2215) METs/day: 0.1 (-0.1 to 0.2) Sedentary time: 32 min/day (-63 to 128) MVPA time: -5 min/day (-301 to 290)	Mean difference (95% CI) Total EE: 82 (-1299 to 1463) Steps: -106 (-1962 to 1749) METs/day: 0.0 (-0.2 to 0.2) Sedentary time: 8 min/day (-84 to 101) MVPA time: -211 min/day (-497 to 76)	Between group mean differences (95% CI), Home-Standard Care Total EE: -678 (-2190 to 839) Steps: 1089 (-946 to 3125) METs/day: 0.1 (-0.1 to 0.2) Sedentary time: 15 min/day (-86 to 116) MVPA time: -8 min/day (-330 to 314)

ESWT = endurance shuttle walk test, CI = confidence interval, Secs = seconds, 12MWD = Twelve-minute walk distance, SGRQ = St. Georges respiratory questionnaire, CRQ = Chronic respiratory disease questionnaire, BDI/TDI = Baseline and transition dyspnoea index, HADS = Hospital anxiety and depression scale, ACQ = Asthma control questionnaire, ACT = Asthma control test, CAT = COPD assessment tool, IQR = Interquartile range, SF-36 = Short form-36 questionnaire, AECOPD = Acute exacerbation of COPD, LOS = Length of stay, ED = Emergency department, $VO_{2\,peak}$ = Peak oxygen uptake, RER = Respiratory exchange ratio, $VO_{2\,max}$ = Maximal oxygen uptake, V_E = Minute ventilation, SD = Standard deviation, Nm = Newton metres, Reps = Repetitions, Min = minute, EE = Energy expenditure, MVPA = Moderate to vigorous physical activity.

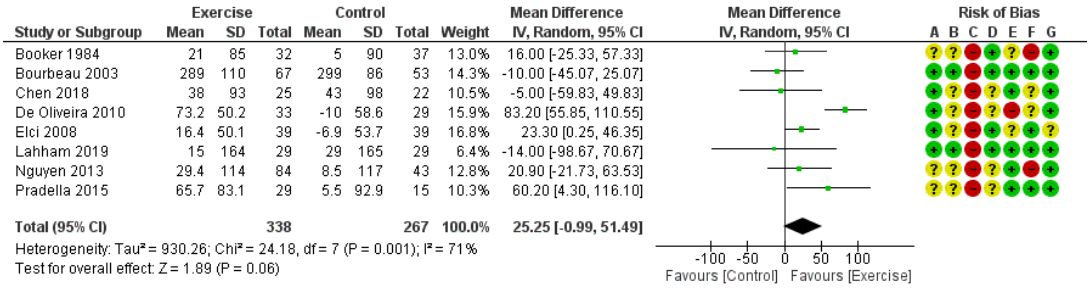

Figure S1. Trial-level data, effect estimates, and forest plot of comparison for change in 6MWT distance following an unsupervised exercise intervention versus usual care for all studies reporting 6MWT, including studies for which data were unclear or not available in published reports (1, 2, 6) and were retrieved from previous systematic reviews (17-19). Risk of bias legend: A) Random sequence generation (selection bias), B) Allocation concealment (selection bias), C) Blinding of participants and personnel (performance bias), D) Blinding of outcome assessment (detection bias), E) Incomplete outcome data (attrition bias), F) Selective reporting (reporting bias), G) Other bias.

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