Supplemental material

Online Supplement Table S1. Summary of included studies.

Study	Design and sample size	Intervention received by experimental group(s) over and above usual care	Control group	Outcomes	Significant differences in favour of intervention group
Mundy 2003[4]	Randomised controlled trial in 458 participants with community-acquired pneumonia. Intervention group: 227 (50%) participants, age ~65 years, pneumonia severity index grade ~3.	Progressive movement.	'Usual care'. No further detail provided.	Adverse events, healthcare utilisation, mortality.	↓ hospital length of stay.
Troosters 2010[25]	Randomised controlled trial in 36 participants with exacerbation of chronic obstructive pulmonary disease. Intervention group: 17 (47%) participants, age 67 (8) years, FEV$_1$ 40 (12)%.	Resistance training of quadriceps.	Standard drug therapy, airway clearance and breathing exercises.	Adverse events, anabolic muscle status, exercise capacity, healthcare utilisation, inflammatory markers, limitation due to dyspnoea, quadriceps strength.	↑ anabolic muscle status, ↑ exercise capacity at discharge, ↑ quadriceps strength at discharge and at 1 month.
Meglic 2011[28]	Single-group study in 19 participants with exacerbation of chronic	Neuromuscular electrical stimulation of quadriceps.	Nil control group.	Functional assessment of chronic illness therapy	N/A.

	obstructive pulmonary disease; age 71 (6) years, FEV_1 29 (11)%.			questionnaire, limitation due to dyspnoea, patient satisfaction, quality of life.	
Carratala 2012[2]	Randomised controlled trial in 378 participants with community-acquired pneumonia. Intervention group: 187 (50%) participants, age 72 (14) years and disease severity using pneumonia severity index score 100 (32).	Progressive movement.	'Usual care'. No further detail provided.	Adverse events, healthcare utilisation, patient satisfaction, mortality.	↓ hospital length of stay.
Giavedoni 2012[21]	Randomised controlled trial in 11 participants with severe exacerbation of chronic obstructive pulmonary disease; age 72 (3) years, FEV_1 41 (6)%.	Neuromuscular electrical stimulation of quadriceps.	The other leg was used as the control. Standard drug and oxygen therapy.	Adverse events, quadriceps strength.	↑ quadriceps strength.
Tang 2012[23]	Randomised controlled trial in 32 participants with exacerbation of chronic obstructive pulmonary disease. Two intervention groups: 11 (34%) participants in the 'low'	Walking and upper and lower limb resistance exercise at either 'low' or 'moderate to high' intensity.	Mobility assessment, functional training for discharge and	Adherence adverse events, Barthel index, exercise capacity, length of stay, lung function, muscle strength.	Nil.

	intensity group, age 68 (10) years, FEV$_1$ 45 (19)% and 10 (31%) participants the 'moderate to high' intensity group, age 74 (10) years, FEV$_1$ 46 (18)%.		airway clearance.		
Tang 2013[27]	Qualitative analysis of 19 participant responses from study 9, age 71 (11) years, FEV$_1$ 48 (18)%.	Walking and upper and lower limb resistance exercise at either 'low' or 'moderate to high' intensity.	Participants of the control group were not invited to participate.	Experience of exercise training during hospitalisation for an exacerbation.	N/A.
Borges 2014[20]	Randomised controlled trial in 29 participants with exacerbation of chronic obstructive pulmonary disease. Intervention group: 15 (52%) age 64 (12) years, FEV$_1$ 42 (14)%.	Upper and lower limb resistance training.	Usual care, including airway clearance.	Adverse events, exercise capacity, inflammatory markers, length of stay, lung function, muscle strength, physical activity, quality of life.	↑ 'impact' domain of quality of life, ↑ exercise capacity, ↑ muscle strength.
Greening 2014[12]	Randomised controlled trial in 389 participants with exacerbation of chronic obstructive pulmonary disease. Intervention group: 196 (50%), age 71 (9) years and FEV$_1$ 52 (25)%.	Walking, resistance training of upper and lower limbs and neuromuscular electrical stimulation of quadriceps.	Airway clearance, mobilisation, education, nutritional screening.	Exercise capacity, healthcare utilisation, mortality, quadriceps strength, quality of life, spirometry.	↑ exercise capacity at 6 weeks, ↓ survival at 12 months.

Greulich 2014[22]	Randomised controlled trial in 40 participants with exacerbation of chronic obstructive pulmonary disease. Intervention group: 20 (50%) age 66 (10) years, FEV_1 33 (13)%.	Whole body vibration.	5 min mobilisation, 5 min of passive movement, and 10 min of respiratory exercises.	Anabolic muscle status, adverse events, chair rising test, exercise capacity, health status, inflammatory markers, muscle area, length of stay, lung function, quality of life.	↑ chair rising test, ↑ exercise capacity, ↓ inflammatory markers.
He 2015[19]	Randomised controlled trial in 94 participants with exacerbation of chronic obstructive pulmonary disease. Intervention group: 66 (70%), age 74 (2) years, FEV_1 38 (3)%.	Walking, upper limb endurance and strength training, breathing retraining, education, stretches.	'Usual care'. No further detail provided.	Activities of daily living dyspnoea scale, adverse events, exercise capacity, health status, limitation due to dyspnoea, quality of life.	Unclear.
Liao 2015[26]	Randomised controlled trial in 61 participants with exacerbation of chronic obstructive pulmonary disease. Intervention group: 30 (49%), age 68 [range 44 to 89] years, peak expiratory flow 140 [range 50 to 240] L/s.	Rehabilitation package, which included airway clearance techniques, pursed lip breathing, walking and upper limb endurance training.	Usual care.	Cough severity, dyspnoea on completion of 6-miute walk test, ease of expectoration, exercise capacity.	↓ cough severity, ↓ dyspnoea, ↑ ease of expectoration, ↑ exercise capacity.

Tahirah 2015[34]	Randomised controlled trial in 38 participants with exacerbation of chronic obstructive pulmonary disease. Intervention group: 20 (53%) age 62 (7) years, FEV$_1$ 34 (14)%.	Walking and functional resistance exercises.	Airway clearance, advice to mobilise.	Exercise capacity, physical activity, quadriceps strength, sit to stand test, Timed Up and Go.	↑ exercise capacity, ↑ physical activity, ↑ quadriceps strength.
Jose 2016[3]	Randomised controlled trial in 49 participants with community-acquired pneumonia. Intervention group 32 (63%), age 51 (21) years, CURB-65 score median [IQR] 1 [0].	Stretching, resistance training of upper and lower limbs and walking.	Airway clearance, breathing exercises and walking.	Adverse events, exercise capacity, Glittre test, inflammatory markers, length of stay, limitation due to dyspnoea, muscle strength, quality of life.	↑ exercise capacity, ↑ Glittre test, ↓ limitation due to dyspnoea, ↑ muscle strength, ↑ 'physical functioning' domain of quality of life.
Torres-Sanchez 2016[29]	Randomised controlled trial in 49 obese participants with exacerbation of chronic obstructive pulmonary disease. Intervention group: 24 (49%), age 72 (9) years, FEV$_1$ 39% [SD not reported].	Deep breathing exercises, active range of motion of the upper and lower limbs, single leg stance and sit to stand.	Usual care.	Adverse events, dyspnoea, exercise capacity, feelings of anxiety, depression, muscle strength, quality of life, spirometry.	↓ feelings of depression ↑ exercise capacity, ↑ muscle strength, ↑ 'self-care, usual activities, mood' domains of quality of life.
Torres-Sanchez 2017[24]	Randomised controlled trial in 58 participants with exacerbation of chronic obstructive pulmonary	Seated lower limb pedalling exercise.	'Usual care' with standard drug therapy.	Adverse events, balance, exercise capacity, length of stay, physical activity,	↑ balance, ↑ physical activity,

					quadriceps strength.	↑ quadriceps strength.
	disease. Intervention group: 29 (50%), age 76 (6) years, FEV_1 42 (11)%.					
Vincent 2017[32]	Qualitative analysis and sub-study of the trial by Greening 2014.[12] Data reported on 100 participants from intervention group, age 71 (9) years, FEV_1 1.14 (0.6) L.	Walking, resistance training of upper and lower limbs and neuromuscular electrical stimulation of quadriceps.	Those in the control group in trial were not invited to participate.	Benefit of exercise healthcare use, family influence, participant confidence, perceptions of recovery.	N/A.	
Cox 2018[31]	Randomised trial in 57 participants with exacerbation of chronic obstructive pulmonary disease (sample age 68 (11) years). Three intervention groups: inpatient exercise 13 (23%), FEV_1 44 (15)%; home exercise 15 (25%), FEV_1 36 (15)%; inpatient + home exercise and 14 (24%), FEV_1 49 (18)%.	Inpatient exercise: upper and lower limb cycling. Home exercise: walking, marching on spot, sit-to-stand, wall push ups, step exercise, squats, bicep curls, arm lifts, shoulder punches with weights, education.	Usual care.	Adverse events, exercise capacity, healthcare utilisation, health status, limitation due to dyspnoea, London Chest Activity scale, quality of life, physical activity.	Nil.	
Torres-Sanchez	Randomised controlled trial in 90 participants with exacerbation of	Breathing and ROM group: deep breathing,	Usual care.	Health status.	In favour of breathing and ROM group (vs	

2018[30]	chronic obstructive pulmonary disease. Two intervention groups: 30 (33%) in 'breathing and ROM' group, age 75 (9) years, FEV_1 31 (5%) and 30 (33%) in resistance training group, age 70 (11) years, FEV_1 30 (8)%.	active range of motion exercises. Resistance training group: upper and lower limb resistance training using elastic bands.			control):↑ 'mobility, self-care, usual activities' domains of health status. In favour of resistance training group (vs control): ↑ domains (except pain) of health status.
Clausen 2019[33]	Single-group in 10 participants with community-acquired pneumonia. Age 74 years (SD not reported), CURB-65 score 2 (SD not reported).	'Fast-track pneumonia pathway' which included a mobilisation within the first 24 hours of admission.	N/A.	Barthel Index, physical activity, quality of life, sedentary time.	Nil.

CURB-65: Confusion Urea, Respiratory rate, Blood pressure, Age ≥ 65 score. FEV_1: Forced expiratory volume in one second. IQR: Interquartile range. N/A: Not Applicable. ROM: Range of movement.SD: Standard deviation. Data are reported as mean (SD) unless otherwise stated.

Online Supplement Table S2. Description of initial exercise prescription, progression and uptake of exercise.

Study	Initial exercise prescription	Method used to progress exercise	Uptake / adherence
Mundy 2003[4]	Daily 'movement out of bed with change from horizontal to upright position for at least 20 min during the first 24 hr of hospitalisation'.	'Progressive movement each subsequent day'; no other details reported.	166 (73%) participants achieved early mobilisation goal.
Troosters 2010[25]	Seated double leg extension, 3 sets of 8 repetitions at 70% of 1RM, performed daily for 7 days.	'Adjustments in the load were made based on symptoms'.	6 (1) sessions completed out of 7 prescribed sessions. 41% of participants performed single leg extension due to dyspnoea.
Meglic 2011[28]	Neuromuscular electrical stimulation of quadriceps for 25 min, twice daily, 6 days/week (no other details).	Details not reported.	All prescribed sessions were performed.
Carratala 2012[2]	Daily 'movement out of bed with change from horizontal to upright position for at least 20 min during the first 24 hr of hospitalisation'.	'Progressive movement each subsequent day'; no other details reported.	370 (98%) participants achieved early mobilisation goal.
Giavedoni 2012[21]	Neuromuscular electrical stimulation of quadriceps for 30 min daily for 14 days. Biphasic pulse 50 Hz, pulse duration of 400ms, 8s on: 20s off. Current increased to maximum tolerated.	Intensity ↑ according to tolerance.	All prescribed sessions were performed.
Tang 2012[23]	'Low intensity' group: walking at 40% of average 3-min walk test speed for 7.5 min and 2 sets of 20 to 25 repetitions at 40% of 1RM.	10% ↑ walking distance once participant achieved distance with a change in Borg score of 1 to 2.	'Low intensity' group completed 78 (17)% of prescribed sessions, range 59% to 100%.

	'Moderate to high intensity' group: walking at 70% of average 3-min walk test speed for 7.5 min and 2 sets of 8 to 10 repetitions at 70% of 1RM. Exercise performed for 15 min twice daily.	↑ load once 2 sets of the prescribed number of repetitions were completed.	'Moderate to high intensity' group completed 71 (19)% of prescribed sessions, range 50% to 100%.
Borges 2014[20]	2 sets of 8 repetitions at 80% of 1RM performed daily. Muscle actions targeted were shoulder flexion, abduction, elbow flexion, knee extension, flexion and hip flexion.	↑ load according to tolerance.	Completed 5.6 sessions (adherence 95%, SD not reported).
Greening 2014[12]	Walking at speed equal to 85% of VO_2 peak estimated from ISWD. Resistance exercise using free weights: 3 sets of 8 repetitions 'based on 1RM'. Neuromuscular electrical stimulation of bilateral quadriceps, 30 min, symmetrical biphasic pulse at 50 Hz, pulse duration of 300ms, 15s on, 5s off. Exercises performed once daily.	Walking time ↑ to maintain Borg dyspnoea score between 3 and 5 and exertion score < 13. Resistance load ↑ to maintain exertion score ≥ 13. Intensity of electrical stimulation ↑ according to tolerance.	Walking training: 2.7 (2.6) sessions. Resistance training: 2.5 (1.9) sessions. Electrical stimulation: 3.6 (3.2) sessions.
Greulich 2014[22]	3 × 2 min on the vibrating platform performed daily.	Details not reported.	Details not reported.
He 2015[19]	Walking for 5 to 10 min at 60% of 'peak work rate achieved in the 6-min walk test'. 2 min of bilateral shoulder flexion and abduction using light free weight. 1 set of 10 repetitions against body weight or free weights (muscle groups not described). Exercises performed daily.	↑ to 20 min of continuous walking as symptoms permitted. ↑ to 3 sets of 10 repetitions when exercises performed 'without any difficulty'.	Completed 9 (1) sessions.

Liao 2015[26]	Upper limb exercise (overhead activity) and walking. Exercises performed twice daily, for 10 min each. No other details reported.	Details not reported.	Details not reported.
Tahirah 2015[34]	Walking training set at the distance achieved on 2-min walk test. Resistance training comprised sit-to-stand, step ups, half squats. Number of repetitions was based performance on the Sit to Stand Test. Exercise performed twice daily.	↑ walk distance by 20% every second day, if symptoms permitted. ↑ number of repetitions of each resistance exercise by 1 set, if symptoms permitted.	4 (1) supervised sessions and 4 (1) unsupervised sessions were completed. Percentage of scheduled supervised and unsupervised sessions were performed were 96 (9)% and 92 (13)%, respectively.
Jose 2016[3]	Warm up and stretches. Walking at 70% peak speed achieved during incremental shuttle walk test. Resistance exercise for 25 min, 3 sets of 8 repetitions at 70% of 1RM using resistance band. Exercise performed daily for eight days.	Walking speed titrated ↑ to maintain dyspnoea score ≥ 4 and ≤ 6 and heart rate equal to rate established by Karvonen's equation. Resistance training load titrated to maintain fatigue ≥ 4 on Borg scale.	8 sessions prescribed. Number of competed sessions not reported.
Torres-Sanchez 2016[29]	Breathing exercises, active movement of upper and lower limbs, and muscle strengthening (no other details reported). Exercise performed twice daily for 30 to 45 min per session.	Progressed according to time, such that by the fifth day they were also completing sit-to-stands and single leg stance. Number of repetitions based on dyspnoea and fatigue (targets not reported).	Details not reported.

Torres-Sanchez 2017[24]	Daily seated pedalling exercise. No other details provided.	Cycling time, velocity and intensity were titrated to maintain dyspnoea and fatigue at score 6 on the Borg scale.	Details not reported.
Cox 2018[31]	Inpatient exercise only group: 16 revolutions of upper and lower limb cycling at 80% of maximal resistance to complete two revolutions 3 times a day for 5 days. Home exercise only group: walking and 8 functional exercises (e.g. squats). Sets and repetitions not reported. Completed 4 sessions over 2 weeks. Sessions were 20 to 60 min. Inpatient and home exercise group: received both interventions.	Inpatient group: 'workload could be increased'; no other details reported. Home exercise: details not reported.	Inpatient exercise: Of 384 prescribed sessions, 131 (34%) sessions were completed across group. Home exercise: Of 92 prescribed sessions, 72 (78%) sessions were completed.
Torres-Sanchez 2018[30]	'Breathing and ROM' group: daily relaxation exercises, pursed lip breathing, active expiration and active range of motion exercises for 30 to 40 min. 'Resistance training' group: daily upper and lower limb training with an elastic band for 30 to 40 min.	'Breathing and ROM' group: details not reported. 'Resistance training' group: progressed according to dyspnoea and fatigue (targets not reported). Load reduced muscle if soreness persisted > a few hours.	Details not reported.
Clausen 2019[33]	Mobilisation for at least 20 min within the first 24 hours of admission. Frequency not described.	Details not reported.	Details not reported.

ISWD: Incremental shuttle walk distance. RM: Repetition maximum. ROM: Range of movement. SD: standard deviation. VO$_2$: rate of oxygen uptake. Data are reported as mean (SD) unless otherwise stated.

Online Supplement S3: Initial search strategy used for MEDLINE

MEDLINE
Date: 05/03/2017
1. hospital*
2. exacerbat*
3. exp. infection
4. exp. symptom flare up
5. deteriorate mp.
6. decline mp.
7. Combine #1 OR #2 OR #3 OR #4 OR #5 OR #6
8. exp. chronic obstructive pulmonary disease
9. exp. cystic fibrosis
10. exp. asthma
11. exp. pneumonia
12. exp. bronchiectasis
13. exp. interstitial lung disease
14. exp. lung
15. respiratory mp.
16. pulmonary mp.
17. Combine #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16
18. exp. exercise
19. exp. exercise therapy
20. exp. resistance training
21. exp. walking
22. exp. bicycling
23. exp. early ambulation
24. early mobili*
25. aerobic mp.
26. exp. muscle strength
27. strength mp.
28. ambulation mp.

29. mobility mp.
30. Combine #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25 OR #26 OR #27 OR #28 OR #29
31. Combine #7 AND #19 AND #30
32. Limits: Humans, adults, English and Portuguese, publication date: 1990- current
33. **Results**: 2121

Details of complete search strategies for all databases available on request.

Online Supplement Table S4. Scoring for the Consensus on Exercise Reporting Template.

Item	Description of:	2	3	4	14	19	20	21	22	23	24	25	26	28	29	30	31	33
					Numbers represent the order of studies as they appear in the reference list													
1	Exercise equipment	0	1	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1
2	Qualification expertise and/or training	1	0	0	1	0	1	0	0	1	1	1	1	0	1	1	1	0
3	Individual or group	0	0	0	0	0	1	1	0	0	0	1	0	0	0	1	1	0
4	Supervision	0	0	0	1	1	1	1	1	1	1	1	0	0	1	1	1	0
5	Adherence to exercise	1	0	1	1	0	1	1	0	1	0	1	0	1	0	0	1	0
6	Motivation strategies	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
7	Method for exercise progression	0	1	0	1	1	1	1	0	1	0	1	0	0	0	0	0	0
8	Each exercise to enable replication	0	1	0	1	0	1	1	0	1	0	1	0	1	1	0	1	0
9	Any home programme component	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0
10	Non-exercise components	1	1	0	1	1	1	0	1	1	0	1	1	0	1	1	1	1
11	Type/ number of adverse events	0	1	0	0	1	1	1	1	1	1	1	0	1	1	0	0	0
12	Setting	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	1
13	Exercise (sets, repetition, duration, intensity)	0	1	0	1	1	1	1	1	1	0	1	0	0	0	0	1	0
14	Whether the exercises were generic or tailored	0	1	0	1	1	1	1	0	1	1	1	0	0	1	1	1	0
15	Decision rule for initial prescription	0	1	0	1	1	1	1	0	1	0	1	0	0	0	0	1	0
16	Adherence or intervention fidelity	0	0	1	1	0	1	1	0	1	0	1	0	0	0	0	1	0
	TOTAL	4	9	4	14	10	14	12	5	12	6	14	4	5	7	7	13	3

0: The minimum detail was not provided to gain a 'Yes' for this item, 1: The minimum detail was provided to gain a 'Yes' for this item.

Online Supplement Table S5. Scoring for the Template for Intervention Description and Replication.

Item	Detail	Numbers represent the order of studies as they appear in the reference list																
		2	3	4	14	19	20	21	22	23	24	25	26	28	29	30	31	33
1	Description of intervention	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	Rationale for intervention	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1
3	Materials used in the intervention	0	1	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1
4	Procedures used in the intervention	0	1	0	1	0	1	1	0	0	0	1	0	1	1	1	1	0
5	Intervention provider expertise	0	0	0	1	0	1	0	0	1	1	1	1	0	1	1	1	0
6	Modes of delivery: individual or group	0	0	0	0	0	1	1	0	0	0	1	0	0	1	1	1	0
7	Location(s)	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	1
8	Details of delivered intervention	0	1	0	1	1	1	1	1	1	0	1	0	0	0	0	1	0
9	Details of titration etc	0	1	0	1	1	1	1	0	1	0	1	0	0	0	0	1	0
10	Details of modifications	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	1	0
11	Methods for assessing/improving adherence or fidelity	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0
12	Assessment of adherence or fidelity	0	0	1	1	0	1	1	0	1	0	1	0	1	0	0	1	0
TOTAL		3	7	4	9	6	11	10	4	8	4	11	5	6	6	7	11	4

0: The minimum detail was not provided to gain a 'Yes' for this item, 1: The minimum detail was provided to gain a 'Yes' for this item.

Online Supplement S6. Risk of bias for 15 RCTs.

	Random sequence generation	Allocation concealment	Blinding of participants and personnel	Blinding of outcome assessment	Incomplete outcome data	Selective reporting	Other bias
Mundy 2003	High	High	High	Low	Low	Low	Low
Troosters 2010	Low	Low	High	High	Low	Low	Low
Carratala 2012	Low	Low	High	High	Low	Low	Low
Giavedoni 2012	Unclear	Unclear	High	Unclear	Low	Unclear	Low
Tang 2012	Low	Low	High	Unclear	Low	Low	Low
Borges 2014	Low	Low	High	Low	High	Low	Low
Greening 2014	Unclear	Unclear	High	Low	Low	High	Low
Greulich 2014	Low	Low	Low	Low	High	Low	Low
He 2015	Unclear	Unclear	Unclear	Unclear	Low	Low	Low
Liao 2015	Low	High	High	Low	Low	Low	Low
Jose 2016	Unclear	Low	High	High	High	Low	Low
Torres-Sanchez 2016	Low	Low	High	Unclear	Low	Low	Low
Torres-Sanchez 2017	Low	Low	High	Low	Low	High	Low
Cox 2018	Low	Low	High	Low	High	Low	Low
Torres-Sanchez 2018	Low	Low	High	Unclear	Low	Low	Low

● High risk of bias   ○ Low risk of bias   ⊞ Unclear