Supplementary information

Methods

Randomisation and blinding

The randomisation schedule was computer-generated by a staff member who was independent of the trial. Allocation was concealed using opaque envelopes kept at the different centres.

Procedures

The Template for Intervention Description and Replication (TIDier) guidelines were adhered to in reporting the trial intervention.[1] All participants received the usual care provided by their treating hospital, which did not routinely involve provision of any specific exercise advice or consultation with a physiotherapist or exercise physiologist at the time the trial was conducted. In addition, UC participants received monthly attention phone calls during the trial from a member of the research team not involved in delivery of the intervention. The purpose of these phone calls was to counter the effect of multiple trial contacts with the IG.

IG participants received a home-based program of exercise, behaviour change strategies and symptom self-management support. All intervention sessions were scripted to standardise the content delivered. Standard exercise session content included discussion of:

- the participant's current medical treatment,
- the current importance of exercise to the participant,
- the effects of exercise for people with cancer and current recommendations,
- current and past levels of physical activity,
- preferences with regards to aerobic exercise type,
- personalised goal setting,
- confidence in performing the prescribed aerobic and resistance exercise for the next week,

• enablers and potential barriers to exercise performance,

• education regarding exercise precautions.

The program commenced with a physiotherapy home-visit to prescribe the exercise program, which comprised aerobic and resistance exercise individualised according to baseline assessment findings. During the initial session the physiotherapist demonstrated the aerobic and resistance exercises and observed the participant's performance. Participants were encouraged to perform aerobic exercise for a minimum of 10 minute bouts. For some participants this was not always possible, commonly due to dyspnea, therefore during some sessions aerobic exercise was prescribed for shorter but more frequent bouts. In contrast other participants were able to exercise for longer than 10 minute bouts. All intervention group participants were educated regarding performance of aerobic exercise at the same relative intensity (moderate) through the use of the Borg RPE scale, a copy of which was provided in their exercise diaries. Resistance training exercises were individually prescribed during the initial physiotherapy session (home-visit). Participants were provided with free weights to perform two upper limb exercises: unilateral shoulder elevation and shoulder horizontal extension. A step was provided if a suitable step was not available within the participant's home environment for the step-up exercise.

Participants were provided with a DVD of the resistance exercises to enhance correct technique along with a Fitbit Zip® activity tracker and exercise diary to record details of their exercise. In addition, if participants agreed they received automated daily weekday text message exercise reminders. A 'health coaching' approach was used during initial and subsequent physiotherapy sessions to support behaviour change regarding exercise, to increase exercise self-efficacy and motivation and to enhance program adherence. We used the Health Change Australia™ Model

of Health Change,[2] which employs principles from cognitive behavioural therapy, motivational interviewing and solution-focused coaching. Key strategies of this approach included building a strong therapeutic alliance with the participant, goal setting, action planning, identification of perceived exercise enablers and barriers and discussion of strategies to overcome barriers. A few days following the initial home-visit the study nurse contacted IG participants and used the Edmonton Symptom Assessment Scale (ESAS)[3] to identify symptoms which may have been impacting on the participant's ability to exercise and to provide education and support regarding non-pharmacological symptom management strategies. Participants were advised to consult with their GP or psychiatrist regarding pharmacological management as appropriate. A booklet which contained non-pharmacological symptom management advice to refer to during phone calls was provided to participants. As with exercise phone calls all symptom management calls were scripted to cover the following content: use of the ESAS to identify the most severe symptoms to focus on during the call; the temporal patterns, aggravating and easing factors and the impact of the symptom on current activities; current management strategies; and reinforcement of behaviours supported by current evidence and identification of new strategies the participant could use, with the use of the trial symptom-management booklet. Symptom management calls were concluded with a summary of the agreed behaviours that the participant planned to focus on for the next week

For the following seven weeks participants received one physiotherapy and one nursing phone call, from the same clinicians, utilising behaviour change techniques to review progress, modify programs as required, set exercise goals for the following week and provide symptom management support. In cases where participants had not met goals, up to two additional physiotherapy home-visits were provided during this initial eight-weeks of the trial. Adherent

participants were defined as those who completed their aerobic exercise on at least two days per week for six of the first eight weeks of the trial.

Following assessment of outcomes at nine weeks, IG participants moved into the maintenance phase of the trial which involved an initial physiotherapy home-visit to review the current exercise program and subsequent monthly physiotherapy telephone calls to review progress and modify programs as required to trial completion at six months. All physiotherapy contacts incorporated behaviour change techniques targeted at increasing exercise self-efficacy, motivation and program adherence.

Four physiotherapists and two nurses were involved in delivering the intervention. The physiotherapists had an average of 18 years' general clinical experience which involved some oncology specific experience (for example as part of oncology or neurosurgery hospital rotations or weekend services) and one worked part-time in a palliative care setting. All physiotherapists received training in health coaching behaviour change techniques by attending a two-day workshop run by Health Change Australia™.[4] The nurse who delivered the majority of symptom management sessions had ten years' clinical experience, six of these as a specialist oncology nurse. All intervention staff had a minimum qualification of a Bachelor or Physiotherapy or Nursing.

Outcomes

Participants completed outcome assessments at baseline, nine-weeks and six-months post recruitment. For pragmatic reasons follow-up assessments were conducted within a two-week window of the scheduled date. All outcomes were measured using methods with demonstrated validity and reliability in oncology populations. Prior to baseline assessment patients were screened for performance status and frailty to ensure they met study inclusion criteria.

Performance status was measured using the Eastern Co-operative Oncology Group Performance Status (ECOG-PS) score, a patient-rated measure with scores of zero indicating the patient is fully active, one: active but can only carry out light work, and two: resting in bed less than <50% of the day.[5] Patients with ECOG-PS scores of three or four were not eligible for study inclusion. The Clinical Frailty Scale (CFS) was used to assess frailty. This gives a clinician-rated assessment of frailty measured on a seven-point scale, ranging from one: 'very fit' (those who exercise regularly and are among the fittest for their age) to seven: 'severely frail' (completely dependent on others).[6] Participants who scored a seven were not eligible for study participation.

At baseline participants' co-morbidities were scored using the Colinet comorbidity scale.[7] Weighted scores for each of tobacco consumption (seven points), diabetes mellitus (five points), renal insufficiency (four points) and one point for each of respiratory, cardiovascular and neoplastic co-morbidities and alcoholism, give an overall score ranging between zero and 20. Higher scores indicate increasing co-morbidities.

Physical activity (PA) was measured objectively using SenseWear Armband (SWA) accelerometers with participants wearing the devices for a seven-day period. Data were used in analyses when a minimum of eight hours per day for four days wear time was recorded.[8] The PA minimal clinically important difference (MCID) has been reported in chronic obstructive pulmonary disease (COPD) as being between 599 and 1131 steps/day.[9] The International Physical Activity Questionnaire (IPAQ) was used for self-report of PA levels during the preceding week. Responses are categorised as high/moderate (meeting PA guidelines) or low (not meeting PA guidelines) and as a continuous energy expenditure score (metabolic equivalent of task (MET) minutes per week).[10] Higher scores indicate increased PA. The Assessment of Quality of Life (AQoL) Version 1 and Functional Assessment of

Cancer Therapy-Lung (FACT-L) questionnaires were used to measure health-related quality of life (HRQoL). The AQoL comprises 15 items, used to calculate scores for five domains and produces an overall utility score which ranges from -0.04 to 1.00.[11] Higher scores indicate improved HRQoL. In inoperable NSCLC AQoL scores are predictive of survival and a mean (SE) change score of -0.13 (0.05) over six months in patients receiving usual care has been reported.[12] The FACT-L contains 36 items in five subscales (four well-being; physical, social/family, emotional, and functional; and a lung cancer specific subscale). The overall scale score range is 0 to 136, with higher scores again indicating improved HRQoL. The Lung Cancer Subscale (FACT-L LCS) includes nine lung cancer specific questions, with scores ranging from 0 to 28 and higher scores indicate lesser symptoms. A trial outcome index (FACT-L TOI) is derived from the sum of scores on lung cancer, functional well-being and physical well-being subscales. FACT-L TOI scores range from 0 to 84, with higher scores indicating improved HRQoL. Over a 12-week period clinically meaningful differences (responders to treatment, time to disease progression) of two to three points and five to seven points are reported for the FACT-LCS and FACT-TOI, respectively, in advanced NSCLC.[13] The Physical Activity Assessment Inventory (PAAI), consisting of 13 items rated on a 0 ('cannot do at all') to 100 ('certain can do') point scale, was used to measure self-efficacy for performance of usual PA under different conditions. The average of the items is used to produce an overall score (from zero to 100) and higher scores indicate greater self-efficacy.[14] Motivation to exercise was measured using the Behavioural Regulation in Exercise Questionnaire, version 2 (BREQ-2), a 19-item tool scored 0 to 4 with higher scores indicating increased amotivation or regulation of exercise. Five subscales are reported as means of each construct; amotivation (four items) reflects a lack of intent to engage in exercise; external regulation (four items) relates to engagement in exercise only due to external pressures (for example to please others); introjected regulation (three items) occurs when the participant

internalizes external pressures to avoid guilt; identified regulation (four items) includes a recognition of exercise as important to achieve outcomes and intrinsic (four items) regulation involves exercising for satisfaction or enjoyment.[15] The MD Anderson Symptom Inventory-Lung Cancer (MDASI-LC) was used to measure symptom severity and distress. The symptom severity component comprises 13 core and three lung cancer specific items, measured on a 0-10 numerical rating scale. The average score is reported, with higher scores indicating worse symptoms. The MCID in lung cancer has been reported as being between 0.98 to 1.21 points.[16] A symptom severity subset of common symptoms for people with lung cancer was defined *a priori*. These symptoms included drowsiness, fatigue, sleep disturbance, shortness of breath, and pain. An additional six questions relate to symptom interference with daily activities (zero indicating 'no interference' and ten indicating 'interfered completely') and form the symptom distress score. The Hospital Anxiety and Depression Scale (HADS) was used to screen for anxiety and depression and includes 14 items, seven anxiety and seven depression, scored zero to three. Subscale scores range from 0 to 21. Higher scores indicate greater distress and are clinically meaningful if greater than seven.[17] The Connor Davidson Resilience Scale (CD-RISC) was chosen to measure resilience. The 10-item version was used. Scores range from zero to 40, with higher scores representing greater resilience.[18]

Statistical analyses

Covariates in imputation models included trial group, treatment intent (radical or palliative), disease stage, smoking status, Clinical Frailty Score, Eastern Co-operative Oncology Group Performance Status (ECOG-PS) score, presence of chronic obstructive pulmonary disease (COPD), living alone, highest education, recruitment site, Colinet comorbidity score and outcome measure scores completed at prior follow-up. Baseline demographics, clinical characteristics and outcomes are reported as mean (SD) or median (IQR) for continuous variables depending on normality of distributions and number (percentages) for categorical variables.

A per-protocol analysis was undertaken comparing results from only those IG participants who had been adherent to results from all UC participants for the primary outcome (6MWD), key secondary outcomes (physical activity and strength) and survival. To be considered as satisfying the intervention protocol, and hence to be considered "adherent", IG participants needed to complete at least two aerobic exercise sessions per week for six of the first eight weeks of the trial, which meant that they had survive at least eight weeks post-baseline. Therefore, to carry out the per protocol survival analysis, the same restriction was imposed on the UC group, to allow an unbiased comparison. On this basis, there were six subjects in the UC group who were omitted from this analysis; these six subjects either died before eight weeks, or were lost to follow-up at a time prior to eight weeks. Subgroup analyses were specified a priori and included analysis of the primary outcome (6MWD) based on ECOG-PS (0/1 versus 2), baseline 6MWD and steps per day divided into tertiles by distribution, and treatment intent (radical versus palliative).[19] HRQoL and symptom severity and distress outcomes were also analysed for the radical versus palliative subgroup.

Results

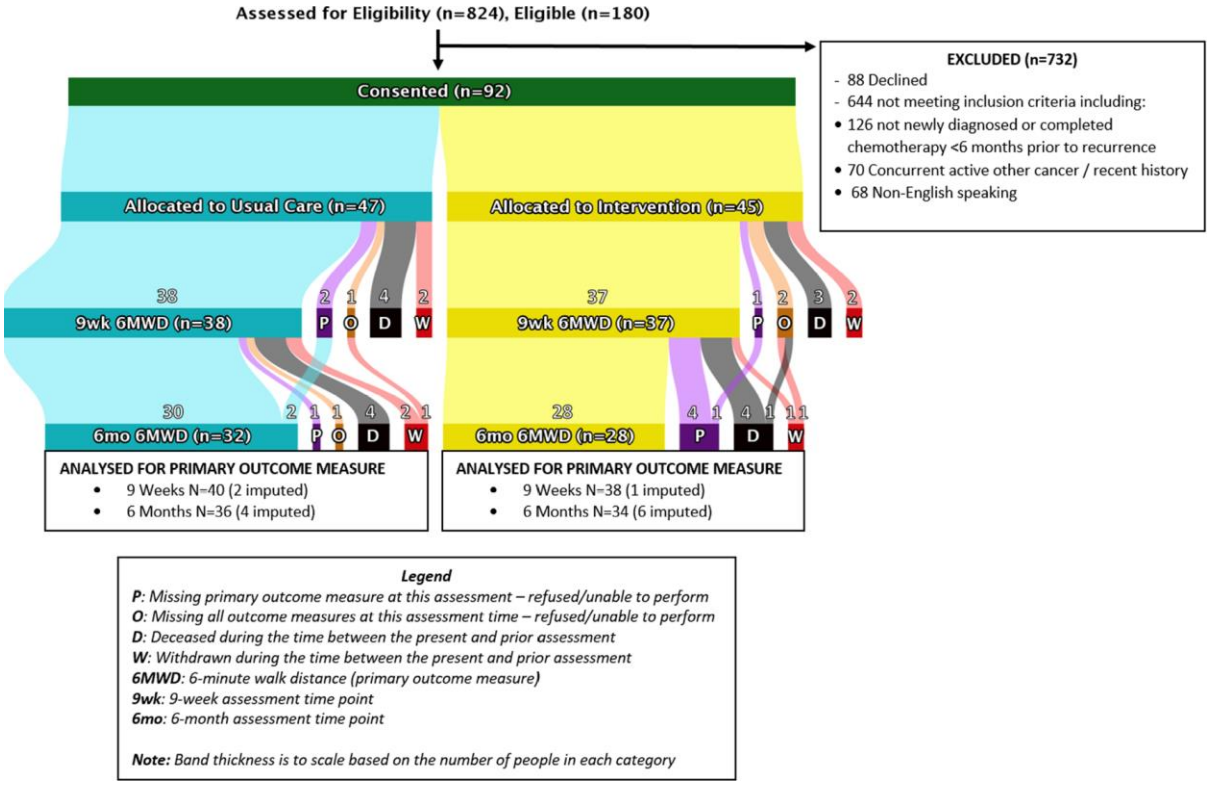

Figure S1: Trial profile for the primary outcome (six-minute walk distance)

The main reasons provided for declining trial participation included 'too much going on' (38%, 33/88) and 'not feeling up to it' (17%, 15/88). The majority of data missing at follow-up time points was due to participant death. Objective physical activity measurement (using SenseWear Armband accelerometers), had the most missing data at each assessment due to participant refusal (devices needed to be worn for a seven-day period) and minimum data requirements not being met (four days of a minimum eight hours of wear were required for inclusion for valid analyses).[8] Table S1 reports further details of missing data.

Table S.1: Patterns of missing data

	Intervention			Usual care		
Time point	**Baseline**	**9 weeks**	**6 months**	**Baseline**	**9 weeks**	**6 months**
Alive	45	42	37	47	43	39
6MWD	45 (100)	37 (88)	28 (76)	47 (100)	38 (88)	32 (82)
Steps per day	39 (87)	30 (71)	28 (76)	41 (87)	35 (81)	27 (69)
MVPA	39 (87)	30 (71)	28 (76)	41 (87)	35 (81)	27 (69)
IPAQ MET minutes	42 (93)	37 (88)	31 (84)	42 (89)	35 (81)	30 (77)
Quadriceps force	45 (100)	37 (88)	29 (78)	47 (100)	37 (86)	32 (82)
Hand-grip strength	45 (100)	37 (88)	30 (81)	47 (100)	39 (91)	32 (82)
FACT-L scale	43 (96)	35 (83)	32 (86)	45 (96)	37 (86)	33 (85)
FACT-L-LCS	44 (98)	36 (86)	32 (86)	45 (96)	37 (86)	33 (85)
FACT-L-TOI	44 (98)	36 (86)	32 (86)	45 (96)	37 (86)	33 (85)
AQoL utility score	43 (96)	36 (86)	32 (86)	46 (98)	37 (86)	33 (85)
MDASI-LC symptom severity	43 (96)	36 (86)	32 (86)	45 (96)	37 (86)	33 (85)
MDASI-LC symptom distress	44 (98)	36 (86)	32 (86)	45 (96)	37 (86)	33 (85)
HADS anxiety and depression	44 (98)	36 (86)	32 (86)	46 (98)	37 (86)	33 (85)
BREQ-2 all subscales	45 (100)	37 (88)	32 (86)	47 (100)	37 (86)	32 (82)
PAAI	44 (98)	35 (83)	31 (84)	46 (98)	37 (86)	30 (77)
CD-RISC	44 (98)	35 (83)	32 (86)	45 (96)	35 (81)	33 (85)

Values are n completed (% of those alive or withdrawn at each time point). Percentages are based on the total sample. 6MWD=six-minute walk distance. MVPA=moderate-to-vigorous physical activity. IPAQ=International Physical Activity Questionnaire. MET=metabolic equivalent of task. FACT-L scale=Functional Assessment of Cancer Therapy-Lung. FACT-L LCS=Lung Cancer Subscale. FACT-L TOI=Trial Outcome Index. AQoL=Assessment of Quality of Life utility score. MDASI-LC=MD Anderson Symptom Inventory-Lung Cancer (symptom severity subset defined *a priori* including drowsiness, fatigue, sleep disturbance, shortness of breath, and pain). HADS=Hospital Anxiety and Depression Scale. BREQ-2=Behavioural Regulation in Exercise Questionnaire, version 2. PAAI=Physical Activity Assessment Inventory. CD-RISC= Connor Davidson Resilience Scale.

There were 14 participants who did not provide data beyond the baseline time point, seven in both the usual care and intervention groups. Compared with those included in analyses, participants who did not provide data beyond baseline had a lower body mass index (BMI) (p=0.062), shorter time since diagnosis (p=0.059), were more likely to live at home alone (p=0.058), performed worse on baseline physical function testing (particularly during the six-minute walk test (6MWT) p=0.064 and hand grip strength p=0.013) and had poorer health-related quality of life (HRQoL) measured by the Functional Assessment of Cancer Therapy-Lung scale (p=0.017) (Table S2).

Table S2: Demographic and clinical characteristics and baseline outcomes of those without follow-up data

	Not included at 9-weeks (n=14)	Included at 9-weeks (n=78)	p-value
Age at baseline (years)	66.1 (15.4)	63.1 (11.6)	0.393
Sex (male)	6 (43%)	45 (58%)	0.462
BMI (kg/m^2)	23.8 (4.2)	26.3 (4.5)	0.062
Disease stage			
IA	0	1 (1%)	
IB	0	2 (3%)	
IIIA	2 (14%)	22 (28%)	0.587
IIIB	2 (14%)	9 (12%)	
IV	10 (71%)	38 (49%)	
Recurrent	0	6 (8%)	
Time since diagnosis (days)	30 (19, 44)	42 (26, 56)	0.059
ECOG-PS, patient rated			
0	5 (36%)	24 (31%)	
1	5 (36%)	47 (60%)	0.075
2	4 (29%)	7 (9%)	

Clinical Frailty Scale score			
1 'very fit'	0	3 (4%)	
2 'well'	0	8 (10%)	
3 'managing well'	0	6 (8%)	
4 'vulnerable'	7 (50%)	36 (46%)	
5 'mildly frail'	6 (43%)	21 (27%)	0.520
6 'moderately frail'	1 (7%)	4 (5%)	
Colinet co-morbidity score	8 (7, 9)	8 (7, 9)	0.978
Cachexic at baseline	7 (50%)	26 (33%)	0.371
Treatment intent at randomisation			
Radical	3 (21%)	39 (50%)	0.092
Palliative	11 (79%)	39 (50%)	
Smoking history			
Never smoker	3 (21%)	14 (18%)	
Ex-smoker	6 (43%)	44 (56%)	0.631
Current smoker	5 (36%)	20 (26%)	
Smoking history pack years	40 (24, 43)	33 (20, 48)	0.94
	n=11	n=64	
Social situation			
Home alone independent	6 (43%)	11 (14%)	
Home with family/friends/supports	8 (57%)	66 (85%)	0.058
Retirement village	0	1 (1%)	
Rural residential status	3 (21%)	23 (30%)	0.537
Highest level of education			
No formal schooling/some primary schooling	1 (7%)	4 (5%)	0.915
Finished primary schooling	2 (14%)	7 (9%)	
Some secondary or high school	3 (21%)	26 (33%)	

Completed secondary or high school	4 (29%)	14 (18%)	
Some/completed trade, community or TAFE college	2 (14%)	8 (10%)	
Some university/currently enrolled	0	5 (6%)	
Completed Bachelor/Masters/PhD degree	2 (14%)	14(18%)	
Employment status			
Working/studying (full or part-time)	3 (21%)	8 (10%)	
Temporary/permanent sick leave	1 (7%)	15 (19%)	
Home duties	0	3 (4%)	0.587
Not employed/taking time off	3 (21%)	9 (12%)	
Retired	7 (50%)	38 (49%)	
Other	0	5 (6%)	
Deceased at six months n (%)	8 (57%)	8 (10%)	<0.005
Physical outcomes			
6MWD, meters	397.9 (165.3) n=14	489.4 (100.7) n=78	0.064
Accelerometry, steps per day	2222.1 (1803.8, 3753.8) n=10	3123.8 (2307.5, 4650.9) n=70	0.120
Accelerometry, MVPA, mins/day	88.4 (36.3, 149.5) n=10	51.1 (26.8, 92.6) n=70	0.269
Self-reported, IPAQ (% meeting PA guidelines)	1 (11%) n=9	21 (27%) n=75	0.492
Self-reported, IPAQ (total MET minutes/week)	240.0 (0.0, 396.0) n=9	252.0 (72.6, 643.5) n=75	0.641
Quadriceps force, Nm	56.5 (37.0, 64.5) n=14	59.8 (48.5, 79.7) n=78	0.172

Hand-grip strength, kgs	21.5 (11.1) n=14	28.9 (9.9) n=78	0.013
Patient-reported outcomes			
FACT-L scale	88.5 (21.2) n=11	101.5 (16.0) n=77	0.017
FACT-L, LCS	16.5 (10.0, 21.0) n=12	20.0 (16.0, 23.0) n=77	0.050
FACT-L, TOI	48.9 (19.2) n=12	60.4 (11.8) n=77	0.068
AQoL utility score	0.65 (0.37, 0.77) n=12	0.71 (0.58, 0.81) n=77	0.133
MDASI-LC - symptom severity subset	3.5 (1.9) n=11	2.9 (2.0) n=77	0.335
MDASI-LC - symptom distress	1.8 (1.0, 3.5) n=12	1.5 (0.2, 3.0) n=77	0.264
HADS anxiety	5.0 (3.0, 13.0) n=13	6.0 (3.0, 9.0) n=77	0.704
HADS depression	4.0 (3.0, 5.0) n=13	3.0 (1.0, 6.0) n=77	0.513
BREQ-2 - amotivation	0.0 (0.0, 1.0)	0.0 (0.0, 0.5)	0.254
BREQ-2 - external regulation	0.0 (0.0, 0.5)	0.0 (0.0, 1.0)	0.348
BREQ-2 - introjected regulation	0.2 (0.0, 0.7)	0.7 (0.0, 1.7)	0.118
BREQ-2 - identified regulation	2.3 (1.1)	2.6 (0.9)	0.307
BREQ-2 - intrinsic regulation	2.4 (1.5, 3.0)	2.5 (2.0, 3.3)	0.538
PAAI	63.1 (16.7) n=13	57.2 (19.3) n=77	0.299
CD-RISC	33.5 (23.0, 38.0) n=12	34.0 (29.0, 38.0) n=77	0.838

Data are n (%), median (IQR), or mean (SD). Variables with no 'n' reported are complete (n=14 not included, n=78 included). Differences were assessed using independent t-tests for continuous variables and chi-square tests for categorical variables. 6MWD=six-minute walk distance. BMI=body mass index. ECOG-PS=Eastern Co-operative Oncology Group Performance Status. MVPA=moderate-to-vigorous physical activity. IPAQ=International Physical Activity Questionnaire. MET=metabolic equivalent of task. Nm=Newton meters. FACT-L scale=Functional Assessment of Cancer Therapy-Lung. FACT-L LCS=Lung Cancer Subscale. FACT-L TOI=Trial Outcome Index. AQoL utility score=Assessment of Quality of Life utility score. MDASI-LC=MD Anderson Symptom Inventory-Lung Cancer (symptom severity subset defined *a priori* including drowsiness, fatigue, sleep disturbance, shortness of breath, and pain). HADS=Hospital Anxiety and Depression Scale. BREQ-2=Behavioural Regulation in Exercise Questionnaire, version 2. PAAI=Physical Activity Assessment Inventory. CD-RISC= Connor Davidson Resilience Scale.

Seventy-eight participants (40 UC, 38 IG) were included in nine-week modified ITT analyses. Multiple imputation data were available for the primary outcome (change in 6MWD from baseline to nine-weeks) in 84% (38/45) and 85% (40/47) of the baseline IG and UC sample respectively (Table 3). The groups were well balanced at baseline for demographic and clinical characteristics including age, body mass index (BMI), smoking status, histological subtype, disease stage, metastatic disease site, performance status, and number of co-morbidities (Table 2). The IG showed a trend towards an increased diagnosis of frailty, a score of five or above on the Clinical Frailty scale,[6] and were more likely to live alone and be retired, compared with UC. Participants were randomized a median (interquartile range (IQR)) of 41 (26, 56) days after diagnosis and a mean (SD) of 5.6 (17.7) days after commencing treatment. Thirty-nine (50%) participants were scheduled to receive radical intent treatment. For outcome measures at baseline there was a trend for UC participants to perform better than those in the IG. There was no difference between groups in response to treatment on imaging (χ^2=3.6, p=0.608) or need for chemotherapy dose reduction (χ^2=0.00, p=1.000). Consistency of 6MWT location on follow-up testing (hospital versus home) was not significantly different between groups at either follow-up (at nine-weeks the same location was used for 87% (33/38) of UC tests compared to 78% (29/37) of IG tests, p=0.507 and 88% (28/32) of UC tests compared to 71% (20/28) of IG tests at six-months, p=0.219). Objective PA measurement duration, using SenseWear Armband accelerometers, occurred for a median (IQR) of 13.4 (11.9, 15.1), 12.6 (11.5, 14.3) and 12.7 (11.4, 14.1) hours per day at baseline (n=70), nine-week (n=65) and six-month (n=55) assessments.

Table S3: Intervention details reported according to TiDier guidelines

Weeks One-Eight		
Exercise sessions Initial face-to-face session, n = 40 participants		
Location	Home	33 (83%)
	Outpatient clinic of treating hospital	6 (15%)
	Medihotel	1 (3%)
Duration of session (mins)		77.9 (20.6)
Therapist travel time (mins)		48.9 (41.5)
Type of aerobic exercise prescribed	Ground walking only	36 (90%)
	Ground walking, Zumba and light boxing	1 (3%)
	Ground walking and stationary cycling	2 (5%)
	Ground walking and arm ergometry	1 (3%)
Behaviour change methods utilised		39 (98%)
Follow-up sessions (n= 235 sessions)		
Number of sessions per participant		6.9 (1.6)
Method of delivery	Telephone	206 (88%)
	Face-to-face home-visit	17 (7%)
	Face-to-face hospital outpatient clinic	12 (5%)
Duration of sessions (mins)		17 (15)
Received weekday exercise text message reminders		32 (80%)
Used trial Fitbit Zip® or personal activity tracker		37 (93%)
Used and returned exercise diary		32 (80%)
Number of aerobic sessions recorded in exercise diary during initial eight-weeks		27.7 (15.7)
Aerobic session duration (mins)		25.1 (14.6)

Number of resistance sessions recorded in exercise diary during initial eight-weeks		22.8 (15.4)
Symptom management sessions n=40 participants, 236 sessions		
Number of sessions per participant		5.9 (1.0)
Duration of sessions (mins)		18.0 (8.0)
ESAS scores	Pain	1.0 (2.0)
	Fatigue	3.0 (2.0)
	Nausea	1.0 (2.0)
	Depression	1.0 (2.0)
	Anxiety	1.0 (2.0)
	Drowsiness	2.0 (2.0)
	Appetite	2.0 (2.0)
	Well being	2.0 (2.0)
	Shortness of breath	2.0 (2.0)
Were topics other than those covered in the standardised script discussed? (yes)		89 (38%)
Reasons for no intervention Weeks One-Eight		
	Deceased	2 (5%)
	Withdrawn	2 (5%)
	Declined exercise	1 (3%)
	Declined symptom management	1 (3%)
Maintenance phase, Weeks Nine–26 n=36 participants, 150 exercise sessions		
Location	Telephone	120 (80%)
	Face-to-face home visit	29 (19%)
	Face-to-face hospital outpatient clinic	1 (1%)
Number of sessions per participant		4.2 (1.5)
Home visit duration (mins)		51.7 (21.1)

Therapist travel time (mins)		48.4 (44.8)
Telephone call duration (mins)		13.2 (6.5)
Used and returned exercise diary		12 (33%)
Number of aerobic sessions recorded in exercise diary per month		13.5 (9.3)
Number of resistance sessions recorded in exercise diary per month		13.1 (9.6)
Reasons for no intervention during the maintenance period	Deceased	4 (10%)
	Withdrawn	3 (8%)
	Declined	2 (5%)

Values are mean (SD) or number (percentages). Behaviour change methods included: explanation of the physiotherapist's role and trial aims, discussion of motivation to exercise, education regarding research benefits of exercise for people with cancer and/or current exercise guidelines, establishment of current activity levels and preferred activities, development of personalized goals, discussion around confidence in completing prescribed home-exercise program and potential barriers to exercise program completion over the following week. ESAS = Edmonton Symptom Assessment Scale.

The ITT analyses involving all 92 participants for the primary outcome revealed no significant between group differences at nine-weeks (p=0.318) or six-months (p=0.979). At nine-weeks there were seven deaths and each of these participants was assigned a 6MWD of 100 m (the minimum 6MWD recorded at baseline or nine-weeks was 116 m). Under the null hypothesis of no difference, the expected values of the mean ranks in each group are the same, and equal to 46.5 at six-months. In the MI analysis the pooled mean ranks were 46.4 (UC) and 46.6 (IG); hence almost exactly "at the null".

Table S4: Within-group change scores from baseline for primary and secondary outcomes, modified intention-to-treat and per-protocol analyses

	Modified intention-to-treat, imputed data			
	Nine weeks		Six months	
Outcome	Intervention group (n=38)	Usual care (n=40)	Intervention group (n=34)	Usual care (n=36)
Primary				
6MWD, m	-33.25 (13.57)	-7.88 (14.39)	-23.30 (25.23)	-64.64 (22.20)
Key secondary				
Accelerometry, steps per day	-254.55 (602.31)	-429.04 (593.82)	361.02 (643.64)	-212.96 (634.55)
Accelerometry, MVPA, mins/day	-3.17 (14.32)	-9.39 (16.44)	-7.30 (15.95)	16.08 (22.27)
Self-reported, IPAQ MET-mins/week	334.26 (294.90)	651.85 (421.74)	471.30 (444.49)	38.05 (579.56)
Self-reported, IPAQ meeting guidelines?	22.1% (10.6%)	30.0% (11.2%)	36.3% (10.8%)	18.5% (12.8%)
Quadriceps force, Nm	2.79 (4.24)	2.48 (4.43)	1.91 (5.47)	1.02 (4.55)
Hand-grip strength, kg	0.09 (0.80)	-0.01 (0.72)	1.13 (1.42)	0.75 (1.16)
Secondary				
FACT-L total scale	2.42 (2.85)	-1.41 (3.20)	5.18 (3.25)	-7.84 (3.13)
FACT-L - LCS	1.04 (0.74)	-0.89 (0.99)	1.89 (1.05)	-2.77 (1.13)
FACT-L - TOI	1.34 (2.07)	-3.25 (2.51)	2.71 (2.13)	-7.70 (2.42)
AQoL utility score	-0.04 (0.04)	-0.02 (0.04)	-0.11 (0.05)	-0.09 (0.06)
MDASI-LC - symptom severity subset	-0.34 (0.50)	0.57 (0.38)	-1.00 (0.55)	1.24 (0.45)
MDASI-LC - symptom distress	0.01 (0.48)	0.62 (0.41)	-0.36 (0.55)	1.04 (0.50)
HADS anxiety	-1.09 (0.66)	-0.88 (0.57)	-0.26 (0.74)	-0.50 (0.65)
HADS depression	0.70 (0.61)	0.30 (0.55)	0.05 (0.87)	1.00 (0.55)
BREQ-2 - amotivation	-0.06 (0.14)	0.24 (0.14)	-0.09 (0.21)	0.50 (0.20)
BREQ-2 - external regulation	0.09 (0.18)	0.20 (0.15)	0.08 (0.27)	0.08 (0.25)
BREQ-2 - introjected regulation	0.41 (0.22)	0.49 (0.20)	0.68 (0.35)	0.20 (0.31)

BREQ-2 - identified regulation	0.33 (0.14)	-0.08 (0.18)	0.47 (0.25)	-0.34 (0.19)
BREQ-2 - intrinsic regulation	-0.10 (0.19)	-0.10 (0.21)	0.41 (0.35)	-0.29 (0.28)
PAAI	0.66 (5.96)	-3.96 (4.55)	-1.24 (6.02)	-5.39 (5.54)
CD-RISC	-1.81 (1.75)	-0.76 (1.20)	0.38 (2.00)	-1.09 (1.27)
Per-protocol, imputed data				
Outcome	Nine weeks Intervention group (n=26)	Usual care (n=40)	Six months Intervention group (n=23)	Usual care (n=36)
Primary				
6MWD, m	-25.78 (12.50)	-7.88 (14.39)	-12.45 (32.74)	-64.64 (22.20)
Key secondary				
Accelerometry, steps per day	-200.45 (696.09)	-429.04 (593.82)	312.32 (792.27)	-212.96 (634.55)
Accelerometry, MVPA, mins/day	1.94 (17.89)	-9.39 (16.44)	-7.89 (17.72)	16.08 (22.27)
Self-reported, IPAQ MET-mins/week	512.85 (296.91)	651.85 (421.74)	440.53 (437.41)	38.05 (579.56)
Self-reported, IPAQ meeting guidelines?	30.8% (11.9%)	30.0% (11.2%)	40.0% (12.3%)	18.5% (12.8%)
Quadriceps force, Nm	3.99 (5.85)	2.48 (4.43)	4.87 (7.22)	1.02 (4.55)
Hand-grip strength, kgs	0.80 (0.63)	-0.01 (0.72)	1.55 (1.94)	0.75 (1.16)

Data are within-group mean change (SE) or percentage (SE), from multiple imputation data sets, nine-weeks minus baseline and six-months minus baseline. 6MWD=six-minute walk distance. MVPA=moderate-to-vigorous physical activity. IPAQ=International Physical Activity Questionnaire. MET=metabolic equivalent of task. Nm=Newton meters. FACT-L scale=Functional Assessment of Cancer Therapy-Lung. FACT-L LCS=Lung Cancer Subscale. FACT-L TOI=Trial Outcome Index. AQoL utility score=Assessment of Quality of Life utility score. MDASI-LC=MD Anderson Symptom Inventory-Lung Cancer (symptom severity subset defined *a priori* including drowsiness, fatigue, sleep disturbance, shortness of breath, and pain), lower scores indicate improved symptom severity and distress. HADS=Hospital Anxiety and Depression Scale, lower scores indicate improved mood. BREQ-2=Behavioural Regulation in Exercise Questionnaire, version 2, lower amotivation subscale scores indicate reduced levels of amotivation. PAAI=Physical Activity Assessment Inventory. CD-RISC= Connor Davidson Resilience Scale.

Table S5: Repeated measures models for interaction of group allocation and time, imputed data (n=70)

Outcome	Estimate of treatment effect	95% CI	P value
6MWD, m	66.91	15.10, 118.72	0.012
Accelerometry, steps per day	425.18	-1109.61, 1959.97	0.583
Accelerometry, MVPA, mins/day	-20.77	-66.62, 25.08	0.372
Self-reported, IPAQ (total MET minutes/week)	859.89	-81.73, 1801.52	0.073
Quadriceps force, Nm	0.09	-13.29, 13.47	0.99
Hand-grip strength, kg	0.40	-3.45, 4.25	0.839
FACT-L total scale	8.09	-0.98, 17.16	0.08
FACT-LCS	2.45	-0.84, 5.75	0.145
FACT-TOI	5.52	-1.25, 12.28	0.11
AQoL utility score	-0.02	-2.00, 1.96	0.984
MDASI-LC - symptom subset severity	-1.14	-3.49, 1.21	0.344
MDASI-LC - symptom distress	-0.75	-3.08, 1.58	0.527
HADS anxiety	0.55	-2.28, 3.38	0.704
HADS depression	-1.30	-3.84, 1.25	0.316
BREQ-2 - amotivation	-0.26	-2.30, 1.79	0.806
BREQ-2 - external regulation	0.02	-2.06, 2.10	0.986
BREQ-2 - introjected regulation	0.49	-1.65, 2.63	0.652
BREQ-2 - identified regulation	0.39	-1.68, 2.47	0.706
BREQ-2 - intrinsic regulation	0.93	-1.19, 3.05	0.384
PAAI	-2.83	-17.98, 12.32	0.712
CD RISC	2.31	-2.97, 7.58	0.386

Estimate of treatment effect is the difference between the mean treatment effect (intervention group minus usual care) at six months relative to nine weeks. 6MWD=six-minute walk distance. MVPA=moderate-to-vigorous physical activity. IPAQ=International Physical Activity Questionnaire. MET=metabolic equivalent of task. Nm=Newton meters. FACT-L scale=Functional Assessment of Cancer Therapy-Lung. FACT-L LCS=Lung Cancer Subscale. FACT-L TOI=Trial Outcome Index. AQoL utility score=Assessment of Quality of Life utility score. MDASI-LC=MD Anderson Symptom Inventory-Lung Cancer (symptom severity subset defined *a priori* including drowsiness, fatigue, sleep disturbance, shortness of breath, and pain), lower scores indicate improved symptom severity and distress. HADS=Hospital Anxiety and Depression Scale, lower scores indicate improved mood. BREQ-2=Behavioural Regulation in Exercise Questionnaire, version 2. PAAI=Physical Activity Assessment Inventory. CD-RISC= Connor Davidson Resilience Scale.

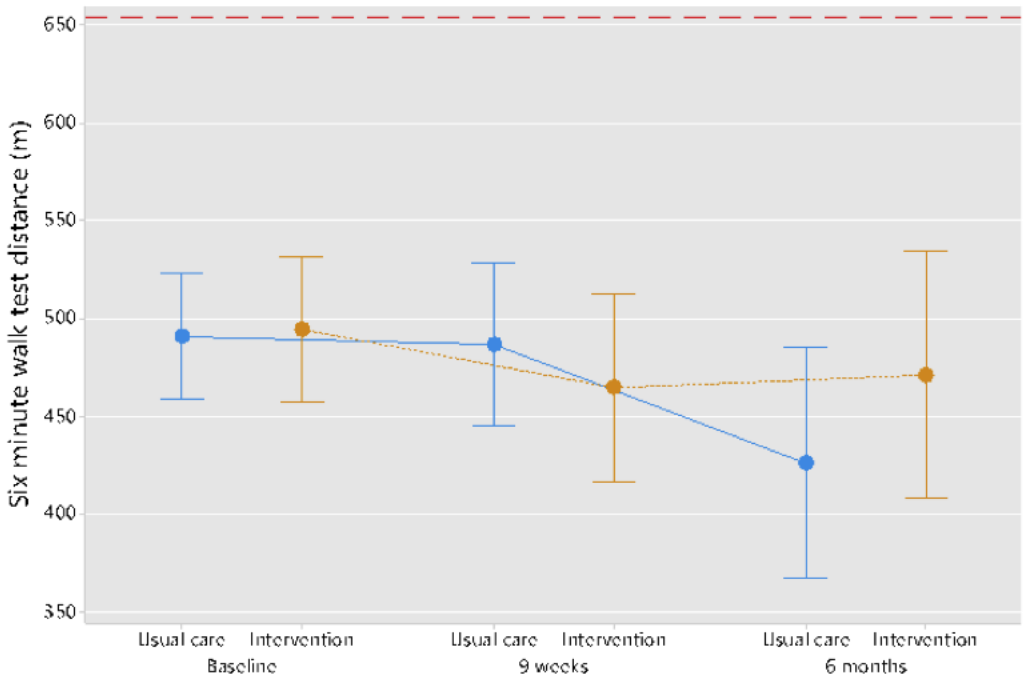

Figure S2: Interaction between group allocation and time for the six-minute walk distance

Footnote: Circles represent mean values (95% CI represented by bars). The solid blue line represents the usual care group and the dashed orange line represents the intervention group. The red-dashed line indicates predicted values based on healthy Australian population reference values.[20]

No trial-related serious adverse events occurred. One minor adverse event, a fall not resulting in injury, occurred during performance of the 6MWT at nine-week assessment in the hospital. Four IG participants reported minor adverse events; three experienced new onset muscular pain relating to commencement of resistance training (one participant declined resistance training beyond the initial session, pain resolved for one participant and the program was modified for the final participant) and one reported palpitations during exercise and was subsequently cleared to exercise following cardiology review. Aerobic exercise adherence was 65% (26/40) and these participants were included in per protocol analyses. Results of per-protocol analyses of primary and key secondary outcomes were not significantly different from those of modified ITT analyses (Table 3 and supplementary file Table S4). Per-protocol survival analyses involved 26 subjects and 10 deaths in the IG, there were 41 subjects and 23 deaths in the UC group. The Kaplan-Meier plot is conditional on surviving beyond 8 weeks,

in both groups (Figure S3). The estimated median survival in the UC group was 432 days; the median survival in the adherent IG was not estimable (survival was estimated to be greater than 50% at the end of follow-up). The log rank test for a difference between the two groups gave p = 0.09.

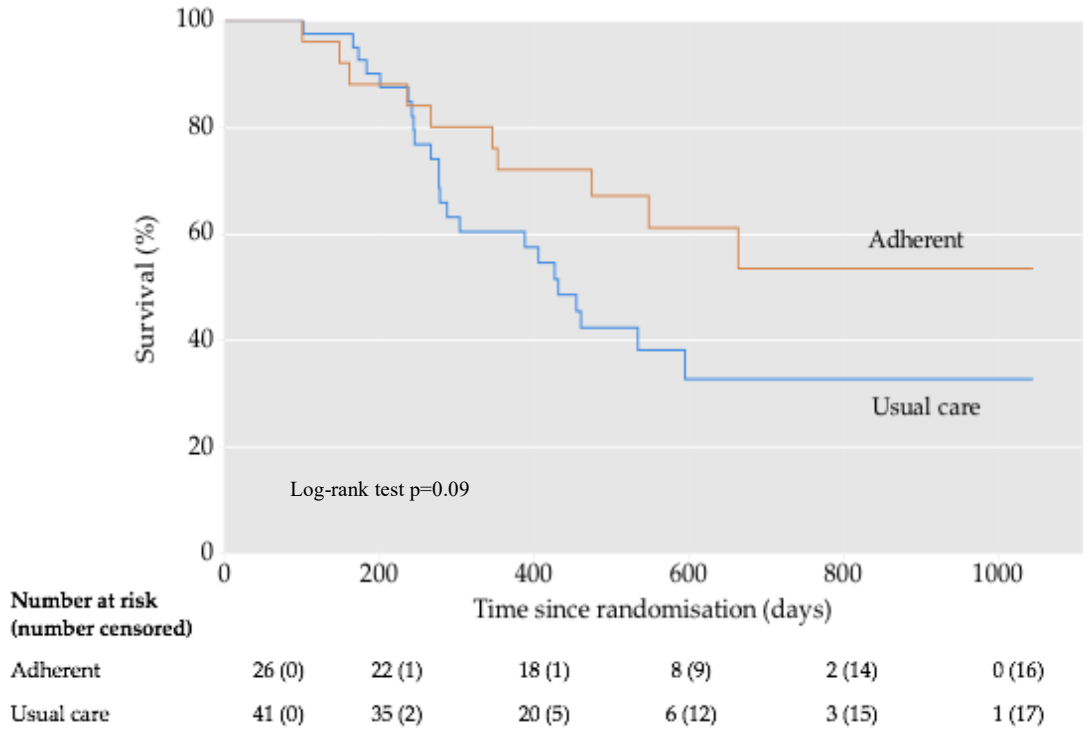

Figure S3: Kaplan-Meier Survival curve for intervention and usual care groups, per protocol analysis.

There were not enough included participants with an ECOG-PS of 2 to undertake the analysis of subgroups by ECOG-PS. There were no significant between group differences according to baseline 6MWD or steps/day tertiles or treatment intent subgroups (Figure S4 and Table S6). The effect of the intervention on 6MWD (mean difference (95%CI)) was greater for those in the highest 6MWD category compared to those in the lowest (38.8m (-53.0, 130.6), p=0.407) and medium (50.5m (-43.2, 144.2), p=0.291) categories at nine weeks, however this finding was reversed at six months. For steps/day subgroups the effect of the intervention on 6MWD (mean difference (95% CI)) was also greater for those in the highest category compared to those in the lowest (35.8m (-60.4, 131.9), p=0.466) and medium (27.1 (-65.8, 120.1), p=0.567) at nine weeks. At six months this was reversed, with greater effects of the intervention seen in the lowest (-2.3m (-148.8, 144.1), p=0.975) and medium (-22.9m (-179.1, 133.3), p=0.773) subgroups when compared to the highest. There were no significant differences in treatment effects in the 'radical' versus 'palliative' treatment intent subgroups, however there was a trend towards greater improvement in 6MWD and HRQoL in the 'radical' group (Figure S4 and Table S6) and reduced symptom severity in the 'palliative' group at both follow-up time points. The effect on symptom distress favoured the palliative group at nine-weeks and the radical group at six-months (Table S6).

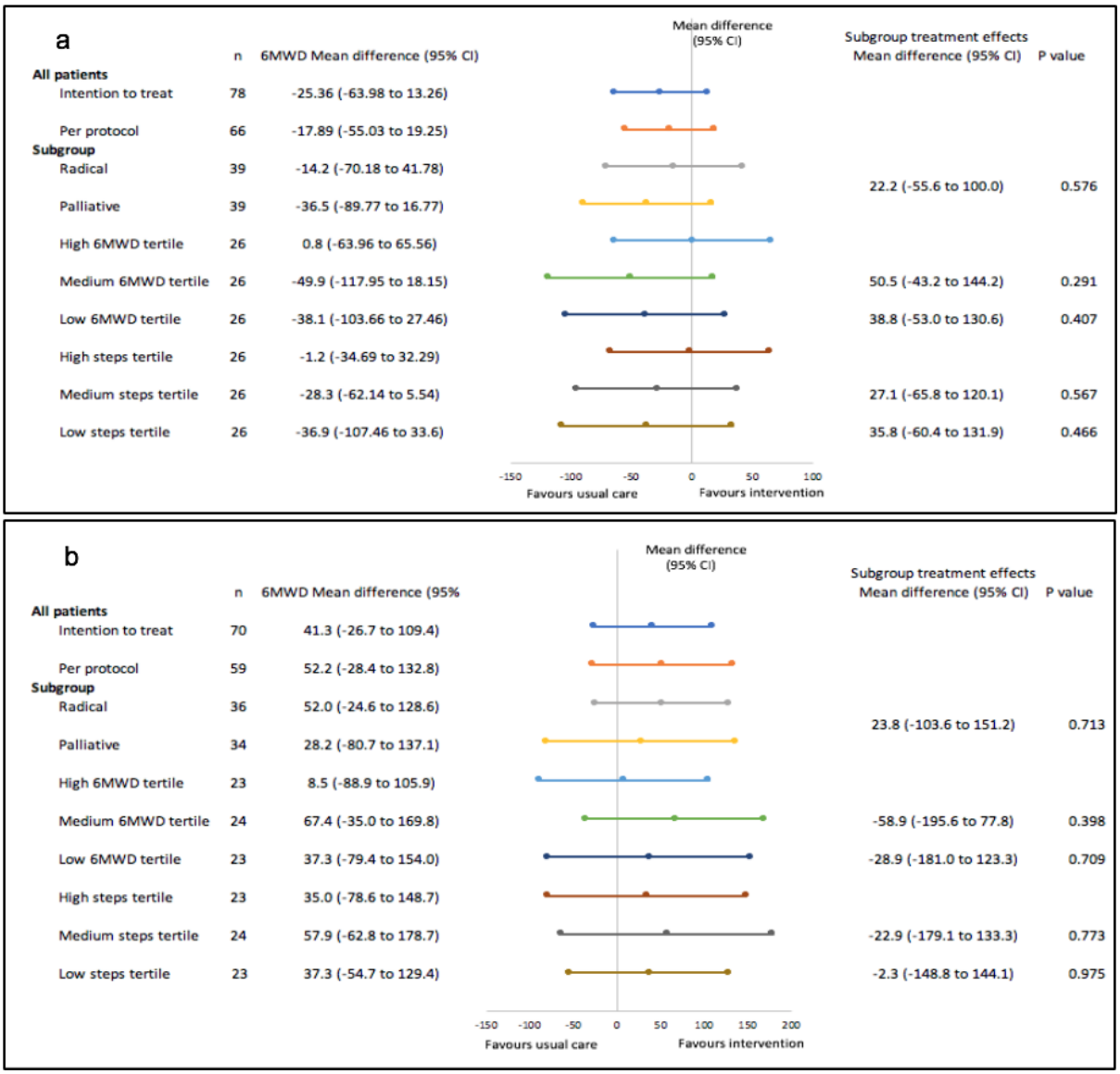

Figure S4: Subgroup analyses for six-minute walk distance at a) nine-weeks and b) six-months follow-up.

Footnote: Data are mean differences (95% CI), intervention group minus usual care group. Subgroup treatment effect mean differences are comparisons of the difference in the treatment effect between subgroups (comparison of treatment effects for six-minute walk distance and steps/day baseline tertiles was performed with the 'high' group used as the reference group)

Table S6: Treatment intent subgroup analyses, mean difference from baseline at nine-weeks and six-months, for health-related quality of life and symptom outcomes.

Outcome	Group	Nine weeks					
		Radical Mean difference (SE) (UC n=20, IG n=19)	**Palliative Mean difference (SE) (UC n=20, IG n=19)**	**Treatment effect Mean difference**	**Treatment effect 95% CI**	**Treatment effect P value**	**Interpretation**
AQoL utility	Usual care	-0.06 (0.05)	0.02 (0.05)	0.1	-0.1, 0.3	0.356	Both usual care and intervention groups showed minimal change in AQoL utility scores. Comparing the radical and palliative patients, the difference in the treatment effect was 0.1, 95% CI: (-0.1, 0.3), favouring radical. The test of zero effect modification gave P = 0.356.
	Intervention	-0.02 (0.05)	-0.04 (0.06)				
FACT-L	Usual care	-0.2 (4.3)	-3.2 (4.2)	0.8	-16.6, 18.1	0.932	The usual care group declined and the intervention group improved on the FACT-L, on average. Comparing the radical and palliative patients, the difference in the treatment effect was 0.8, 95% CI: (-16.6, 18.1), favouring radical. The test of zero effect modification gave P = 0.932.
	Intervention	4.5 (4.4)	0.7 (4.4)				
FACT-L LCS	Usual care	-1.5 (1.3)	-0.3 (1.3)	1.2	-4.0, 6.3	0.662	The usual care group declined and the intervention group improved on the FACT-L LCS, on average. Comparing the radical and palliative patients, the difference in the treatment effect was 1.2, 95% CI: (-4.0, 6.3), favouring
	Intervention	1.2 (1.3)	1.3 (1.4)				

							radical. The test of zero effect modification gave P = 0.662.
FACT-L TOI	Usual care	-2.2 (3.3)	-4.5 (3.2)	-0.2	-13.8, 13.0	0.957	The usual care group declined and the intervention group improved on the FACT-L TOI, on average. Comparing the radical and palliative patients, the difference in the treatment effect was -0.2, 95% CI: (-13.8, 13.0), favouring palliative. The test of zero effect modification gave P = 0.957.
	Intervention	2.4 (3.4)	0.3 (3.4)				
MDASI-LC symptom subset	Usual care	0.3 (0.6)	0.8 (0.6)	1.8	-0.6, 4.3	0.140	There was minimal change in average reported symptoms in patients treated radically, palliative patients showed a worsening in the usual care group and improvement in the intervention group. Comparing the radical and palliative patients, the difference in the treatment effect was 1.8, 95% CI: (-0.6, 4.3), favouring palliative. The test of zero effect modification gave P = 0.140.
	Intervention	0.3 (0.6)	-1.0 (0.6)				
MDASI-LC symptom distress	Usual care	-0.1 (0.6)	1.4 (0.6)	1.1	-1.4, 3.5	0.396	There was minimal change in average reported symptom distress in patients treated radically, palliative patients showed a worsening in the usual care group and little change in the intervention group. Comparing the radical and palliative patients, the difference in the treatment effect was 1.1, 95% CI: (-1.4, 3.5), favouring palliative. The test of zero effect modification gave P = 0.396.
	Intervention	-0.2 (0.6)	0.2 (0.6)				
Outcome	**Group**			**Six-months**			

		Radical Mean difference (SE) (UCn=20, IG n=16)	Palliative Mean difference (SE) (UCn=18, IG n=16)	Mean difference	95% CI	P value	Interpretation
AQoL utility	Usual care	-0.1 (0.1)	-0.1 (0.1)	0	-0.3, 0.3	0.885	Both usual care and intervention groups showed minimal change in AQoL utility scores. Comparing the radical and palliative patients, the difference in the treatment effect was 0.0, 95% CI: (-0.3, 0.3). The test of zero effect modification gave P = 0.885.
	Intervention group	-0.1 (0.1)	-0.1 (0.1)				
FACT-L	Usual care	-8.2 (4.2)	-7.4 (4.6)	1.7	-15.8, 19.2	0.849	The usual care group declined and the intervention group improved on the FACT-L, on average. Comparing the radical and palliative patients, the difference in the treatment effect was 1.7, 95% CI: (-15.8, 19.2), favouring radical. The test of zero effect modification gave P = 0.849.
	Intervention group	5.6 (4.0)	4.7 (5.4)				
FACT- L LCS	Usual care	-4.7 (1.4)	-0.3 (1.5)	3.1	-2.8, 9.0	0.299	The usual care group declined and the intervention group improved on the FACT-L LCS, on average. Comparing the radical and palliative patients, the difference in the treatment effect was 3.1, 95% CI: (-2.8, 9.0), favouring radical. The test of zero effect modification gave P = 0.299.
	Intervention	1.3 (1.3)	2.6 (1.9)				
FACT-L TOI	Usual care	-7.7 (3.1)	-7.7 (3.4)	2.1	-10.6, 14.8	0.744	The usual care group declined and the intervention group improved on the FACT-L TOI, on average. Comparing the radical and palliative patients, the difference in the treatment effect was 2.1, 95% CI: (-10.6,
	Intervention	3.7 (2.9)	1.6 (3.8)				

						14.8), favouring radical. The test of zero effect modification gave P = 0.744.
MDASI-LC symptom subset	Usual care	1.2 (0.6)	1.2 (0.7)	1.1	-1.7, 4.0	0.430	The usual care group reported worsening of MSADI-LC symptoms and the intervention group improvement, on average. Comparing the radical and palliative patients, the difference in the treatment effect was 1.1, 95% CI: (-1.7, 4.0), favouring palliative. The test of zero effect modification gave P = 0.430.
	Intervention	-0.5 (0.6)	-1.6 (0.9)				
MDASI-LC symptom distress	Usual care	0.5 (0.6)	1.7 (0.7)	-1.0	-3.9, 1.8	0.475	Usual care MSADI-LC symptom distress worsened, improvements were seen for radical intervention group participants. Comparing the radical and palliative patients, the difference in the treatment effect was -1.0, 95% CI: (-3.9, 1.8), favouring radical. The test of zero effect modification gave P = 0.475.
	Intervention	-1.4 (0.6)	0.8 (0.9)				

Treatment effect = intervention group minus usual care, radical minus palliative subgroups. Test of effect modification = radical versus palliative. AQoL utility score=Assessment of Quality of Life utility score. FACT-L scale=Functional Assessment of Cancer Therapy-Lung. FACT-L LCS=Lung Cancer Subscale. FACT-L TOI=trial outcome index. MDASI-LC=MD Anderson Symptom Inventory-Lung Cancer (symptom subset defined apriori including drowsiness, fatigue, sleep disturbance, shortness of breath, and pain), lower scores indicate improved symptom severity and distress.

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