TITLE: A randomised controlled trial of the compuLsive Exercise Activity TheraPy (LEAP): A new approach to compulsive exercise in anorexia nervosa.

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Abstract

Objective: To compare the efficacy of the compuLsive Exercise Activity theraPy (LEAP) programme integrated with manualised cognitive behavioural therapy for anorexia nervosa (CBT-AN) compared to CBT-AN alone.

Method: Seventy-eight adults were randomised to CBT-AN, delivered with or without 8 embedded sessions of LEAP, for a total of 34 individual outpatient sessions. Participants were assessed at baseline, the end of the first phase of CBT-AN (which included LEAP), mid-therapy, end of therapy, and at 3 and 6-months follow-up. Linear mixed effects modelling was used for comparing trajectories over time by group in primary outcomes of pathological exercise cognitions and secondary outcomes of exercise frequency, BMI, eating disorder (ED) symptoms, AN stage of change, anxiety/depression, and health related quality of life.

Results: There were significant improvements over time in all outcomes. There were no significant differences between treatment groups in primary outcome measures. Fidelity and end-of- treatment participant satisfaction were satisfactory across both conditions.

Discussion: CBT-AN and LEAP added to CBT-AN resulted in improved attitudes and beliefs towards exercise and general improvements in BMI and eating disorder psychopathology in people with AN.

Introduction

Compulsive physical activity is common in people with anorexia nervosa (AN) (e.g., Fietz, Touyz, & Hay, 2014) and is associated with poorer outcomes (e.g., Steinhausen, Grigoroiu-Serbanescu, Boyadjieva, Neumärker, & Winkler, 2008). The Cook et al. (2016) review supported incorporating psychoeducation and cognitive restructuring of exercise beliefs into AN treatment but empirical research is lacking.

A cognitive behavioural model of compulsive exercise (Meyer, Taranis, Goodwin & Haycraft, 2011) has proposed a re-conceptualisation of exercise as having multiple maintaining factors including affect regulation. The present trial aimed to evaluate a cognitive behavioural therapy (CBT) for exercise embedded in the treatment of AN based upon this model, namely compuLsive Exercise Activity theraPy (LEAP). Primary outcomes were reduced pathological exercise cognitions. Secondary outcomes were reduced levels of driven exercise and eating psychopathology, improved weight gain, motivation to change, and health related quality of life (HRQoL).

Method

Design

This 3-site 2-armed parallel RCT recruited participants from clinics and community advertising. Eligibility procedures included an exercise frequency measure, body mass index (BMI; kg/m^2), the Eating Disorder Examination (EDE; Fairburn, Cooper, & O'Connor, 2008), the Mini-International Neuropsychiatric Interview (MINI; Sheehan, & Lecrubier, 2010) and medical assessment.

Those who met eligibility criteria and consented were randomised using an internet website with stratification by site, restricting vs. binge-eating/purging AN subtype, current use of psychotropic(s), and having had psychotherapy for AN within past 12 months. Only

the allocating investigator (PH) had access to randomisation group data. Assessors and participants were blind to group. Participants were informed they were having alternate forms of CBT and of the rationale for blinding. At end of treatment all were asked: *"Do you think you were in the new (novel) or existing (control) randomised condition for therapy?"*.

The two treatment groups were: 34 individual sessions over 8-10 months of manualised CBT for AN (CBT-AN; Pike, Walsh, Vitousek, Wilson, & Bauer, 2003) or two sessions of CBT-AN, eight sessions of LEAP treatment embedded within CBT-AN sessions, and then 24 further sessions of CBT-AN. Therapy was twice weekly for four weeks and weekly thereafter with 3 and 6 months follow-up delivered by CBT-trained specialist therapists.

Participants

Eligibility criteria were: ≥ 18 years, meeting DSM-5 (APA, 2013) criteria for AN, BMI 14 - 18.5, and reporting at least one exercise activity during the previous month Exclusion criteria were: a diagnosis of psychosis or bipolar disorder; and/or a high level of suicide risk; and/or medical compromise precluding outpatient care; and/or DSM-5 substance use disorder associated with 'clinically significant impairment or distress' (APA, 2013).

Ethics approvals were obtained from: the Western Sydney University Human Research Ethics Committee (HREC; lead committee) Protocol Approval number H7732; University of Sydney HREC Protocol Approval number 2012/684; the National Research Ethics Service in the UK, Health Research Authority Approval number 10/H0406/25; and the Institutional Review Board at Columbia University Protocol Approval number 1205012397.

Assessment measures

Eating disorder features and BMI were assessed using the EDE v6 (Fairburn, Cooper & O'Connor, 2008) interview. To reduce participant burden the EDE was administered at

baseline, end of treatment and 6 months follow-up. Cronbach's α for the EDE global score in the present study was .90.

Exercise activity at screening used the validated Exercise Participation Screening Questionnaire (EPSQ) (Davis, Kennedy, Ravelski, & Dionne 1994, Young et al., 2017). Participants were asked to report the number of weeks of engaging in any exercise in the past 4 weeks), the average number of exercise sessions per week, and the average duration of each session. Exercise frequency was computed by multiplying number of weeks x number of sessions per week x average duration in 30 minute blocks.

Exercise cognitions: These were assessed with the self-report 21-item Exercise Beliefs Questionnaire (EBQ), the 24-item Compulsive Exercise Test (CET), and the 8-item Commitment to Exercise Scale (CES). The EBQ (Loumidis & Wells, 1998) measures maladaptive beliefs about exercise in four domains: 'social desirability'; 'physical appearance'; 'mental and emotional functioning'; and 'vulnerability to disease and aging' with established psychometric properties (Young et al., 2017). Cronbach α for the EBQ total was .95. The CET (Taranis, Meyer & Touyz, 2011) measures core features of the LEAP model for compulsive exercise: Avoidance and Rule-Driven Behaviour, Weight Control , Mood Improvement, Lack of Exercise Enjoyment, and Exercise Rigidity. It has established psychometric properties (Young et al., 2017). Cronbach's α of the CET-total was .92. The CES (Davis, Brewer, & Ratusny, 1993) measures obligatory aspects of exercise behaviour (e.g., making up for missed exercise sessions). It has robust psychometrics (Young et al., 2017) and Cronbach α in this study was .95.

Health Related Quality of Life (HRQoL) was assessed with the widely used and validated Short Form-12 item Health Status Questionnaire v2 (SF-12; Ware, Kosinski & Keller, 1996). Cronbach's α for the overall scale was .88. Eating Disorder Quality of Life (EDQoL; Engel et al., 2006) was assessed with this disorder specific 25-item measure. It has

robust psychometric properties and Cronbach's α for the overall scale was .93. Depression and anxiety symptoms were assessed with the Kessler-10 item scale (K-10). It has robust psychometrics (Andrews & Slade, 2001). Cronbach's α was .92.

Motivation to change was assessed with the validated 20-item AN Stages of Change Questionnaire (ANSOCQ; Rieger, Touyz & Beumont, 2002) designed according to the Prochaska stages of change model was used. Cronbach's α for the overall scale was .91.

End of treatment participant's satisfaction with therapy was assessed with the 8-item Client Satisfaction Questionnaire (CSQ; Larsen, Attkisson, Hargreaves, & Nguyen, 1979). It has a high degree of internal consistency and has been found to correlate with therapists' assessment of client satisfaction and with early treatment drop out. Cronbach's alpha was .93, *n*=48. Participants were also asked to rate treatment suitability, perceived success of treatment, and if they would recommend it to others on a scale 1-9 (higher scores being a more positive perception).

Interventions

In LEAP, the aim is to equip individuals with knowledge and skills to enable them to regain control of their exercise behaviour in order to participate in age-, goal- and health-status appropriate exercise. LEAP consists of eight sessions embedded in 50-minute duration CBT-AN sessions. It incorporates behavioural experiments to reduce driven exercise and specific cognitive activities related to the individual's views on the maintenance of excessive exercise; education about what constitutes 'healthy' exercise; cognitive skills and strategies necessary to challenge maladaptive attitudes, beliefs and behaviours toward exercise; alternative (adaptive) emotion coping strategies; and relapse prevention. CBT-AN is an active three phase treatment aimed at restoring weight and normal eating habits by challenging underlying beliefs and thoughts through cognitive restructuring and behaviour change (Pike, Walsh, Vitousek Wilson, & Bauer, 2003).

Therapists and supervisors (MLP, PH, ST) were trained in LEAP and CBT-AN by CM, JA, and KP with a three-day training. Each therapist conducted two pilot supervised 34 session treatments. Weekly teleconference supervision was conducted and therapists also met onsite to review patients' progress. All sessions were audiotaped and therapist fidelity was assessed by an audit conducted by KP.

Regular follow-up medical assessments by a doctor blind to group were required and if indicated participants with medical compromise were hospitalised returning to the outpatient treatment trial provided this was less than 21 days. In addition to the Study Executive Committee an independent Data Management Safety Board (DMSB) of three independent clinical trial researchers met once to perform an interim futility analysis when over 50% of participants were recruited. At this time the advice was for the trial to proceed.

Statistics

Data were cleaned and inspected for normality. Using SPSS version 20, baseline univariate between-group tests (parametric and non-parametric) were done to compare groups at baseline on outcome variables and demographic data, with alpha set to .01 because of multiple comparisons.

STATA was used for linear mixed effects modelling with maximum likelihood imputation to test for between-group differences in the continuous outcome measures. These analyses were conducted by RC who was blind to group assignment. Estimates of effect size (Cohen's *d*) were calculated. All tests were 2-tailed.

An *a priori* power analysis was based on a standardized effect size of moderate improvements on the exercise questionnaires (assessing primary outcomes) of 0.5-0.6, with α (one sided) = .05, β = .2, the estimated minimum *n* per group was 51 -36.

Results

Seventy-eight adults were randomised (see Table 1): Sydney (*n*=28), Leicester (*n*=40) and New York (*n*=10). Between treatment group and site features are reported in Table 1 and Additional online Table 1. Participants in the UK were older than others. There were no other significant site differences (all p>.01).

INSERT TABLE 1 ABOUT HERE

Participant flow (see Additional online Figure 1): Thirty-five percent of those eligible to participate were randomized. Eighty-seven percent completed LEAP and the comparable CBT-AN treatment period. Fifty-five percent completed 75% of therapy sessions. Assessment attrition at 6-months was 45%; higher in the LEAP arm (53% vs 38%)

Between group outcome analyses: Primary and secondary outcome data are presented in Table 2.

INSERT TABLE 2 ABOUT HERE

There was a significant effect of time for all outcomes. There were no significant effects of group by time interactions with the exception of BMI (see also Additional online Figure 2). At 6-months 20 (52.6%) in the LEAP and 15 (37.5%) in the CBT-AN arm had BMI>18.5 and there were 22 (28%) people in "remission", i.e. scoring within 1 SD of community norms for Global EDE (Mond, Hay, Rodgers, Owen, & Beumont, 2004) BMI >18.5 (n= 11 in each treatment group).

Fidelity: Three raters had mean inter-rater agreement range of 68.63-96.25 on CBT components. Out of a total 56 rated sessions, only 3 sessions (5.4%) were rated as not conforming to standard CBT protocol. In 94.6% of sessions (53/56), clinicians were considered to have adhered to the basic overall structure and principles of the therapy.

Client satisfaction: At end of treatment the mean overall CSQ score was 3.39 (SD .56, range 3.12-3.53, n=48, maximum score of 4) and this did not differ between treatment groups (t(46)=1.175, *p*=.862). The mean scores for the therapy's suitability was 7.29 (SD 1.76, n=49), perceived success was 6.43 (SD=1.99, n=49), and recommendation to others was 7.49 (SD=1.77, n=49) (maximum scores of 9 for these three ratings).

Blinding: Thirty-nine (50%) participants answered the question on blinding, 14 considered they were in the novel group, 18 in the control group and seven did not know. Eleven (61%) correctly identified they received novel therapy and 14 (66%) correctly identified that they received the standard therapy. Overall 25 (64%) correctly identified their treatment group.

Discussion

In this study there was improvement over time for all outcomes. The severity of core compulsive exercise features on the CET improved to the levels of Australian young women in the community (Taranis, Touyz, & Meyer, 2011) and patients "recovered" from AN (Young, Rhodes, Touyz & Hay, 2015). There were no significant between group differences with the exception of BMI. However, the pattern of change was difficult to interpret in that BMI increased more rapidly during treatment in CBT-AN than in LEAP, but at 6-months months follow-up BMI was higher in the LEAP compared to the CBT-AN group. Also, one significant interaction out of 11 measures is nearing chance. Thus caution must be applied to the result.

Limitations of the study were that participants had a range of levels of compulsive exercise (albeit the mean CET was similar if not higher than reported in people with eating disorders) and attrition which was particularly high at the six month follow-up. Further, although minimal, CBT-AN also addresses exercise minimally with CBT approaches (1-2

sessions in the later phase of CBT-AN) and 64% participants were correct in guessing their treatment assignment, both of which may have reduced differences between groups. Strengths were maintenance of treatment fidelity, use of multiple sites which improves generalisability, and use of robust measures.

In conclusion, this study adds to previous literature regarding the incorporation of physical activity and cognitive restructuring of attitudes towards compulsive exercise into AN treatment. Clinicians may choose to use CBT-AN with or without LEAP for people with anorexia nervosa.

Declarations

PH has received in sessional fees and lecture fees from the Australian Medical Council, Therapeutic Guidelines publication, and New South Wales Institute of Psychiatry and royalties from Hogrefe and Huber, McGraw Hill Education, and Blackwell Scientific Publications, and she has received research grants from the NHMRC and ARC. She is Deputy Chair of the National Eating Disorders Collaboration in Australia (2012-2013). In July 2017 she provided a commissioned report for Shire Pharmaceuticals on lisdexamfetamine and binge eating disorder.

ST has received royalties from Hogrefe and Huber, Mc Graw Hill Education and Routledge for the publication of books/chapters. He is the Chair of the Shire (Australian) BED Advisory Committee and has received travel grants, research grants and honoraria from Shire for commissioned reports.

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Table 1

Participant demographic and clinical features by randomisation group

		LEAP	CBT-AN				
Feature	*n*	*M (SD)*	*M (SD)*	*t (df)*	*p*	*Cohen's d*	95% CI
Age/years	78	26.1 (7.9)	28.6 (10.3)	1.16 (76)	.25	.27	[-.18, .72]
Onset AN /years	72	16.7 (4.9)	20.2 (9.4)	1.94 (70)	.06	.45	[.001, .90]
Lowest adult weight /kg	76	40.7 (4.3)	41.7 (5.1)	-.91 (74)	.37	.21	[-.23, .66]
		Mdn (IQR)		*U (Z)*		$\eta 2_{\dagger}$	
EPSQ total	78	130 (16-336)	180 (62-314)	685 (-.75)	.45	.17	-
		n (%)		χ^2 (df=1)	*p*	*RR*	
Male	78	2 (5.0%)	2 (5.3%)	.003	1.00††	1.05	[.16, 7.10]
Marital status-Married	78	8 (21%)	13 (33%)	1.30	.26	.65	[.30, 1.39]
University education	78	19 (50%)	22 (55%)	.20	.66	.91	[.60, 1.40]
Employed	78	19 (50%)	28 (70%)	3.27	.12	.71	[.49, 1.04]
Restrictive sub-type AN	78	24 (63%)	26 (65%)	.03	.87	.97	[.70, 1.36]

Note: CI = confidence interval; EPSQ = Exercise Participation Screening Questionnaire; RR = Risk Ratio; AN = Anorexia Nervosa; Employed = paid employment or home-maker;

† Eta squared ††Fisher's exact test

Table 2

Primary and secondary outcomes between groups with between group effect size (Cohen's d) at each time point and linear mixed effects modelling analyses with maximum likelihood imputation of complete sample (n=78).

		Baseline	T1 10 weeks LEAP end	T2 20 weeks Mid therapy	T3 34 weeks End therapy	T4 3 months follow up	T5 6 months follow-up	Time		Group x time	
Outcome	Group	*M (SD)*						*F* *(df)*	*p*	*F* *(df)*	*p*
Compulsive Exercise Test	LEAP	15.7 (4.3)	14.9 (4.4)	12.5 (4.3)	11.9 (5.5)	13.2 (4.5)	12.8 (5.1)	44.46 (1,383.31)	<.001	3.71 (1, 310.00)	.06
	CBT-AN	16.8 (4.5)	15.1 (5.4)	14.9 (5.1)	14.1 (4.8)	13.9 (4.8)	13.7 (5.1)				
	Cohen's *d*	.25	.04	.51	.43	..15	.18				
	95% CI	[-.20, .70]	[-.40, .49]	[.06, .96]	[-.02, .88]	[-.29, .60]	[-.27, .62]				
Exercise Beliefs Questionnaire	LEAP	45.6 (21.2)	37.5 (23.8)	30.2 (20.4)	27.1 (21.1)	29.6 (27.4)	29.3 (20.8)	19.15 (1, 56.25)	<.001	2.80 (1,356.25	.10
	CBT-AN	46.0 (24.3)	43.7 (27.4)	44.9 (25.8)	40.0 (27.5)	39.4 (27.5)	44.0 (27.9)				
	Cohen's *d*	.02	.24	.63	.53	.36	.60				
	95% CI	[-.43, .46]	[-.20, .69]	[.18, 1.09]	[.07, .98]	[-.09, .81]	[.14, 1.05]				
Commitment to Exercise Scale	LEAP	60.8 (27.9)	46.5 (26.4)	34.8 (25.0)	36.8 (26.5)	36.0 (29.7)	31.3 (24.2)	56.17 (1, 373.34)	<.001	.90 (1,373.34)	.34
	CBT-AN	70.1 (26.7)	60.9 (30.8)	58.5 (30.4)	47.8 (30.4)	50.5 (30.4)	51.9 (32.4)				
	Cohen's *d*	.34	.51	.85	.39	.48	.72				
	95% CI	[-.11, .79]	[.06, .96]	[.39, 1.31]	[-.06, .83]	[.03, .93]	[.26, 1.18]				

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Table 2 contd

		Baseline	T1 10 weeks LEAP end	T2 20 weeks Mid therapy	T3 34 weeks End therapy	T4 3 months follow up	T5 6 months follow-up	Time		Group x Time	
Outcome	Group	*M (SD)*						*F* *(df)*	*p*	*F* *(df)*	*p*
Psychological distress, Kessler-10 questionnaire	LEAP	31.5 (9.2)	30.1 (9.1)	27.9 (9.8)	24.3 (8.4)	23.3 (7.8)	23.2 (7.6)	8.98, (1, 379.82)	<.01	1.23 (1, 379.82)	.27
	CBT-AN	30.4 (9.9)	27.8 (10.6)	26.8 (9.5)	22.3 (9.8)	22.0 (7.5)	22.5 (8.2)				
	Cohen's *d*	-.12	-.23	-.11	-.22	-17	-.09				
	95% CI	[-.56, .33]	[-.68, .21]	[-.56, .33]	[-.66, .23]	[-.62, .28]	[-.53, .36]				
Anorexia Nervosa Stage of Change	LEAP	2.4 (.6)	2.7 (.8)	3.0 (.8)	3.0 (.9)	2.9 (1.1)	2.7 (1.9)	26.89 (1, 385.21)	<.001	16.23 (1, 385.21)	.52
	CBT-AN	2.4 (.6)	2.8 (.8)	2.9 (.7)	3.3 (1.0)	3.2 (1.3)	3.4 (1.5)				
	Cohen's *d*	0	.13	.13	.32	.25	.41				
	95% CI	[-.44, .44]	[-.32, .57]	[-.58, .31]	[-.13, .76]	[-.20, .69]	[-.04, .86]				
EDQoL	LEAP	1.6 (.6)	1.5 (.6)	1.4 (.7)	1.1 (.8)	1.2 (.8)	.9 (.7)	36.54 (1, 85.04)	<.001	4.02 (1, 385.04	<.05
	CBT-AN	1.8 (.8)	1.5 (.7)	1.4 (.9)	1.0 (1.0)	1.0 (.8)	1.1 (.9)				
	Cohen's *d*	.28	0	0	-.11	.25	..25				
	95% CI	[-.16, .73]	[-.44, .44]	[-.44, .44]	[-.55, .33]	[-.70, .20]	[-.20, .69]				

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Table 2 contd

		Baseline	T1 10 weeks LEAP end	T2 20 weeks Mid therapy	T3 34 weeks End therapy	T4 3 months follow up	T5 6 months follow-up	Time		Group x Time	
Outcome	Group	*M (SD)*						*F (df)*	*p*	*F (df)*	*p*
HRQoL MCS	LEAP	28.7 (10.9)	32.1 (11.5)	33.4 (12.5)	35.6 (10.0)	34.2 (11.0)	37.8 (10.9)	19.367 (1, 381.96)	<.001	.98 (1, 381.96)	.32
	CBT-AN	29.5 (13.0)	33.3 (11.8)	33.4 (12.4)	39.1 (11.4)	39.9 (11.6)	40.2 (13.1)				
	Cohen's *d*	..07	.10	0	.33	.50	.20				
	95% CI	[-.38, .51]	[-.34, .55]	[-.44, .44]	[-.12, .77]	[.05, .96]	[-.25, .64]				
HRQoL PCS	LEAP	47.7 (9.2)	46.2 (10.5)	48.2 (9.4)	51.2 (10.8)	51.2 (6.8)	51.4 (9.4)	8.98 (1, 379.82)	.003	1.23 (1, 379.82)	.27
	CBT-AN	46.2 (11.1)	48.3 (11.5)	49.6 (9.1)	51.2 (9.6)	50.2 (8.5)	48.9 (11.3)				
	Cohen's *d*	-.15	.19	.15	0	.-13	-.24				
	95% CI	[-.59, .30]	[-.26, .64]	[-.29, .60]	[-.44, .44]	[-.57, .32]	[-.69, .21]				
EDE Driven Exercise	LEAP	49.24 (30.12)	n.a.	n.a.	24.05 (31.34)	n.a.	23.47 (21.29)	40.68 (1, 116.90)	<.001	.856 (1, 116.90)	.36
	CBT-AN	58.20 (27.39)	n.a.	n.a.	38.27 (25.21)	n.a.	35.70 (24.93)				
	Cohen's *d*	.31	n.a.	n.a.	.50	n.a.	.53				
	95% CI	[-.14, .76]	n.a.	n..a	[.05, .95]	n.a.	[.07, .98]				

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Table 2 contd

		Baseline	T1 10 weeks LEAP end	T2 20 weeks Mid therapy	T3 34 weeks End therapy	T4 3 months follow up	T5 6 months follow-up	Time		Group x Time	
Outcome	Group	*M (SD)*						*F* *(df)*	*p*	*F* *(df)*	*p*
EDE Body Mass Index (kg/m2)	LEAP	16.58 (1.04)	n.a.	n.a.	16.99 (4.04)	n.a.	19.04 (3.40)	7.92 (1, 99.96)	.01	6.48 (1, 99.96)	.01
	CBT-AN	16.47 (1.20)	n.a.	n.a.	18.49 (2.90)	n.a.	18.12 (2.98)				
	Cohen's *d*	-.10	n.a.	n.a.	.43	n.a.	-.29				
	95% CI	[-.54, .35]			[-.02, .88]		[-.74, .16]				
Global EDE score	LEAP	3.54 (1.29)	n.a.	n.a.	2.28 (1.32)	n.a.	2.08 (1.77)	34.37 (1, 104.56)	<.001	.38 (1, 104.56)	.54
	CBT-AN	3.18 (1.29)	n.a.	n.a.	2.16 (1.42)	n.a.	1.99 (1.47)				
	Cohen's *d*	-.28	n.a.	n.a.	-.09	n.a.	-.06				
	95% CI	[-.73, .17]			[-.53, .36]		[-.50, .39]				

Note: CI = confidence interval; EDQoL = Eating Disorder Quality of Life Questionnaire; HRQoL MCS = Health Related Quality of Life Mental Health Component Score on the Short Form 12 item questionnaire; HRQoL PCS = Health Related Quality of Life Physical Health Component Score on the Short Form 12 item questionnaire; EDE = Eating Disorder Examination; n.a. = not applicable

Additional online Table: Site group demographic, and primary outcome comparisons

		Australia (Aus) N=28	UK n=40	USA n=10		
Feature	n	Median (IQ range)			K-W H, df=2, p	Post hoc p<.05
Age/years	78	27.5 (23.5-31.7)	22.2 (19.6-26.5)	36.1 (23.2-54.6)	9.42, <.01	UK<Aus, USA
Age perceived onset AN /years	72	16.0 (14.0-20.5)	16.0 (14.0-20.3)	20.0 (17.0-30.0)	2.23, .33	-
Lowest adult weight /kg	76	39.5 (36.8-42.0)	41.9 (39.5-45.0)	42.1 (39.0-44.1)	4.44, .11	-
EPSQ total score	78	86 (44-311)	168 (54-365)	216 (184-283)	2.84, .24	-
Compulsive Exercise Test (CET)	78	15.55 (12.40-18.22)	17.37 (14.68-19.63)	18.99 (15.03-19.71)	6.38, .04	-
Exercise Beliefs Questionnaire (EBQ)	78	48.96 (30.78-64.36)	46.80 (24.12-59.60)	58.60 (30.10-85.34)	2.47, .29	-

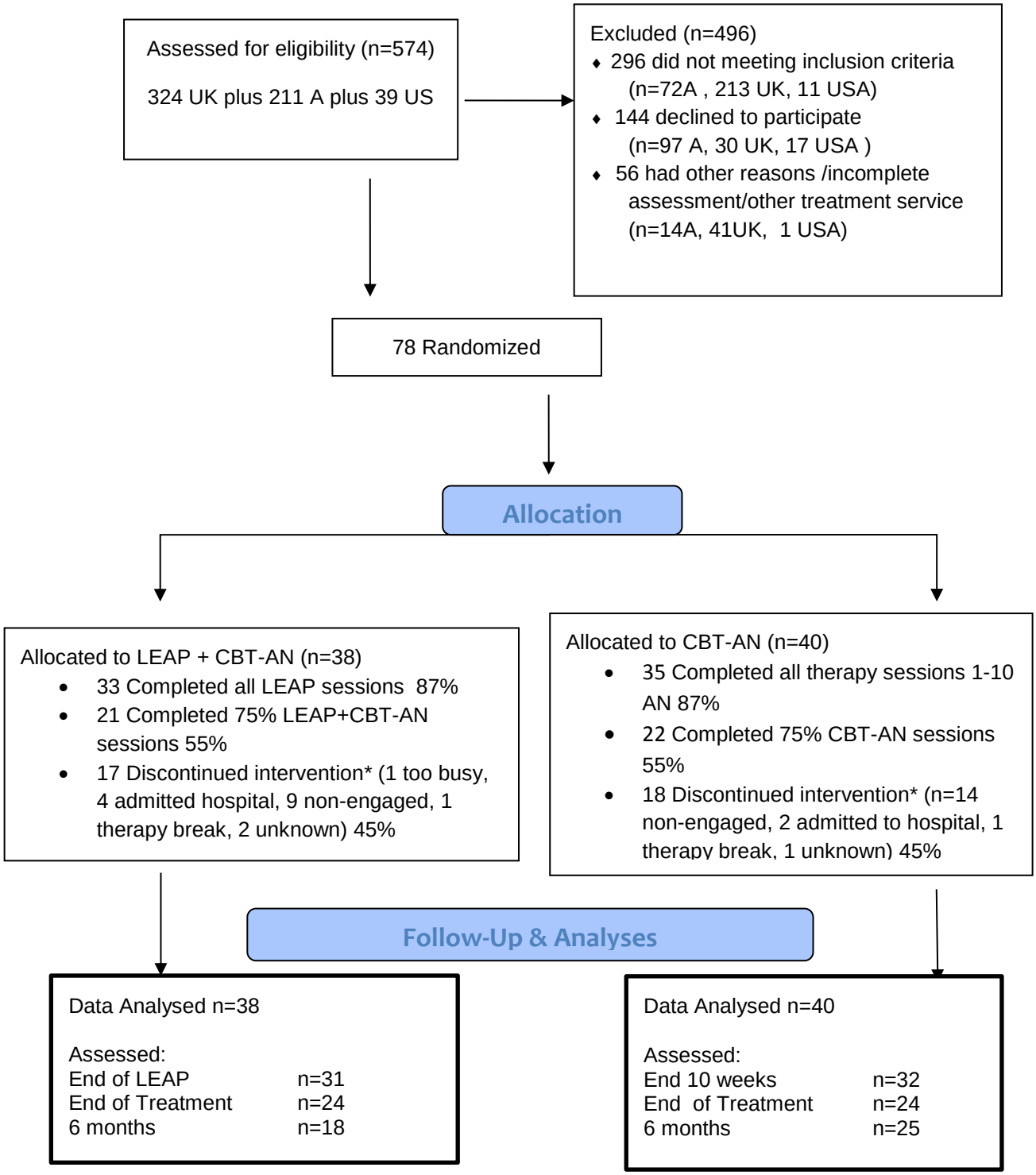
Table contd on next page

Additional online Table contd: Site group demographic, and primary outcome comparisons

		Australia (Aus) N=28	UK n=40	USA n=10		
Feature	n	Median (IQ range)			K-W H, df=2, p	Post hoc p<.05
Commitment to Exercise Scale (CES)	78	65.09 (41.70-86.94)	70.13 (54.75-90.88)	85.06 (59.75-87.50)	1.17, .56	-
EDE BMI kg/m^2	78	16.40 (15.60-17.24)	16.80 (15.60-17.39)	17.36 (16.71-17.80)	5.03, .08	-
Global EDE score	78	3.0 (2.1-3.7)	3.9 (3.1-4.8)	2.4 (.8-4.2)	5.71, .06	-
EDE Driven exercise	78	54.5 (10.5-79.5)	60.0 (34.0-81.5)	73.0 (67.0 - 84.0)	3.58, .17	-
		n (% those within those with the feature)			χ^2, df=2, p	
Male	78	2 (50%)	1 (25%)	1 (25%)	1.289, .53	-
Marital status-Married	78	9 (43%)	8 (38%)	4 (19%)	2.231,.33	-
University level education	78	18 (44%)	16 (39%)	7 (17%)	5.295,.07	-
In paid employment/ homemaker	78	19 (40%)	22 (47%)	6 (13%)	1.137, .57	-
Restrictive sub-type	78	18 (36%)	24 (48%)	8 (16%)	1.391, .50	

EPSQ = Exercise Participation Screening Questionnaire

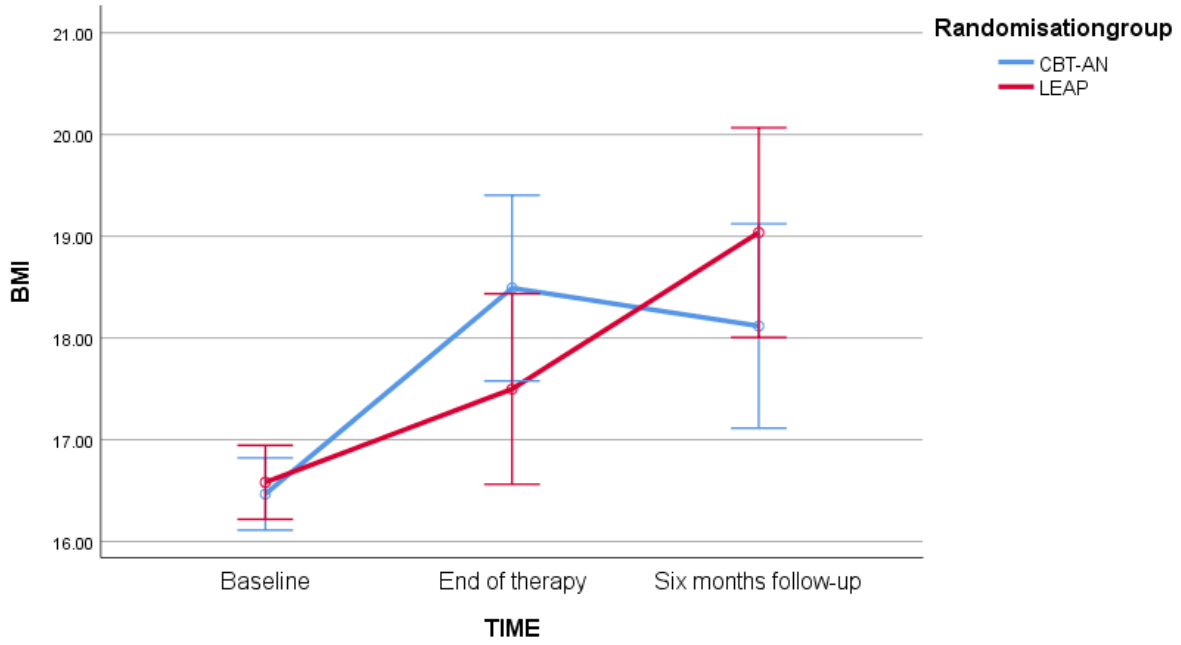
Additional online Figure 1. Participant flow



*Note: None were returned to the study after less than 3 weeks of hospitalisation.

A=Australia, UK=United Kingdom, USA=United States of America , LEAP =The compuLsive Exercise Activity TheraPy added to Cognitive Behaviour Therapy for Anorexia Nervosa arm of the trial, CBT-AN = The Cognitive Behaviour Therapy for Anorexia Nervosa without LEAP arm of the trial

Additional online Figure 2. Body mass indices (BMI) for each intervention group over time with maximum likelihood imputation of complete sample (N=78).



BMI (kg/m^2) as measured during Eating Disorder Examination,

Error bars represent 95% CI.