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ORIGINAL ARTICLE

Active Living Becomes Achievable (ALBA): An Evaluation of the Effectiveness of a Behaviour Change Intervention at Promoting Physical Activity for Improved Mental Wellbeing

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Abstract Physical activity (PA) has been shown to be beneficial for physical and mental wellbeing. However, there is evidence to indicate people with mental health conditions are significantly less active than the general population. The aim of the research is to evaluate the effectiveness of Active Living Becomes Achievable (ALBA), a behaviour change intervention designed to specifically target individuals with mental and physical health conditions to increase motivation and adherence to physical activity to improve physical and mental wellbeing. 318 participants were recruited through existing exercise referral schemes in three areas of Scotland. A quantitative outcome evaluation, with a before and after design was carried out to assess the effectiveness of the intervention. Participants completed 5 outcome measures—the Scottish Physical Activity Questionnaire (SPAQ), the Self-Efficacy for Exercise Scale (SEE), the Warwick Edinburgh Mental Wellbeing Scale (WEMWBS), the Patient Activation Measure (PAM) and the Rosenberg Self Esteem Scale—and wore an activity tracker for 16 weeks. Participants who opted into the long-term study were monitored for up to 12-months. ALBA significantly improved mental wellbeing, patient activation and self-efficacy. Although the intervention did not appear to increase adherence to PA. The ALBA intervention was effective at improving mental wellbeing but did not have a significant effect on PA levels. This suggests that the additional support offered through the ALBA intervention was key to improving wellbeing.

Keywords Mental health · Evaluation · Adherence · Exercise · Intervention · Behaviour change

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Introduction

According to the World Health Organisation (WHO), mental health conditions are a major contributor to the global burden of disease, with depression alone accounting for 4.3% of the global burden of disease and is one of the leading causes of disability [57]. Epidemiological research in Scotland suggests that mental health conditions cost the NHS an estimated £10.7 billion per year [28] with 17% of adults

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exhibiting possible symptoms of a mental health condition [50].

Mental health conditions have consistently been found to be co-morbid with physical health conditions, such as cardiovascular disease (CVD), cancer, diabetes and other non-communicable diseases (NCD) [8, 15, 35]. In Scotland, it is estimated that around 2 million people have at least one long term condition, and one in four adults report some form of long-term disability or chronic health problem [28]. One of the Scottish Government's key aims as outlined in the *Mental Health Strategy 2017–2027* [49] is to improve the physical and mental wellbeing of people with mental health condition, in order to help people experiencing poor mental health to live longer and healthier lives.

Physical Activity (PA) is linked with improved physical and mental health, with evidence showing that regular PA reduces the risk of coronary heart disease (CHD) [22], type 2 diabetes [5] and cancer [18]. Substantial evidence has also been found to support the effectiveness of PA in reducing anxiety [16, 58] and depression [41, 45]. Engagement in PA can also have a wide range of social benefits, such as improved quality of life, increased opportunities for social engagement, and enjoyment [20, 37].

Despite the well-established benefits of PA for mental health, the evidence suggests that people with mental health conditions are less active than the general population [56]. A meta-analysis conducted by Schuch et al. [45] found a large (SMD = 1.11, 95% CI 0.79–1.43) antidepressant effect of exercise on depression when compared to non-active controls. There is also evidence to suggest that PA can help to prevent subsequent depressive episodes [25]. Knapen et al. [20] found that for mild-to-moderate depression, the effects of PA were comparable to antidepressants and psychotherapy, whereas for severe depression, PA was considered a valuable complimentary treatment. A systematic review conducted by Vancampfort et al. [56] revealed that people with serious mental health conditions are significantly more sedentary than healthy controls. This review concluded that, given the established health benefits of PA for people with mental health conditions, there is a need for more targeted intervention specific to this population to prevent physical inactivity.

The National Institute for Health and Care Excellence (NICE) Guidelines recommend structured exercise programs as a treatment for mild to moderate depression [32]. Yet, individuals who have a mental health condition are more likely to drop out of exercise referral schemes (ERS) [52]. This lack of adherence to ERS means that individuals with mental health conditions often do not engage long enough to see the health benefits. It has been suggested that a possible reason for this lack of adherence may be the prescribed intensity, as it has been found that interventions which are tailored to individual needs and preferences are more effective for participants with mental health conditions. A recent study found that an individually tailored ERS which allowed individuals with depression to exercise at their preferred intensity had greater antidepressant effects than at the prescribed intensity of the ERS [31].

'Active Living Becomes Achievable' (ALBA) is a complex behaviour change intervention which aims to address the issue of poor physical and mental health in people with mild-to-moderate mental health conditions by improving adherence to ERS. The ALBA intervention has been designed to be integrated into the existing ERS and uses cognitive-behavioural strategies to increase individual's motivation to engage in PA. The Medical Research Council (MRC) guidance advocates the importance of evaluating complex interventions [6]. The aim of this study was to evaluate the effectiveness of the ALBA intervention at increasing adherence to PA and improving mental wellbeing in individuals with mental health conditions.

Method

Design

The study was a pre and post design with an optional 6 and 12 months follow up period. The intervention was delivered in 3 areas in Scotland: Fife, North Ayrshire and West Lothian. Ethical approval was granted by the NRES Committee for West of Scotland on 09 January 2017 (REC ref 16/WS/0246) and from Edinburgh Napier University School of Applied Sciences Ethics Committee.

Participants

Recruitment for ALBA participants was conducted in collaboration with the local leisure trusts. Participants were recruited through existing ERS pathways. Assessment of suitability for the ALBA intervention was conducted at point of referral by the Health and Wellbeing Teams at the respective sites. Table 1 details the inclusion/exclusion criteria.

Intervention

The "Active Living Becomes Achievable" (ALBA) intervention is a multicomponent intervention developed by the charity the Scottish Association for Mental Health (SAMH). ALBA is based on the COM-B (Capability, Opportunity and Motivation = Behaviour) model of behaviour change [29]. The COM-B model of behaviour change is a simple model of behaviour change, which posits that for a behaviour to take place, the individual needs to have the capability, opportunity, and motivation to carry out the behaviour.

The intervention consisted of the following components: (a) weekly, and then fortnightly 1:1 face-to-face hourly meetings with a trained behaviour change practitioner (BCP) over the course of 16 weeks; (b) access to the exercise referral programme that was offered by the local leisure centre; (c) an activity tracker and the "Get Active" app which was designed to increase motivation and facilitate self-monitoring of behaviour; and (d) access to peer supporters, who have been through the ALBA intervention and peer supporter training who can offer support outside of the sessions with the BCP's. How these components map onto the COM-B model is demonstrated in Fig. 1.

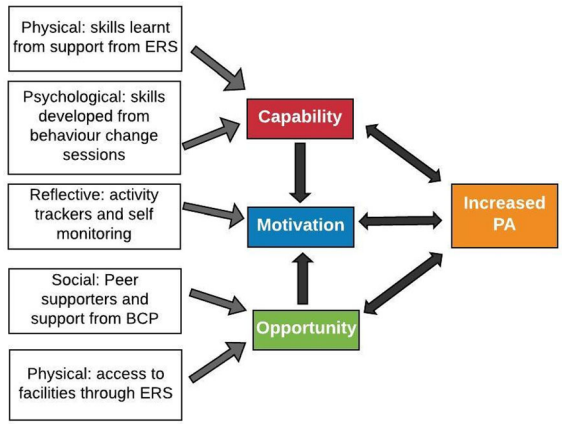

Fig. 1 ALBA Components mapped onto the COM-B Model

The one-to-one sessions with the BCP involve the use of cognitive-behavioural techniques and motivational interviewing to help elicit behaviour change and encourage participants to set goals and overcome barriers which prevent them from engaging in physical activity. To undertake the role of BCP, the recruited practitioners underwent a thorough training program, including Motivational interviewing training, Applied Suicide Intervention Skills Training (ASIST), Living Life to the Full Training for low mood and stress, and Enhancing Behaviour Change Training, which was specifically developed for delivering ALBA and is recognised by Chartered Institute for the Management of Sport and Physical Activity (CIMSPA).

Measures

Scottish Physical Activity Questionnaire (SPAQ) (Lowther et al. [23]) is a self-report questionnaire assessing seven-day recall of moderate and vigorous activity in minutes and incorporating a Stage of Exercise Behaviour Change instrument. The SPAQ

Table 1 Inclusion/exclusion criteria

Inclusion criteria	Exclusion criteria
Aged 18 and over Inactive and have been referred either by their GP or health professional into an exercise referral scheme due to either a long-term health condition or a mental health condition	High risk due to health reasons (unstable angina, uncontrolled resting BP > 180/100 mmhg, significant drop in BP during exercise, tachycardia > 100 bpm, unstable or acute heart failure, uncontrolled acute systemic illness, unable to maintain seated upright position, place others and themselves at risk) or if their mental health condition is classified as severe and enduring

requires participants to estimate the amount of time in minutes spent engaging in physical activity over the previous week, there is a measure of leisure time activity and work time activity. It was developed and validated in a Scottish community sample for the investigation of changes in the activity of groups and has good reliability (Cronbach's alpha = 0.998).

Activity Trackers (Storm ID LTD 2016) served as an objective measure of physical activity. The tracker devices were worn on either the wrist or the hip. Activity was captured in the form of step count. To log data, participants were set up with a username and password on the "Get Active" app (Version 1.0.27.2) which then allowed data from the tracker to be synchronised by smart phone or tablet with the account. Participants were able to login to their account themselves to synchronise data, view graphs and charts of their daily and weekly step count. The trackers needed to be synced with the account once every thirty days, or the data for that time period was lost. Data were collected for 16 weeks; participants were subsequently monitored for up to 12 months. The sensitivity of the activity trackers was tested against Omron pedometers, in a real person walking test. The results found that the Storm activity trackers had an error rate of 2.8% per 1000 steps when worn on the wrist compared against the Omron 2.6% error rate for the same distance.

Warwick-Edinburgh Mental Well Being Scale (WEMWBS) [47] is a self-report measure of mental well-being. It is a 14-item scale with 5 response categories, summed to provide a single score ranging from 14–70. The items are all worded positively and cover both feeling and functioning aspects of mental wellbeing. WEMWBS has been validated in people ages 14–74, has good content validity, and high internal consistency (Cronbach's $\alpha = 0.91$).

Rosenberg Self-Esteem Scale (Rosenberg [42]) is a tool for measuring global self-esteem. The scale is a ten item Likert scale with items answered on a four-point scale—from strongly agree to strongly disagree. The scale ranges from 0–30. Scores between 15 and 25 are within normal range; scores below 15 suggest low self-esteem. It has demonstrated excellent internal consistency (range from 0.77 to 0.88). Test–retest reliability for the RSE range from 0.82 to 0.85.

Patient Activation Measure—Mental Health (PAM-MH) [13] is a self-report measure of patient activation. Patient activation is a concept which specifies the level of patients' engagement, self-reported knowledge, skills, behaviours, and confidence for self-management of health and chronic diseases. There are 13 items, which have four possible response options ranging from (1) strongly disagree to (4) strongly agree, and an additional ''not applicable'' option. The measure was validated in an out-patient population waiting for mental health treatment by Moljord et al. [30]. The test–retest reliability (Pearson's r = 0.74) and concurrent validity were good, and the PAM-MH showed sensitivity to change.

Self-Efficacy for Exercise Scale (SEE) (Resnick and Jenkins [38]) is a 9-item questionnaire that focuses on the self-efficacy expectations for exercise. Self-efficacy, one of the most consistent predictors of exercise adherence, is related to stage of change [36]. The participant is asked about their confidence level, on a scale from 0 (not confident) to 10 (very confident), if they would exercise 3 times per week for 20 min during each of the nine situations, the scale has a range of total scores from 0 to 90.

Demographic Information such as age, gender, ethnicity, and race will be collected from participants during the first questionnaire. A measure of socioeconomic status will be calculated from the answer to a proxy measure question about level of education and postcode, using the Scottish Index of Multiple Deprivation (SIMD16; http://simd.scot).

Procedure

Recruitment of participants occurred between March 2017 and December 2018.

Participants who consented to taking part in the study were set up with an activity tracker by the behaviour change practitioner (BCP) at the initial meeting, which was then used to collect physical activity data throughout the 16-week intervention period. At the first appointment the participants completed the baseline measures. Participants received a minimum of 2 weeks of 1:1 behaviour change session's prior to starting an exercise program, then during the 12 weeks of PA they received fortnightly meetings with the behaviour change practitioner. In these fortnightly meetings the participants were also supported to sync their trackers.

At the end of the 16-week intervention period participants had their final meeting with the BCP, at this meeting they completed the post-intervention

measures of questionnaires. Participants were then given the option to consent to long term follow up. Participants who opted into the long-term study (Table 3) continued to use their tracker. The BCP also offered check in appointments with the long-term participants every three weeks. These meetings were not longer than 30 min and were offered in person or on the phone but did not involve delivering any new intervention content. At the 6 and 12-month post intervention points, long term participants were asked to complete the questionnaire measures. These were sent by post or email according to preference of participant, or it was arranged for the participant to meet with the BCP in order to complete the measures.

Numbers of Recruits and Sample Size Calculations

A target of 336 (112 participants in each area) was set based on capacity of BCP and to account for drop out. Previous studies which have evaluated cognitive behaviour interventions have found a medium effect size for changes on depression [7], similarly, studies which have evaluated the use of behavioural support have found a medium effect size of 0.43 [4]. Therefore, following this convention, the effect size 0.43 was projected for this study. An a priori power analysis was conducted on G*Power 3.0 [11] running a mean: difference between two independent means with the following assumptions: one tailed hypothesis, d = 0.43, alpha error. 05, power 80%. This returned a projected sample size of 136 to achieve this effect size for a within group comparison.

Data analysis

Primary Outcome

Adherence was analysed by calculating the number of participants as a percentage that achieved the threshold criteria level of adherence in each area. Reasons for drop out or excluding participants were categorised.

Secondary Outcomes

An intention-to-treat approach was taken to the analysis [14], with last observation carried forward (LOSCF; Salkind [43]). This was to preserve sample size to ensure sufficient power. Data was imported into SPSS and checked for outliers and homogeneity of variance. All statistical analyses were conducted using SPSS 20 (IBM). Extreme case outliers were removed. A MANOVA was conducted to measure the effectiveness of the intervention on mental wellbeing, PA level, self-esteem, self-efficacy, and patient activation. Time point was used as the independent variable and the measures SPAQ, SEE, PAM, WEMWBS and ROSENBERG, alongside the tracker data, were used as the dependent variables. Post hoc ANOVAs were performed as a follow up analysis.

Results

In total, 318 participants were recruited to take part in the ALBA intervention, across all three areas. Overall, ALBA participants were 68% female, 90.3% White—British, 20.8% came from the most deprived SIMD Decile, average age 41.2 (min 18, max 80, SD = 13.10), and 45.5% considered themselves to have a disability.

Table 2 breaks down the demographic information by area.

Adherence

Of these 318, 171 participants completed the intervention, giving a completion rate of 53%. Of the 171 participants who completed the intervention, 129 (40.6%) were classified as adhering as they attended 8 or more sessions with BCP. Reasons for drop out were recorded when possible (see Table 3), although the majority of participants who dropped out, provided no reason and contact was lost (Fig. 2).

The activity tracker data is presented in Table 4. Data from each participant was organised by date, and weekly totals were calculated. Adherence to the CMO guidelines was calculated based on the assumption that 3000 steps is equivalent to 30 min of moderate activity, based on the cadence of 100 steps/per minute [26, 54]. Therefore, to meet recommended PA guidelines, an individual would have to complete an additional of 3000 steps, over and above the < 5000 sedentary level, meaning a daily step count of > 8000 would equate to meeting the PA recommendations [53]. The UK Chief Medical Office (CMO) guidelines published in 2019 advocate accumulating 150 min of moderate to vigorous PA in a week, a translation of

Table 2 Participant demographics by area

	Fife (n = 107)	West Lothian (n = 126)	North Ayrshire (n = 85)
Sex	66% Female	64.8% Female	74.7% Female
	33% Male	35.2% Male	24.1% Male
	1% Prefer not to say		1.2% Prefer not to say
Age (mean)	43.4 (SD = 12.58)	38.7 (SD = 12.83)	41.8 (SD = 13.69)
	Min: 20	Min: 18	Min: 20
	Max: 69	Max: 70	Max: 80
Ethnicity	96% White British	89.6% White British	88.4% White British
	1.6% Other	8% White Other	4.7% White Other
	1.6% Asian or Asian British—Chinese	0.8% Asian or Asian British—Any other Asian background	1.2% Other
		0.8% Mixed—White & Black African	
Disability (yes/no)	54.8% Yes	34.4% Yes	49.4% Yes
	45.2% No	65.6% No	50.6% No
Education level	11.8% University (less than 4-year Bachelors)	9.8% University (less than 4-year Bachelors)	16.9% University (less than 4-year Bachelors)
	44% College (HND or HNC)	30.3% College (HND or HNC)	25.3% College (HND or HNC)
	8.8% High school (6 years)	10.7% High school (6 years)	8.4% High school (6 years)
	12.7% High school (5 years)	17.2% High school (5 years)	15.7% High school (5 years)
	15.7% High school (4 years)	27.9% High school (4 years)	28.9% High school (4 years)
SIMD decile	Most Deprived decile 1:17.4%	Most Deprived decile 1: 16.9%	Most Deprived decile 1: 30.8%
	Least Deprived Decile 10: 5.8%	Least Deprived Decile 9: 1.4%	Least Deprived Decile 9: 5.8%

Table 3 Reasons for drop out

Reason for drop out	*N*	%
No reason	64	52
Health complications	14	11
Decided not for them	8	6
Too busy	8	6
Started full time employment	4	5
Complete intervention but didn't want to do study	3	4
Bereavement	2	2
Change of staff	2	2
Didn't think suitable	2	2
Family circumstances	2	2
Moved	2	2
Difficulty getting to appointments	1	1
Health—GP decided not suitable	1	1
Lack of childcare	1	1
Started volunteering	1	1

this into steps would equate to a weekly total of > 50,000 steps/week (baseline of 5000 a day for 7 days with an additional 15,000). The percentage of participants who met these criteria was calculated. The mean weekly total step count was calculated across all participants.

Secondary Outcomes

Table 5 presents the means and standard deviation on each measure across the four timepoints.

Before a Multivariate analysis of variance (MANOVA) could be conducted, the data was tested against a range of assumptions of normality and equality of variance. First, the Box's test of equality of covariance matrices was significant (0.000), meaning that covariance matrices for the dependent variables were not equal across groups. Second, the Shapiro–Wilk test of normality was used to investigate the assumption of normality. The assumption of normality was violated for SPAQ and objectively measured PA. Furthermore, the Pillai's trace statistic was reported, as said statistic

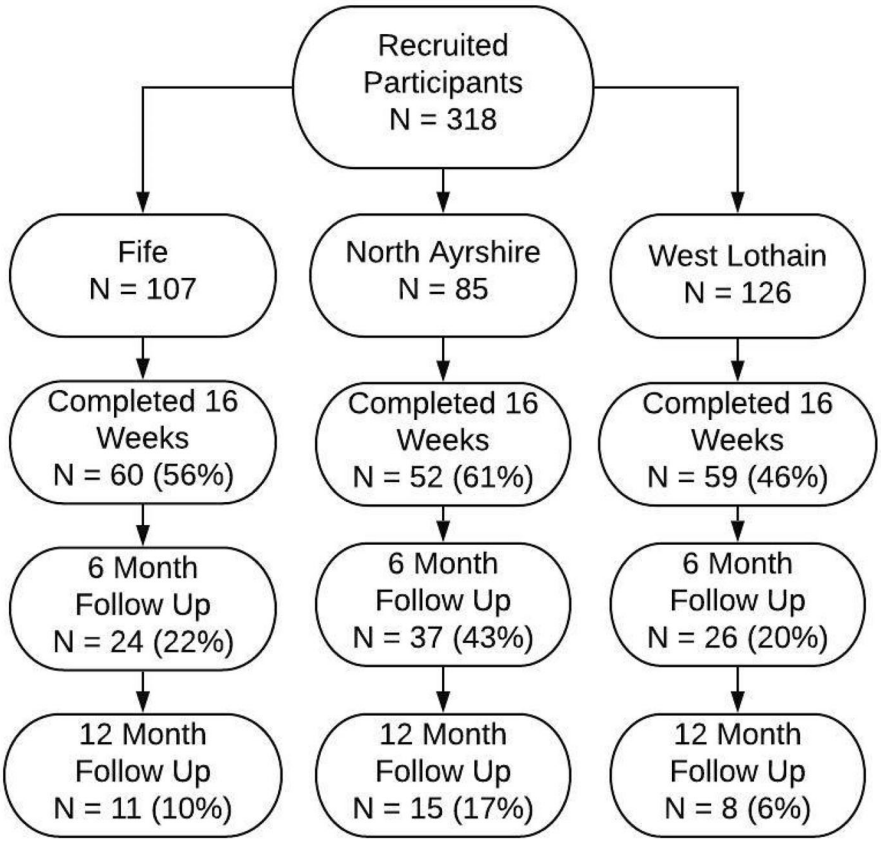

Fig. 2 Flow Diagram of Participants in ALBA

is the most robust, especially when there are violations of assumptions as above [1].

A MANOVA was conducted to measure the effectiveness of the intervention on mental wellbeing, PA level, self-esteem, self-efficacy, and patient activation There was a statistically significant difference pre and post intervention, F (18, 3114) = 8.687, $p < 0.001$; Pillai's trace = 0.143, partial $\eta 2 = 0.048$.

Separate univariate ANOVAs on the outcome variables revealed that there was a statistically significant change over time on:

- Steps as measured by activity tracker (F (3, 1041) = 25.087; $p < 0.001$, partial $\eta 2 = 0.067$),
- SPAQ (F (3, 1041) = 7.282; $p < 0.001$, partial $\eta 2 = 0.021$),
- SEE (F (3, 1041) = 3.871; $p < 0.05$, partial $\eta 2 = 0.011$),
- WEMWBS (F (3, 1041) = 16.895; $p < 0.001$, partial $\eta 2 = 0.046$)
- PAM (F (3, 1041) = 8.524; $p < 0.001$, partial $\eta 2 = 0.024$).

There was no significant effect of time on Rosenberg (F (3, 1041) = 1.004; $p = 0.390$; partial $\eta^2 = 0.003$).

Post hoc tests using the Bonferroni correction revealed that there was a significant positive change between baseline, post intervention, 6 months, and 12 months for SPAQ (m = − 159.48, $p < 0.001$; m = − 193.57, $p < 0.001$; m = − 188.59, $p < 0.001$) but was not significant post intervention, 6 month follow up or 12 month follow up. The same pattern was seen for:

- SEE (m = − 4.03, $p < 0.001$; m = − 4.85, $p < 0.001$, m = − 4.87, $p < 0.001$).
- PAM (m = − 2.23, $p < 0.001$; m = − 2.22, $p < 0.001$; m = − 2.11, $p < 0.001$) and
- WEMWBS (m = − 4.63, $p < 0.001$; m = − 4.83, $p < 0.001$; m = − 4.94, $p < 0.001$).

Table 4 Number of steps as measured by Storm Activity Trackers

	N	Mean weekly total steps	95% CI		% Meeting CMO guidelines
			Lower bound	Upper bound	
Baseline	277	34,195.93	31,147.09	37,244.77	22
Week 2	269	32,018.19	28,861.01	35,175.37	20
Week 3	251	31,043.91	27,810.75	34,277.07	17
Week 4	225	33,911.82	29,987.27	37,836.37	17
Week 5	213	34,494	30,374.03	38,613.97	18
Week 6	206	34,609.98	30,560.29	38,659.68	17
Week 7	190	34,320.01	30,180.90	38,459.12	14
Week 8	189	32,079.86	28,082.44	36,077.29	14
Week 9	179	31,795.17	27,652.15	35,938.20	12
Week 10	168	34,419.11	30,033.57	38,804.65	14
Week 11	163	36,397.51	31,716	41,079.02	15
Week 12	156	31,823.28	27,557.06	36,089.49	14
Week 13	146	36,564.36	31,553.95	41,574.76	13
Week 14	138	36,766.8	32,049.13	41,484.48	14
Week 15	140	32,545.21	28,190.46	36,899.95	11
Week 16	133	31,560.66	27,019.22	36,102.10	10

Table 5 Descriptive statistics

Variable	Baseline mean (SD)	16 Weeks mean (SD)	6 Months mean (SD)	12 Months mean (SD)
Objective PA (STEPS)	33,676.80 (25,746.11)	21,514.80 (21,563.71)	21,011.27 (21,755.51)	18,079.34 (18,628.72)
SPAQ (mins)	675.85 (611.40)	969.83 (982.42)	964.00 (881.84)	935.61 (843.80)
Self-efficacy (SEE)	34.61 (20.42)	39.49 (20.52)	39.63 (20.83)	39.86 (20.56)
Patient activation (PAM)	37.67 (6.06)	40.04 (6.78)	40.03 (6.51)	39.99 (6.46)
Mental wellbeing (WEMWBS)	34.64 (9.33)	39.89 (10.71)	40.10 (10.89)	40.13 (10.97)
Self esteem (ROSENBERG)	13.83 (6.99)	14.58 (5.90)	14.64 (5.97)	14.59 (6.00)

In conclusion, the ALBA intervention had a significant positive effect on self-reported PA, self-efficacy for exercise, patient activation and mental wellbeing, which was sustained over the follow up period of 6 and 12 months. There was a significant decrease in steps as measured by the activity trackers from baseline (m = 34,308.78) to post intervention (m = 11,690.58, $p < 0.001$), 6 months (m = 12,858.46, $p < 0.001$) and 12 months follow up (m = 14,275.96, $p < 0.001$).

Discussion

The aim of this study was to evaluate the effectiveness of the ALBA intervention. It found mixed results. The intervention was reasonably well adhered to, and results suggested a positive effect on self-reported PA. Results also indicated that the intervention was effective at improving mental wellbeing, self-efficacy and patient activation, and the positive effects were maintained over the long-term follow up period. However, the objectively measured activity trackers showed a significant mean *decrease* in physical

activity. Further, the results showed no significant effect on self-esteem.

Previous studies have found that better adherence to interventions is associated with greater effectiveness. It was hypothesised that as the ALBA intervention used a combination of cognitive and behavioural strategies, it would enhance adherence to PA. However, adherence to PA according to the objective measure was disappointing, and as the intervention went on the number of participants who met the CMO guidelines decreased. Just 53% of participants completed the intervention, with 41% attending 8 or more sessions with the BCP. This is at the lower end of adherence rates when compared to previous trials of cognitive behavioural interventions for mental health populations (39–80.56%; Peddie et al. 2019), and compared to trials of exercise interventions for depression (Krogh et al. 2013) and psychotherapy interventions (Rethorst et al. 2009).

However, meaningful comparisons of adherence rates across different trials are challenging due to heterogeneity in methods used to measure it. The level of adherence seen in the ALBA trial is more comparable to evidence from evaluations of ERS, which suggest that adherence ranges from 12 to 93% (Pavey et al. 2012), putting ALBA nearer the middle of this range.

In short, there is a wide discrepancy in adherence in different trials and interventions which have been delivered in real life settings. Further, definitions of adherence vary across studies, as there is no gold standard definition. Adherence is often measured as attendance or as attrition. However, these measures do not capture how much an individual has actually *engaged*, which is why this study chose to use the objective measure of PA to assess adherence to PA guidelines. It was hoped that using an objective measure would increase the content validity, as it would be able to capture all activity that participants engaged in, not just activity participated in during attendance at the ERS. However, this choice of measurement may have presented its own methodological issues, which will be discussed below.

Self-reported PA as measured by the SPAQ significantly increased during the intervention period and then was maintained over time. However, this did not correspond with the objectively measured PA, which indicated that PA decreased over time. Therefore, the results of the objective and subjectively measured contradict each other. There are numerous reasons why the self-report and objectively measured PA may not correspond. For one, the activity trackers could not pick up on activities such as cycling and swimming, which could be reported in the self-report measure. Subjective measures of PA also have their short comings, with evidence suggesting that they are subject to reporting bias [34]. It is possible that participants overreported the amount of PA due to either the social desirability bias or recall bias. Social desirability bias is a bias where individuals distort their self-reported behaviour in a favourable direction [33]. Individuals in the ALBA intervention may have felt pressure to report increasing PA and may have wanted to gain the approval of the BCP that they had been working with, which may have led them to over report the amount of PA they engaged in by the end of the intervention period.

It was observed from the activity tracker data that the highest percentage of individuals meeting the activity guidelines was in the baseline week, before any intervention activities had taken place. The mean value at baseline was 34,308.78 steps, close to 5000 steps per day. This is well above the average number of steps taken by people without mental health conditions. For example, the average Briton walks between 3000 and 4000 steps a day [3], making our baseline measure significantly above average to begin with. This was an unexpected result; however, it might be attributed to the introduction of the activity trackers. The activity trackers provided the participants with immediate feedback on their behaviour, which increased their awareness and may have resulted in immediate behaviour change [55]. Whilst this is a positive change and highlights how activity trackers can be used to motivated behaviour change, this complicated the analysis as there was no "true" baseline measure of participants PA prior to taking part in ALBA.

Despite the lack of consistent evidence to support that ALBA participants increased PA, there is evidence to support the improvements in mental wellbeing. Engaging in less than 150 min a week is still associated with a positive effect on mental wellbeing [25]. A study conducted by Jonsdottir et al. [17] found that people who engaged in 120 min of PA per week were at a 63% reduced risk of developing depression compared to those who engaged in less PA. Further to this, a study by Morres et al. [31] found evidence to

support that exercising at a preferred intensity was associated with improvements in mental health in women with depression. Therefore, the evidence from ALBA is interpreted to support the public health message that "some activity is better than none", especially for adults who have been previously inactive. Research has found that exercise at any intensity has been associated with lower risk of mortality [10], with an increase of just 2000 steps/day seeing positive health benefits [53], with a greater relative benefit at lower levels of baseline PA [9].

The results also showed that the ALBA intervention has a positive impact on self-reported mental wellbeing, with the average WEMWBS score increasing from 34.7 to 39.9, these improvements are maintained through the 6 and 12 months follow up, suggesting that the ALBA intervention promoted long-term improvements in mental wellbeing. Data collected in the Scottish Health Survey suggests that the national mean WEMWBS score is 49.4 [51]. Whilst the scores from the ALBA intervention falls below the national average, they show a significant increase which is highly likely to represent meaningful improvement to the individuals [24].

The improvements in mental wellbeing occurred despite the lack of a significant increase in PA in ALBA participants. This could be interpreted to mean that the changes in participants' PA, including the baseline increase, were still enough to improve their mental wellbeing. The optimal dose of PA to improve or sustain mental health is unknown [19], although it is well accepted that a dose–response relationship exists between PA levels and health outcomes. Evidence suggests that meeting the PA guidelines is associated with a 22% decreased likelihood of developing depression [44]. However, it is important to acknowledge that lighter doses of PA can have mental health benefits, particularly as those who are at the greatest risk of poor mental health are more likely to be inactive [48]. Perhaps the intervention impacted on the way the participants *thought* about PA, and these small changes were enough to significantly improve their mental wellbeing.

Considering the effect that the ALBA intervention had on mental wellbeing it was anticipated that there would also be a positive impact on self-esteem. However, despite mean scores rising over the time of the study, the results of the outcome evaluation showed no significant change in self-esteem. The findings support the theoretical notion that self-esteem is a relatively stable construct, and that it is not easily changed [12]. Previous reviews of the impact of PA on self-esteem have concluded that there is an inconsistent and weak relationship between PA and self-esteem. This is often attributed to conceptual and methodological issue. The Rosenberg Self Esteem Scale [42] is one of the most widely used self-esteem measures, however, there has been some criticism of the design of this measure, particularly the negative worded questions, which has called into question the construct validity. Another issue with the Rosenberg Self-Esteem scale is that it is a global self-esteem measure. Evidence suggests that global self-esteem is relatively stable, whereas domain specific self-esteem is more changeable. Therefore when examining the effect of PA on self-esteem it has been recommended to use a physical self-esteem measure rather than a global one [27]. If a domain specific measure had been selected, then perhaps the results would have been different.

Self-efficacy has consistently been identified as predictive of PA behaviour [39, 46], yet the evidence from the ALBA trial suggests that the increase in self-efficacy did not translate into actual behaviour change. This change in self-efficacy must therefore be interpreted as an increased confidence and sense of mastery towards PA. Poor self-efficacy can contribute to a vicious cycle, whereby a person does not pursue achievable goals or tasks [2], leading to feelings of frustration which can impact on an individual's mental health and wellbeing, particularly when these goals are important to them. The evidence from the ALBA intervention suggested that as self-efficacy increased that participants were able to break this cycle, as they gained experience of setting and achieving manageable goals. However, this increase in self-efficacy might not have translated into significant changes in PA or resulted in participants meeting the PA guidelines because of the goals they set themselves. Participants' goals may have been small step goals or might have been related to incorporating PA into achieving other daily life tasks i.e. getting the bus, tidying the house, which were meaningful to them and contributed to improving their mental wellbeing through increased sense of purpose.

Finally, the findings from this study add nuance to the debate about the contribution of PA to mental health recovery. In mental health care, recovery is

defined as "*a personal process of learning how to live and how to live well with or without enduring symptoms or vulnerabilities*" [40], p. 402). Leamy et al. [21] proposed the CHIME framework to help others understand recovery. CHIME identifies five processes most relevant to personal recovery in mental health: connectedness; hope and optimism for the future; identity; meaning in life and empowerment (CHIME). This model helps to explain how the ALBA intervention helped to support improvements in mental wellbeing, and in turn influenced better engagement in PA and self-management of health, as it was supportive of connectedness as participants were able to develop relationships with the BCPs and peer supporters and were able to find meaning in life and empowerment through being able to set their own goals and receive support to achieve them. In summary, ALBA was therefore supportive of wider mental health recovery, through the promotion of person-centred PA.

Limitation

One major limitation of the ALBA intervention was the evaluation design. In community intervention trials, such as the ALBA trial, there is often a trade-off between scientific design and public health pragmatism. A "before-after" design is generally considered to be a relatively weak evaluation design as there is a lack of control or comparison group. Without a control or comparison group, it is harder to attribute the observed effects to the ALBA intervention or occurred due to other factors or outside influence. It was decided that adopting an RCT design was not feasible as randomisation at an individual level would be too resource intensive. There were also issues regarding a control group, as the intervention was opt-in, it was decided that it would be unfair not to offer the intervention and it was deemed unethical to use data from individuals who did not chose to participate as a comparison group. Therefore, a "before-after" design was considered the "best possible" under the circumstances in which the ALBA intervention was implemented.

Another methodological weakness was the activity trackers used as an objective measure. As discussed, the sensitivity of the activity trackers was tested against Omron pedometers, in a real person walking test. The results found that the Storm activity trackers had an error rate of 2.8% per 1000 steps when worn on the wrist compared against the Omron 2.6% error rate for the same distance. However, the trackers were not tested against the gold standard ActivGraph, a reliable and valid tool for measuring PA in free living populations, or observer counting from video camera in a laboratory. Therefore, the activity trackers cannot be considered a truly reliable objective measure. However, it was considered that the benefit that the participants received from using them as a self-monitoring tool made them a valuable component of the intervention.

Conclusion

The ALBA intervention was a novel study that had a small but significant impact. It was effective at promoting mental health recovery through the promotion of physical activity. ALBA had a long lasting and beneficial effect on mental wellbeing, confidence, and engagement in self-management of health care. That it didn't show an increase in objectively measured physical activity is almost certainly down to the unusually high baseline measures obtained.

The ALBA intervention offers an approach that joins both physical and mental health in a move towards mental health recovery. Through the ALBA intervention, participants were encouraged to and support in engaging in purposeful activity, setting, and achieving goals and make use of increased opportunities for social interaction. Therefore, these findings suggest that participating in ALBA helped to facilitate mental health recovery, as physical activity was used as a tool which helped the participants to re-engage in meaningful activities, which in turn promoted improvements in wellbeing.

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Declarations

Conflict of interest No potential conflict of interest was reported by the authors.

Ethical Approval Ethical approval for this project was granted by the NRES Committee for West of Scotland on 09 January 2017 (REC ref 16/WS/0246) and from Edinburgh Napier School of Applied Sciences Ethics committee.

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