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ORIGINAL ARTICLE

Targeting motivation and self-regulation to increase physical activity among patients with rheumatoid arthritis: a randomised controlled trial

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Abstract The purpose of this study is to evaluate the effects of targeting both the motivation and action phases of behaviour change in a 5-week intervention to increase physical activity (PA) among patients with rheumatoid arthritis (RA) not meeting current PA recommendations. In a randomised controlled trial, a control group—which received a group-based patient education session led by a physical therapist—was compared to a treatment group which received the education session plus a motivational interview from a physical therapist and two self-regulation coaching sessions from a rheumatology nurse. Outcomes included leisure-time PA, days per week with at least 30 min of moderate-intensity PA, self-efficacy and autonomous motivation (cognitions which predict PA initiation and maintenance), disease activity, functional status, depressive symptoms and fatigue. Effects were assessed using mixed models repeated measures. Of the 78 patients randomised, 76 and 67 completed the post-treatment and follow-up assessments, respectively. Significant treatment effects were found for leisure-time PA ($p=0.022$), active days/week ($p=0.016$), self-efficacy ($p=0.008$) and autonomous motivation ($p=0.001$). At post-treatment and 6-months follow-up, significantly more treated patients than controls met current PA recommendations. No significant effects were found for disease activity, functional status, depressive symptoms or fatigue. Combining motivation- and action-focused intervention approaches improved PA-related cognitions and led to improved uptake and maintenance of leisure-time PA. However, further research is necessary to identify ways of helping patients with RA transition to—and maintain—more intensive forms of PA which are more likely to improve disease activity and functional status.

Keywords Behaviour change · Motivational interviewing · Physical activity · Rheumatoid arthritis · Self-efficacy · Self-regulation

Trial registration: Netherlands Trial Register, http://www.trialregister.nl; Identifier NTR2240.

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The importance of physical activity (PA) for patients with rheumatoid arthritis (RA) is well documented, and PA promotion forms part of recommended care for RA [1]. Despite this,

many RA patients do not undertake regular PA or meet the recommended norm of 30 min of moderate-intensity PA on 5 days of the week (5×30 recommendation) [2]. These facts, coupled with the elevated risk of cardiac events and cardiac-related mortality within this patient group [3] have led to the development of PA interventions for patients with RA.

While some existing interventions in this area lead to increases in PA behaviour in the short term, others do not, and the effects of such interventions are not well maintained over time [4]. This may be explained by a tendency of these interventions to focus solely on the action phase of behaviour change: using self-regulation (SR) techniques including goal setting, action planning and problem solving [5–7], but paying little attention to the motivational aspects of behaviour change [8, 9].

According to several prominent behaviour change theories, the action phase of behaviour change is preceded by a motivational stage, in which changes in cognitions lead to the formulation of intentions [10]. As strong intentions are more readily and consistently translated into behaviour [11], interventions targeting cognitions which strengthen intentions should lead to better uptake and maintenance of behavioural changes, particularly when coupled with the self-regulation techniques described above [12, 13].

Self-efficacy and autonomous motivation for PA are two important cognitions in this motivational phase. Self-efficacy for PA (an individual's judgment of whether he or she could be physically active [14]) predicts PA [15, 16], and is particularly important when promoting PA among insufficiently active individuals [17]. Self-efficacy for PA is increased by successful, positive experiences with PA [18], and this is best done by using self-regulation techniques tailored toward small, measurable achievements and by limiting failures when pursuing PA goals [19].

Autonomous motivation is another such cognition, and is the extent to which one might participate in PA because it is personally important—as opposed to doing so for extrinsic reasons (e.g. to please others) [20]. As autonomous motivation predicts sustained PA among patients with RA [21], PA interventions that target this variable may yield better long-term maintenance of PA. Motivational interviewing (MI) is one therapeutic technique believed to increase autonomous motivation [22], but to date, its effects on autonomous motivation have scarcely been investigated [23].

This randomised controlled trial examined the effects of an intervention which combines motivational interviewing and self-regulation coaching to specifically target autonomous motivation, self-efficacy and PA among sedentary patients with RA. By combining motivation and action phase-related components, we expected to show better maintenance of PA at 6 months compared to patient education alone. In addition, we examined the effects of the intervention upon disease activity, functional status, depressive symptoms and fatigue.

Methods

Study design

This parallel-group randomised controlled trial was approved by the Leiden University Medical Center Ethics Review Board, and was conducted in accordance with the Declaration of Helsinki between August 2010 and December 2011. The trial protocol is registered with the Netherlands Trial Register (http://www.trialregister.nl; Identifier NTR2240).

Participants and procedures

Patients who were older than 18, diagnosed with RA according to the American College of Rheumatology criteria [24], and who had attended the outpatient rheumatology department of either Leiden University Medical Center, HAGA Hospital, or Reinier DeGraaf Gasthuis were potentially eligible for study participation. Randomly selected groups of 250 eligible patients were mailed leaflets describing the study. Those who responded were screened via telephone, and were excluded if they met the 5×30 PA recommendation, had received physical therapy for RA within the last 6 months, had difficulty ambulating or could not attend treatment sessions due to scheduling or transportation issues.

Remaining patients provided informed consent and were randomly allocated (1:1) to receive a patient education session (control), or the patient education session plus one motivational interview and two self-regulation coaching sessions (treatment). Randomisation was conducted using a computer-generated allocation code which remained locked until after the participants' characteristics had been entered. The researcher who conducted randomization and enrolment (EH) was not involved in data entry or analysis, and the allocation code was concealed from other researchers until after data had been prepared for analysis.

Initial calculations using a power level of 0.8 and alpha of 0.05 revealed that a sample size of 60 per group was necessary to detect a between-groups difference in physical activity of 30 min (SD per group=210 min) (see trial registration). However, due to slower than expected recruitment during the study, revised sample size calculations were conducted based on the findings of a meta-analysis of PA interventions among individuals with arthritis (d=0.69) [4] and an intervention which targeted PA increases among sedentary individuals with RA (a 24 % between-groups difference of people meeting the 5×30 recommendation at post-treatment) [25]. These revised calculations (also using a power level of 0.8 and alpha of 0.05) indicated that sample sizes of 35 and 38 per group would be sufficient to detect such differences in self-reported PA—the greater of which served as minimum threshold for trial recruitment.

Interventions

All participants were treated in the Leiden University Medical Center. In week 1, both control and treatment participants attended a small group educational session (three to seven people) which included exclusively treatment or control participants. The education sessions were delivered by a physical therapist with several years of experience in delivering similar sessions, and who was blinded to participants' group allocations. The educational session presented information about the importance of PA for people with RA, about recommended PA guidelines, and resolved myths surrounding PA and RA. Five steps to take when increasing PA were discussed [(1) choose fun activities; (2) start with a comfortable intensity and duration; (3) increase duration of PA; (4) increase frequency of PA; and (5) increase intensity of PA], and patients were provided with a list of arthritis organizations and exercise classes in the area. The control group received no further intervention.

In week 2, treated patients received a one-to-one MI which lasted no more than 45 min and was conducted by one of three physical therapists who received training in the delivery of MI prior to the start of the study. During the MI, patients weighed the pros and cons of (re-)engaging in PA, and links were made between a more physically active lifestyle and long-term goals that were important to the patient (e.g. maintaining independence). At the end of the MI, patients set a long-term goal and received an exercise diary. Patients were instructed to complete the exercise diary on seven consecutive days and bring it along to the first self-regulation coaching session.

In weeks 4 and 5, a rheumatology nurse delivered two one-to-one SR coaching sessions to patients in the treatment group. These 40–60-min sessions emphasized self-regulation theory [5], and to enhance fidelity of intervention delivery, followed the structure of a workbook developed for this study. Coaching sessions began with a review of patients' exercise diaries. Patients received feedback on their progress, and worked with the nurse to set short-term, realistic PA goals and action plans for the coming week (i.e. what PA, when, for how long). At the end of each session, patients were prompted to complete the exercise diary for the following week. The sessions also included barrier identification and problem solving (coping planning), breaking large goals down into smaller ones, activating social support, self-reward, and the use of reminders to be physically active. The behaviour change techniques used in each session of the intervention are presented in Table 1 [26].

In weeks 6, 12 and 18, patients in the treatment group received a follow-up phone call from the rheumatology nurse to further discuss the patient's efforts in self-regulating physical activity. These follow-up phone calls utilized the same techniques as the face-to-face sessions, and lasted no more than 20 min.

Outcomes

All outcomes were assessed by means of self-report postal questionnaires at baseline, post-treatment (6 weeks later) and follow-up (32 weeks after baseline).

Leisure-time physical activity (PA) was the primary outcome for this study, and was assessed using the Short Questionnaire to Assess Health-Enhancing Physical Activity [27], which includes engagement in walking, cycling and sporting activities. For each activity, days per week were multiplied by minutes per day, and these products were summed to calculate minutes per week of leisure-time PA. Additionally, participants answered one question to determine how many days per week they engaged in at least 30 min of moderate intensity PA over the past month [28]. This single item was also used to screen individuals for eligibility for the study [25].

Self-efficacy for PA was assessed using an 18-item questionnaire from Bandura [29]. Each item presents a situation in which it may be difficult to engage in PA (e.g. when busy, bad weather), and allows participants to rate the likelihood that he/she could be physically active from 0 (not at all likely) to 10 (certainly). The 18 item scores were summed to create the total self-efficacy score.

Autonomous motivation for PA was measured with three items from the Treatment Self-Regulation Questionnaire [30]. Each item is scored from 1 (totally disagree) to 7 (totally agree), and measures the extent to which participants engaged in PA for personal reasons (e.g. enjoyment, fun). The autonomous motivation score was calculated by taking the mean of the three items.

Disease activity was measured with the Rheumatoid Arthritis Disease Activity Index (RADAI) [31]. The RADAI assesses joint inflammation over the last 6 months, present tenderness/swelling, arthritis pain, duration of morning stiffness, and present joint pain. Total disease activity is the mean of these five domains, scored from 0 to 10, with higher scores indicating more disease activity.

Functional status was assessed with the 20-item disability scale of the Health Assessment Questionnaire (HAQ) [32]. Each item is scored on a 0–3 scale, where zero indicates no functional limitations and three indicates severe limitations. Total functional status score is the mean of these 20 item scores.

Depressive symptoms were assessed using 6 items from the Brief Symptom Inventory (BSI) [33]. Participants rated each distress item from 0 to 4, with higher scores representing more distress. The total depressive symptoms score was the mean of the scored items.

Fatigue was assessed with the 20-item Checklist of Individual Strengths (CIS-20) [34]. The CIS-20 presents statements such as "I feel well rested" and "I feel physically exhausted," to which participants respond on a seven-point scale. After reversing the appropriate items, the sum of all

Table 1 Session-by-session description of intervention content using CALO-RE taxonomy of behaviour change techniques

Behaviour change technique	BCT no.	Session 1 (GPES)	Session 2 (MI)	Session 3 (SRC 1)	Session 4 (SRC 2)	Session 5 (TFU 1)	Session 6 (TFU 2)	Session 7 (TFU 3)
Provide information on consequences of behaviour in general	1	✓						
Provide individualized information on consequences of behaviour	2	✓						
Provide information on where and when to perform the behaviour	20	✓						
Provide instruction on how to perform the behaviour	21	✓						
Facilitate social comparisons	28	✓		✓	✓			
Motivational interviewing	37		✓					
Prompting focus on past success	18		✓					
Prompt self-monitoring of behaviour	16		✓	✓	✓	✓	✓	✓
Goal setting (outcome goal)	6		✓					
Goal setting (behavioural goal)	5			✓	✓	✓	✓	✓
Action planning	7			✓	✓	✓	✓	✓
Set graded tasks	9			✓	✓			
Prompt review of outcome goals	11			✓		✓	✓	✓
Provide feedback on performance	19			✓	✓	✓	✓	✓
Teach to use prompts or cues	23			✓	✓			
Barrier identification or problem solving	8				✓	✓	✓	✓
Relapse prevention or coping planning	35				✓	✓	✓	✓
Prompt review of behavioral goals	10				✓	✓	✓	✓
Prompt rewards contingent on progress towards behaviour	12				✓			
Plan social support or social change	29				✓			
Use of follow-up prompts	27					✓	✓	✓

BCT no. behaviour change technique number taken from CALO-RE taxonomy of behaviour change techniques [26]; *GPES* group patient education session, led by physical therapist and took place in week one of the intervention; *MI* motivational interview, delivered by different physical therapist and took place in either week 2 or week 3 depending upon scheduling availability; *SRC* self-regulation coaching sessions, led by rheumatology nurse practitioner and took place in week 4 and week 5 of the intervention; *TFU* telephone follow-up contacts, conducted by same rheumatology nurse practitioner in weeks 6, 12 and 18 of the intervention

items produces a total fatigue score, with higher scores indicating more fatigue.

Statistical analyses

Data were analysed with SPSS software version 18 (SPSS; Chicago, IL, USA). Between-groups differences at baseline were assessed by means of t-tests for continuous variables, and chi-square tests for categorical variables. The effects of the intervention were investigated using an intention-to-treat (ITT) principle which included all participants as randomised; with missing values imputed using the last observation carried forward method.

As a primary test of intervention effects, mixed model repeated measures analyses with group assignment as a between-subjects factor and time-point as a within-subjects factor were run for each outcome variable. A significant interaction ($p<0.05$) of the within- and between-subjects factors (group × time) signifies that the respective changes in outcomes of the intervention and control groups differed over time. These repeated measures analyses were controlled for age, sex and baseline disease activity.

At post-treatment and follow-up, effect sizes (Cohen's d) were calculated using the Comprehensive Meta-Analysis software package [35], with positive effect sizes indicating desirable changes. Finally, chi-squared analyses examined between-groups differences in individuals meeting the 5×30 recommendation.

Results

In total, 1,251 patients received information about the study, 701 were interested in participating and screened for eligibility, and 78 were randomized to the treatment ($n=38$) and education control ($n=40$) groups (Fig. 1). At baseline, the

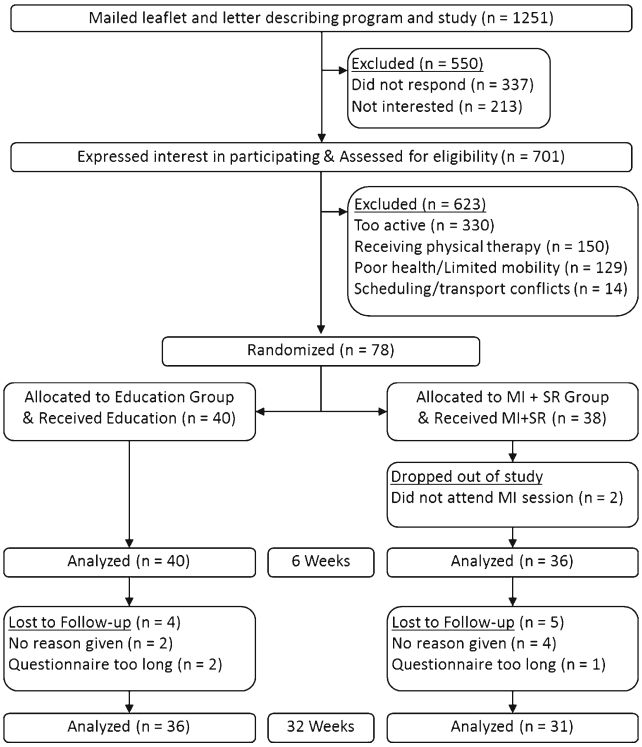

Fig. 1 CONSORT diagram for flow of participants through the trial

intervention group reported significantly less disease activity and included more females than the control group. The groups did not significantly differ on any other demographic or disease-related variables (Table 2).

Over the 32 weeks of the study, there were significant main effects (group × time) on leisure time PA ($F=4.01$; $p=0.022$), days per week with 30 min of PA ($F=4.39$; $p=0.016$), total self-efficacy ($F=5.18$; $p=0.001$) and autonomous motivation ($F=7.16$; $p=0.008$); but not disease activity ($F=2.17$; $p=0.121$), functional status ($F=0.64$; $p=0.530$), depressive symptoms ($F=1.35$; $p=0.266$) or fatigue ($F=0.43$; $p=0.651$) (Table 3).

At post-treatment (6 weeks), there were significant differences in change scores from baseline in favour of the treatment group on total self-efficacy for PA and days per week with 30 min of PA, but not for the other outcomes. Furthermore, a significantly higher percentage of participants in the treatment group (67 %) met the 5×30 recommendation for PA than in the control group (23 %) (Table 4).

At follow-up (32 weeks), the significant differences in change scores persisted for total self-efficacy for PA and days per week with 30 min of PA, and the difference for autonomous motivation became significant as well. For disease activity, there was a significant difference in favour of the control group, but no differences for any other outcomes. Finally, 48 and 25 % of treated and control participants met the 5×30 recommendation, respectively (Table 4). No harms of participation or adverse events were reported by patients in either group.

Discussion

The intervention tested here combined physical therapist-led motivational interviewing and nurse-led self-regulation coaching to address both the motivation and action stages of behaviour change. Six-months after receiving this 5-week intervention, patients in the treatment group had increased their leisure time PA by 84 min more per week, and were active on 1.2 additional days per week, than those in the control group. Among insufficiently active patients like those included in this study, these increases could be enough to lower cardiovascular disease risk by 20 % [36].

The increases in physical activity produced here by combining motivation- and action-focused approaches required little in terms of staff resources (fewer than 5 h of total contact time), yet are in contrast to the null findings demonstrated by a number of more resource-intensive PA interventions which

Table 2 Baseline characteristics of treatment and control groups

Characteristic	Treatment ($n=38$)	Control ($n=40$)	*P*
Age	60.7 (11.9)	64.7 (11.5)	0.141
Women, *n* (%)	30 (79 %)	22 (55 %)	0.024
Body mass index	27.7 (4.3)	26.3 (3.6)	0.122
Employed, *n* (%)	13 (34 %)	9 (23 %)	0.128
Education			
Primary, *n* (%)	18 (47 %)	16 (42 %)	0.645
Secondary, *n* (%)	14 (37 %)	15 (40 %)	0.813
Tertiary, *n* (%)	6 (16 %)	7 (18 %)	0.761
NSAID use, *n* (%)	24 (63 %)	21 (53 %)	0.347
Disease activity, RADAI (0–10)	2.86 (1.74)	3.87 (2.03)	0.021
Functional status, HAQ (0–3)	0.98 (0.73)	1.25 (0.59)	0.078

Values are presented as mean (standard deviation) unless otherwise indicated

NSAID non-steroidal anti-inflammatory drugs, *RADAI* Rheumatoid Arthritis Disease Activity Index, *HAQ* Health Assessment Questionnaire

Table 3 Tests of group × time intervention effects for all outcomes at baseline, post-treatment, and follow-up

	Treatment group (n =38)	Control group (n =40)	Effect (95 % CI)	p value[a]	Effect size[b]
Leisure time PA (SQuAsH) (minutes per week)				0.022	
Baseline	216 (175)	209 (211)			
Post-treatment	295 (204)	224 (243)	64 (−12.2, 140.2)		0.29
6 months	303 (294)	212 (285)	84 (−2.9, 170.9)		0.29
Days per week with at least 30 min of PA (0–7)				0.016	
Baseline	2.7 (1.2)	3.0 (1.1)			
Post-treatment	4.6 (1.5)	3.5 (1.4)	1.4 (0.70, 2.10)		0.97
6 months	4.3 (1.6)	3.4 (1.6)	1.2 (0.49, 1.91)		0.75
Autonomous motivation (0–7, 7=more autonomous motivation)				0.001	
Baseline	5.9 (0.8)	5.4 (1.2)			
Post-treatment	6.0 (0.8)	5.2 (1.4)	0.3 (−0.06, 0.66)		0.26
6 months	6.1 (0.7)	5.1 (1.2)	0.5 (0.24, 0.76)		0.51
Self-efficacy for PA (0–180, 0=low self-efficacy)				0.008	
Baseline	78.1 (44.9)	84.2 (37.2)			
Post-treatment	92.8 (37.7)	79.8 (40.4)	19.1 (7.1, 31.1)		0.49
6 months	95.8 (41.8)	82.9 (38.8)	19.0 (5.8, 32.2)		0.47
Disease Activity (RADAI) (0–10, 0=no disease activity)				0.121	
Baseline	2.9 (1.7)	3.9 (2.0)			
Post-treatment	3.1 (1.7)	3.7 (1.9)	0.4 (−0.01, 0.80)		−0.22
6 months	3.2 (1.8)	3.7 (2.1)	0.5 (0.03, 0.97)		−0.27
Functional status (HAQ) (0–3, 0=no disability)				0.530	
Baseline	0.98 (0.73)	1.25 (0.59)			
Post-treatment	0.99 (0.70)	1.28 (0.58)	−0.02 (−0.11, 0.07)		0.03
6 months	0.99 (0.72)	1.29 (0.63)	−0.03 (−0.15, 0.09)		0.04
Depressive symptoms (BSI) (0–4, 0=no symptoms)				0.266	
Baseline	0.33 (0.46)	0.27 (0.60)			
Post-treatment	0.26 (0.41)	0.24 (0.56)	−0.04 (−0.15, 0.07)		0.08
6 months	0.22 (0.36)	0.27 (0.59)	−0.11 (−0.26, 0.04)		0.22
Total fatigue (CIS-20) (20–140, 20=no fatigue)				0.651	
Baseline	67.1 (24.8)	76.9 (18.3)			
Post-treatment	62.5 (22.9)	75.1 (17.2)	−2.8 (−8.0, 2.4)		0.14
6 months	62.7 (24.2)	75.2 (19.0)	−2.7 (−8.9, 3.5)		0.12

Values are the mean (SD) unless otherwise indicated

PA physical activity; *SQuAsH* Short Questionnaire to Assess Health-Enhancing PA; *RADAI* Rheumatoid Arthritis Disease Activity Index; *HAQ* Health Assessment Questionnaire; *BSI* Brief Symptom Inventory; *CIS* Checklist of Individual Strengths

[a] Main effects of group × time interaction based on repeated measures mixed ANOVAs adjusted for age, gender, and baseline level of disease activity

[b] Mean difference standardized by pooled SD (Cohen's d; <0.2 trivial; 0.2–0.49 small; 0.5–0.79 medium; ≥0.8, large)

utilized only action-focused approaches. In recent studies, neither the 8-week People with Arthritis Can Exercise program [37], nor a 1-year PA coaching program [38] led to significant increases in PA behaviour. Although not conclusive, this difference in outcomes across studies lends initial support to the importance of addressing motivation in PA

Table 4 Percentage of patients meeting the 5×30 recommendations for physical activity at each time point

Time	Treatment group	Control group	p	OR	95 % CI
Baseline	0/38 (0 %)	0/40 (0 %)	–	–	–
6 weeks	24/36 (67 %)	9/39 (23 %)	<0.001	6.67	(2.41, 18.44)
32 weeks	15/31 (48 %)	9/36 (25 %)	0.049	2.81	(1.01, 7.89)

OR odds ratio

interventions for individuals not meeting recommended levels of PA.

Further support is lent to this hypothesis by the significant effects of the current intervention upon self-efficacy and autonomous motivation for PA—cognitions which play an important role in the motivational phase of behaviour change. While other interventions have increased self-efficacy for PA, this is the first study to demonstrate an effect upon autonomous regulation among individuals with RA. As the effect of the intervention on autonomous motivation became stronger over time, the effects of motivational interviewing upon autonomous motivation may additionally require that patients build repertoires of enjoyable experiences with PA and internalize their once extrinsic PA goals [39].

While this intervention led to maintained increases in PA and improvements in PA-related cognitions, no corresponding improvements in disease activity or functional status were evidenced. This could reflect a lack of statistical power or sensitivity to change in the case of the HAQ [40], and a case of regression to the mean for disease activity [41], as the groups significantly differed on this variable at baseline. It may also reflect inactive patients' preferences for low-intensity modes of PA such as walking and cycling [42]. While patients were informed during the education sessions that dynamic forms of PA were most likely to improve their RA symptoms and functional ability [43], they were also encouraged to engage in the modes and intensities of PA that they enjoyed. This was done because enjoyable activities were more likely to foster autonomous motivation and long-term maintenance, and, among this inactive group of patients, self-efficacy for initiating more intensive forms of PA was undoubtedly low. Among inactive patients in this study, the focus on engagement in enjoyable activities led to uptake and maintenance of PA; however, achieving improvements in disease-related variables appears to require engagement in more intensive forms of PA. This presents a practical challenge for clinicians: to make dynamic forms of exercise more appealing and seemingly 'doable' to individuals with RA, and to do so in a way that promotes maintenance by not undermining patients' sense of control and autonomy [44]. As maintenance of PA is critical to its continued benefit, additional research should focus on the ideal ways to transition from initial engagement in enjoyable low-intensity PA which is readily maintained, to more intensive forms of PA which are less readily maintained but provide greater benefit for individuals with RA.

Several limitations of this study should be noted. First, PA in this study was measured with self-report measures and may be subject to response bias [45]. Objective measures of PA (e.g. accelerometers) should be used in any replication of this study. Second, due to the multi-component nature of this intervention, it is difficult to determine which components (or combination of components) led to changes in cognitions and behaviour. Future investigations could test motivational interviewing and self-regulation coaching in a full-factorial design to determine whether each has individual effects on cognitions and behaviour, or whether this specific combination of components is necessary. Finally, while this study suggests that changes in PA-related cognitions are related to increased PA behaviour, it did not specifically test whether changes in cognitions predict changes in behaviour.

In conclusion, targeting both the motivation and action phases of behaviour change led to increases in the PA-related cognitions self-efficacy and autonomous motivation, and to increases in physical activity that were maintained at 32-weeks follow-up. While the intervention did not improve disease activity or functional status, the fact that it led to increased PA with a minimal amount of contact time makes it a good starting point for promoting PA among insufficiently active individuals in clinical practice.

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