Testing a newly developed activity pacing framework for chronic pain/fatigue: a feasibility study

Deborah Antcliff, Anne-Maree Keenan, Philip Keeley, Steve Woby, Linda McGowan

ABSTRACT

Objectives To test the feasibility of using a new activity pacing framework to standardise healthcare professionals' instructions of pacing, and explore whether measures of activity pacing/symptoms detected changes following treatment.

Design Single-arm, repeated measures study.

Setting One National Health Service (NHS) Pain Service in Northern England, UK.

Participants Adult patients with chronic pain/fatigue, including chronic low back pain, chronic widespread pain, fibromyalgia and chronic fatigue syndrome/myalgic encephalomyelitis.

Interventions Six-week rehabilitation programme, standardised using the activity pacing framework.

Outcome measures Feasibility was explored via patients' recruitment/attrition rates, adherence and satisfaction, and healthcare professionals' fidelity. Questionnaire data were collected from patients at the start and end of the programme (T1 and T2, respectively) and 3 months' follow-up (T3). Questionnaires included measures of activity pacing, current/usual pain, physical/mental fatigue, depression, anxiety, self-efficacy, avoidance, physical/mental function and quality of life. Mean changes in activity pacing and symptoms between T1-T2, T2-T3 and T1-T3 were estimated.

Results Of the 139 eligible patients, 107 patients consented (recruitment rate=77%); 65 patients completed T2 (T1-T2 attrition rate=39%), and 52 patients completed T3 (T1-T3 attrition rate=51%). At T2, patients' satisfaction ratings averaged 9/10, and 89% attended ≥5 rehabilitation programme sessions. Activity pacing and all symptoms improved between T1 and T2, with smaller improvements maintained at T3.

Conclusion The activity pacing framework was feasible to implement and patients' ability to pace and manage their symptoms improved. Future work will employ a suitable comparison group and test the framework across wider settings to explore the effects of activity pacing in a randomised controlled trial.

Trial registration number NCT03497585.

INTRODUCTION

Activity pacing is a principal coping strategy for patients with long-term conditions, including chronic low back pain, chronic widespread pain, fibromyalgia and chronic fatigue syndrome/myalgic encephalomyelitis (CFS/ME).1–5 Chronic pain and chronic fatigue are known to coexist,6 7 and overlap in symptoms, including depression, anxiety and disability.8–11 Conditions of chronic pain/fatigue may share similar disease processes: physical deconditioning following under-activity/avoidance, pathophysiological/psychological processes and central sensitisation.11–16 Treatments aim to reverse some of these processes: to improve physical/mental functioning, increase tolerance and improve quality of life.12 15 17 Recommended treatments include psychological therapies (eg, cognitive–behavioural therapy) and graded exposure to activity/exercise,15 16 of which activity pacing is a key component.18–20

Patients with chronic pain/fatigue may present with altered behaviours, including underactivity or avoidance of activities that are perceived as harmful or that may exacerbate symptoms; overactivity or excessive persistence to push through/distract from symptoms; or fluctuations between overactivity and underactivity.21 Activity pacing provides an alternative behaviour to enable
patients to (re-)engage with activities in a manner that encourages their progression towards more regular or improved functioning.1 22 23

At present, there remains confusion regarding how activity pacing is defined or interpreted, and the effects on patients’ symptoms.3 24 25 There is no widely used guide to standardise how healthcare professionals instruct activity pacing to patients; and uncertainty whether different methods are required for symptoms of chronic pain versus chronic fatigue.3 26 This poses challenges how to advise patients with both chronic pain and fatigue.

We have developed an activity pacing framework using an inclusive approach for patients who present at rehabilitation services with chronic pain and/or fatigue. Using the Medical Research Council guidelines for developing complex interventions, mixed methods were implemented to encompass theoretical and stakeholder standpoints.27 Mixed methods comprise quantitative and qualitative approaches to collecting and analysing data.28 Stage I: Healthcare professionals’ survey gathered opinions on activity pacing (n=92).4 These findings, together with existing research formed the first draft of the framework and accompanying appendices. Stage II: Nominal group technique refined the activity pacing framework using a consensus meeting between patients and healthcare professionals (n=10).29 During the development of the activity pacing framework, stakeholders included healthcare professionals and patients with the aim of increasing the clinical utility and acceptability of the framework (see online supplemental figure 1 Content of the Activity Pacing Framework: Theory and Overview, and Appendices and Teaching Guide booklets.)

The conceptual model of the activity pacing framework (see figure 1) follows principles of quota-contingency and the operant approach (eg, setting goals according to time/distance/activity). The activity pacing framework is underpinned by concepts of rehabilitation with aims of improving physical and cognitive function; and engagement in, and satisfaction with meaningful activities, while managing symptoms.4 29 The activity pacing framework includes the potential for reversibility of some of the consequences of chronic pain/fatigue, such as the potential to reduce levels of disability. Together with containing themes of adjusting activities, planning and consistency, the activity pacing framework also includes themes of progression regarding the amount and/or variety of activities. Therefore, the activity pacing framework is considered to be a rehabilitative approach that moves forward from only adapting, or in some cases maladapting to the long-term condition. The activity pacing framework differs from energy conservation/adaptive pacing approaches which involve undertaking activities according to symptom severity (symptom-contingency) with an aim of reducing or avoiding symptoms.30 31 Within the current activity pacing framework, quota-contingency is advised alongside concepts of flexibility and choice to enable relevance and sustainability in conditions where symptoms may vary. The framework refers to all types of activities including work, household activities, cognitive activities, physical activities, exercise and relaxation to increase its wider relevance for patients with chronic pain and/or fatigue, for varying abilities and behaviours.

The aim of this study was to test the feasibility of using the activity pacing framework to underpin a rehabilitation programme for chronic pain/fatigue. In preparation for a future clinical trial, specific objectives included: (1) Exploring participant recruitment/attrition rates and adherence/acceptability (for both chronic pain and fatigue); (2) Exploring healthcare professionals’ fidelity to the framework and (3) Exploring the suitability of the outcome measures, including the modified 28-item Activity Pacing Questionnaire (APQ-28).

METHODS

Study design

This single-arm, repeated measures study is reported as a non-randomised feasibility study using the extended Consolidated Standards of Reporting Trials guidelines,32 33 (see online supplemental table 1). Quantitative questionnaire data were collected from patients at the start (T1) and end (T2) of the 6-week rehabilitation programme, and at 3-month follow-up (T3). The study was prospectively registered (protocol available at ClinicalTrials.gov: NCT03497585). The acceptability of the
Participant recruitment
Participants were identified from consecutive referrals to a rehabilitation programme for chronic pain/fatigue in a Pain Service in Northern England, UK. All patients attended a minimum of one face-to-face appointment before referral to the programme. Participants received the study information via the post 1 week before attending the programme and/or during the first session of the programme. The consent form was completed either at home or during the first session.

Eligibility criteria
Eligible patients were aged ≥18 years, with symptoms for ≥3 months and with a general practitioner or hospital consultant diagnosis of chronic low back pain, chronic widespread pain, fibromyalgia or CFS/ME. Patients were required to read and write in English. Ineligible patients were those with evidence of a serious underlying pathology, such as a current diagnosis of cancer, or patients with severe mental health or cognitive functioning issues.

Sample size
A sample size of 50 patients has been recommended for feasibility studies to enable estimates of recruitment/attrition, means/SD and changes in means to prepare for future clinical trials. To attain a sample of 50 participants at T3, it was estimated that 340 patients may need to be approached to allow for a 50% recruitment rate at T1, a 40% attrition rate between T1 and T2 and a 50% return rate at T3.

Existing rehabilitation programme
The existing rehabilitation programme comprised of six consecutive weekly sessions (each 3.5 hours) delivered by healthcare professionals (pain specialist physiotherapists and psychological well-being practitioners). The programme included understanding complex symptoms, sleep hygiene, graded exercise, goal setting, relaxation and mindfulness. Pacing was instructed in one session but was not informed or standardised by any particular guide or framework.

Activity pacing framework standardised programme
The existing 6-week programme was modified though restructuring and standardisation using the activity pacing framework. Activity pacing was formally instructed on two sessions (weeks 2–3). However, activity pacing was referenced throughout the programme in relation to other coping strategies, for example, how activity pacing can assist graded exercise (weeks 1–5) or set-back management (week 6). In comparison to the existing rehabilitation programme, the activity pacing framework standardised programme included more in-depth discussions of activity behaviours (avoidance, overactivity-underactivity cycling and excessive persistence) to assist patients to identify their current approach to activities. This aimed to facilitate patients’ recognition of which facets of activity pacing were most relevant to them. The two activity pacing sessions focused on the aims of activity pacing, barriers to activity pacing, facets of activity pacing (e.g., breaking down tasks, switching between activities, having more consistent activity levels, allowing flexibility, gradually increasing the amount or variety of activities), and stages of activity pacing (introducing activity pacing, finding baselines, adjusting activities, planning, consistency, learning and progressing). Practical exercises included completing an activity diary to discuss patients’ activity patterns and setting goals in which activity pacing could be practised (see online supplemental figure 2. Content of the rehabilitation programme). Patients received a handout to summarise the key concepts of activity pacing. The healthcare professionals (as above) received training on the framework during a half-day session and could contact the lead researcher (DA) for any queries. All patients attended the standardised programme, but patients chose whether to participate in the study through their optional completion of the study questionnaires and consent form.

Data collection
Feasibility outcomes
Measures of feasibility included participant recruitment/attrition rates, adherence (number of sessions attended), acceptability (two satisfaction rating scales regarding the programme content and length where 0=dis satisfied and 10=fully satisfied), and missing data in the questionnaire. For every programme, healthcare professionals completed a 13-item fidelity checklist based on the conceptual model of the activity pacing framework to ensure their inclusion of key elements from the framework. Each clinician was observed once by the lead researcher.

Clinical measures
The self-reported paper questionnaire booklets (T1, T2 and T3) included standardised clinical measures. T1 could be completed during session one or at home, T2 could be completed during session 6, and T3 was sent in the post to be completed at home. Telephone reminders were made if the T3 questionnaires were not returned within 2 weeks. The T1 booklet contained demographic questions, in addition to following measures included in T2 and T3:

1. Activity pacing was measured using the APQ-28. The 26-item APQ was initially validated among patients with chronic pain/fatigue and contained five subthemes: Activity adjustment, Activity planning, Activity consistency, Activity acceptance and Activity progression (Cronbach’s alpha=0.72–0.92). See online supplemental table 2, Five themes of the APQ-28 with examples. Each item is scored between 0='never did this' and 4='always did this'. Two items have been added that correspond to important aspects of activity pacing that emerged during the development of the activity pacing framework, explored via interviews with patients and healthcare professionals, is reported elsewhere.
pacing framework. The new items: APQ12: ‘I found a baseline amount of activities that I could do on ‘good’ and ‘bad’ days’ and APQ15: ‘I had a flexible approach with my activities’ were added to the subthemes of best conceptual fit (activity adjustment and activity acceptance, respectively). Each subtheme was calculated as a mean score. The APQ-28 subthemes, similarly to the following scales, permitted one missing item per subscale.

2. Current and usual pain were measured using two 11-point Numerical Rating Scales, where 0='no pain' and 10='worst possible pain'.

3. Physical fatigue (seven items) and mental fatigue (four items) were measured using the Chalder Fatigue Questionnaire, where scores of 1='much worse than usual' and 4='better than usual'. Two subscale scores were summated where higher scores indicated less fatigue.

4. Depression was measured using the nine-item Patient Health Questionnaire-9, the items of which are based on the Diagnostic and Statistical Manual of Mental Disorders Fourth Edition. Items were rated between 0='not at all' and 3='nearly everyday'. Total scores of 1–4=minimal depression, 5–9=mild depression, 10–14=moderate depression and ≥15=severe depression.

5. Anxiety was measured using the seven-item Generalised Anxiety Disorder Assessment. Items were rated between 0='not at all' and 3='nearly everyday'. Total scores of 5–9=mild anxiety, 10–14=moderate anxiety and ≥15=severe anxiety.

6. Self-efficacy was measured using the 10-item Pain Self-Efficacy Questionnaire (PSEQ) where items were rated between 0='not at all confident' and 6='completely confident'. Total scores of PSEQ ≥40 indicate those patients who are more likely to continue implementing coping strategies/behavioural changes and PSEQ ≤16 are considered low.

7. Avoidance was measured using the ‘Escape and Avoidance’ subscale of the Pain Anxiety Symptoms Scale-short version (PASS-20). The five items were rated between 0='never' and 5='always' where higher total scores indicated greater avoidance.

8. Physical and mental function were measured using the 12-Item Short-Form Health Survey (SF-12). Two subscale scores (out of 100) were calculated using the SF-12 software (V.2; 1-week recall) where higher scores indicated better function.

9. Health-related quality of life was measured using the EQ-5D-5L (EuroQol five-dimensions, five-levels). The EQ-5D-5L was calculated as an index score.

Data analysis

Feasibility outcomes and participants’ demographics were analysed using descriptive statistics. Clinical outcomes were estimated as changes in activity pacing and symptoms between T1-T2, T2-T3 and T1-T3 (mean change, 95% CIs). The validity of the modified APQ-28 was estimated using Cronbach’s alpha and item correlations; and sensitivity analyses explored the effects of including the two new APQ-28 items. Data were analysed using IBM SPSS Statistics V.26 statistical software (IBM).

Patient and public involvement

Patient and public involvement (PPI) commenced during the initial planning stages of the mixed methods programme to develop and test the activity pacing framework. A meeting with five PPI representatives discussed the study purpose and practical issues around the proposed methods (online survey, nominal group technique and feasibility and acceptability studies). PPI guided on improving the accessibility of patients’ participation and reducing burden (eg, location and duration of meetings). A PPI representative has acted as an advisor on the study, involving commenting on study documents/questionnaire booklets and coding qualitative interviews. Acceptability interviews with patients explored practical issues surrounding the feasibility study, which will further assist the planning of a future randomised controlled trial (RCT) of activity pacing.

RESULTS

Recruitment and T1 data collection commenced in May 2018 and T3 data collection ended in December 2019 due to attaining the target sample.

Demographics

Among the 107 participants who completed the baseline (T1) measures, participants were predominantly female (n=92, 86.0%) with a mean age of 55.25±12.83 years. Low back pain was most frequently reported (n=79, 73.8%) and CFS/ME least frequently reported (n=12, 11.2%). Sixty-five participants (61.3%) reported two or more conditions of chronic pain and/or fatigue. Of the 12 participants with CFS/ME, 10 participants reported CFS/ME as their main condition, and 11 reported at least one comorbidity of LBP (n=7), chronic widespread pain (n=6), fibromyalgia (n=7) or another condition (n=3). (see table 1 for participant demographics and table 2 for baseline scores for activity pacing and symptoms.)

Feasibility outcomes

Recruitment and attrition (objective 1)

Of the 144 patients invited to participate, 139 were eligible (96.5%). The reasons for ineligibility included: three patients reported only neck pain, one patient reported neck/knee pain and one patient reported thoracic pain. Of the 139 eligible patients, 107 (77.0%) were recruited at T1, 69 (64.5%) completed the 6-week programme and 65 (60.7%) completed the T2 measures (attrition rate=39.3%). Fifty-two participants completed T3 (80.0% of T2; attrition rate from T1=51.4%). There were no serious adverse events (see figure 2).
Of the 107 participants, the median number of rehabilitation programme sessions attended was five (58.9% participants attended ≥5 sessions); 83.2% participants attended at least one activity pacing session and 56.1% attended both activity pacing sessions. Of the 65 participants who completed T2, the median number of sessions attended was six (89.2% participants attended ≥5 sessions); 100% of participants attended at least one activity pacing specific session and 54 (83.1%) participants attended both activity pacing sessions. There were no statistically significant
differences between participants who completed T2 or dropped out in terms of demographics or baseline symptoms. Of the 12 participants with CFS/ME, six completed T2 (50%) and six completed T3 (100% of T2, 50% of T1); whereas 59 of the 95 participants without CFS/ME completed T2 (62%) and 46 completed T3 (78% of T2 and 48% of T1).

Acceptability of the rehabilitation programme/questionnaires (objective 1)
On T2, participants rated their satisfaction of the length and content of the rehabilitation programme as mean=8.8 (SD=1.7) and 9.1 (SD=1.5), respectively. The satisfaction of only those participants with CFS/ME was mean=9.0 (SD=0.9) and 9.2 (SD=1.0).

There were minimal missing data in the questionnaire booklets (approximately 1%). Some participants wrote comments regarding their perceived benefits of implementing activity pacing and other coping strategies. Two participants wished for a longer programme or a follow-up session (see figure 3 for examples of participants’ comments).

Fidelity to the activity pacing framework (objective 2)
Each healthcare professional observation demonstrated good adherence to the framework against a number of key points. Healthcare professionals reported 100% adherence in their fidelity checklists for each rehabilitation programme. Healthcare professionals reported that some participants spent over 20 min completing the questionnaire booklet, and that not all participants completed the activity diaries.

Interventions between T2 and T3
Of the 52 respondents at T3, two patients received lumbar epidural steroid injections, one patient had acupuncture, one attended a chiropractor and one patient had knee surgery.

Clinical outcomes
Validity of the APQ-28 (objective 3)
At T1, the two new APQ-28 items showed ease of completion through minimal missing answers (Item APQ12=0 missing answers, Item APQ15=1 missing answer). The scores of the new items utilised the full range, and the mean scores (Items APQ12=1.67 and APQ15=1.91) sat within the range of the other APQ-28 items (mean=1.17–2.78). The new items demonstrated optimal fit with their allocated subthemes via highest interitem correlations and item-total correlations (item total correlations: APQ12 and Activity adjustment, r(106)=0.76, p<0.001; Item APQ15 and Activity acceptance, r(106)=0.68, p<0.001). The internal consistency for Activity adjustment increased with the addition of Item APQ12 (Cronbach’s alpha=0.86 to 0.88), and for activity acceptance with the addition of item APQ15 (Cronbach’s alpha=0.68 to 0.72).
The internal consistency of the other APQ-28 subthemes were: activity planning=0.86, activity consistency=0.80 and activity progression=0.69.

Mean changes in activity pacing and symptoms (objective 3)
Between T1 and T2, all five APQ-28 subtheme mean scores increased, indicating improved activity pacing. There were small reductions in APQ-28 scores between T2 and T3. However, all five subthemes showed overall improvements between T1-T3, with Activity planning showing the greatest increases (see table 3). Sensitivity analyses showed marginal increases in mean changes following the addition of the two new APQ-28 items.

Between T1 and T2, the mean scores of all symptoms improved. Current pain reduced more than usual pain. Physical and mental fatigue both improved, as did self-efficacy and quality of life. Mental function improved more than physical function. Depression, anxiety and avoidance all reduced. There was some deterioration in symptoms between T2-T3, but between T1 and T3 all symptoms demonstrated clear improvements except avoidance (−1.46, 95% CI −3.92 to 0.10) and physical function (1.62, 95% CI −0.81 to 4.06) (see table 4). Observing only the subgroup of participants with CFS/ME, improvements were seen between T1-T2 and T1-T3 across all APQ-28 subthemes and symptoms.

DISCUSSION
This study fulfilled the original aims of testing the feasibility and acceptability of using a new activity pacing framework to standardise instructions of activity pacing to assist planning a future effectiveness RCT. The study recruited to target and patients with chronic pain and chronic fatigue demonstrated both improvements in activity pacing strategies and reductions in symptoms.

Feasibility
The activity pacing framework demonstrated feasibility through excellent fidelity to the framework by healthcare professionals via self-reported checklists and observations. Acceptability was demonstrated through patients’ high satisfaction scores. Not all patients completed the activity diaries, however, this was optional for patients to facilitate their own self-reflection.

The recruitment rate (77%) was higher than estimated in the study protocol (50%). This was similar to a study exploring a 5-week exercise programme for chronic hip pain (recruitment rate=76%), and this rate is considered ‘Good’ using cut-off levels of 80%=excellent and 70%=good from a feasibility study exploring a mind-body physical activity programme for chronic pain. The attrition rate between T1 and T2 (39.3%) was as predicted in the protocol (40%), and lower than the 60% attrition rates reported across other studies investigating programmes for chronic pain. The attrition rate between T2 and T3

Figure 2 CONSORT diagram showing the flow of participants through the study. CONSORT, Consolidated Standards of Reporting Trials.

Figure 3 Participants’ written comments following attending the rehabilitation programme.

Table 3  Mean changes in the five subthemes of activity pacing (APQ-28) between T1 (baseline), T2 (end of 6 weeks’ treatment) and T3 (3 months’ follow-up)

<table>
<thead>
<tr>
<th>Measures</th>
<th>T1 mean (SD)</th>
<th>T2 mean (SD)</th>
<th>T2-T1 mean change (95% CI); effect size(d)</th>
<th>T3 mean (SD)</th>
<th>T3-T2 mean change (95% CI); effect size(d)</th>
<th>T3-T1 mean change (95% CI); effect size(d)</th>
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<tr>
<td>APQ-28 activity adjustment</td>
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<td>(n=51)</td>
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<td></td>
<td>T1 mean=1.73 (0.77)</td>
<td>T2 mean=1.93 (0.07)</td>
<td>0.07 (95% CI=0.26 to 0.38); d=0.11</td>
<td>T3 mean=2.04 (0.23)</td>
<td>−0.26 (95% CI= −0.35 to −0.18); d=0.13</td>
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<td>(n=50)</td>
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<td></td>
<td>T1 mean=1.73 (0.77)</td>
<td>T2 mean=2.02 (0.06)</td>
<td>−0.17 (95% CI= −0.33 to −0.01); d=0.04</td>
<td>T3 mean=2.12 (0.23)</td>
<td>−0.23 (95% CI= −0.35 to −0.11); d=0.12</td>
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<td>APQ-28 activity planning</td>
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<td></td>
<td>T1 mean=1.27 (0.95)</td>
<td>T2 mean=1.34 (0.82)</td>
<td>−0.09 (95% CI= −0.29 to −0.09); d=−0.10</td>
<td>T3 mean=1.25 (0.91)</td>
<td>−0.20 (95% CI= −0.37 to −0.03); d=−0.20</td>
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<td>(n=52)</td>
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<tr>
<td></td>
<td>T1 mean=1.27 (0.95)</td>
<td>T2 mean=1.70 (0.95)</td>
<td>−0.60 (95% CI= −0.72 to −0.58); d=−0.58</td>
<td>T3 mean=2.00 (0.87)</td>
<td>−0.25 (95% CI= −0.34 to −0.16); d=−0.23</td>
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<td>APQ-28 activity consistency</td>
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<td></td>
<td>T1 mean=1.82 (0.96)</td>
<td>T2 mean=1.93 (0.82)</td>
<td>−0.25 (95% CI= −0.39 to −0.11); d=−0.25</td>
<td>T3 mean=1.75 (0.88)</td>
<td>−0.10 (95% CI= −0.28 to 0.09); d=−0.11</td>
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<td>T1 mean=1.82 (0.96)</td>
<td>T2 mean=2.55 (0.72)</td>
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<td>T1 mean=1.87 (0.84)</td>
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<td>T1 mean=1.87 (0.84)</td>
<td>T2 mean=2.55 (0.72)</td>
<td>−0.50 (95% CI= −0.64 to −0.36); d=−0.46</td>
<td>T3 mean=2.09 (0.87)</td>
<td>−0.01 (95% CI= −0.20 to 0.08); d=−0.02</td>
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<td></td>
<td>T1 mean=1.45 (0.88)</td>
<td>T2 mean=2.39 (0.89)</td>
<td>−0.45 (95% CI= −0.65 to −0.25); d=−0.45</td>
<td>T3 mean=1.45 (0.85)</td>
<td>−0.05 (95% CI= −0.24 to 0.14); d=−0.05</td>
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<td>T1 mean=1.45 (0.88)</td>
<td>T2 mean=2.39 (0.89)</td>
<td>−0.45 (95% CI= −0.65 to −0.25); d=−0.45</td>
<td>T3 mean=1.45 (0.85)</td>
<td>−0.05 (95% CI= −0.24 to 0.14); d=−0.05</td>
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APQ-28, 28-item Activity Pacing Questionnaire.
Table 4  Mean changes in measures of symptoms between T1 (baseline), T2 (end of 6 weeks’ treatment) and T3 (3 months’ follow-up)

<table>
<thead>
<tr>
<th>Measures</th>
<th>T1 mean (SD)</th>
<th>T2 mean (SD)</th>
<th>T3 mean (SD)</th>
<th>T3-T1 mean change (95% CI); effect size(d)</th>
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<td>Current pain (n=65)</td>
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<tr>
<td>T1 mean=6.63 (1.97)</td>
<td>T2 mean=5.04 (2.36)</td>
<td>T3 mean=5.65 (2.31)</td>
<td>0.62 (95% CI=−0.08 to 1.31); d=0.26</td>
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<td>Usual pain (n=65)</td>
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<td>T1 mean=7.30 (1.82)</td>
<td>T2 mean=6.53 (2.10)</td>
<td>T3 mean=6.55 (1.91)</td>
<td>0.02 (95% CI=−0.48 to 0.52); d=0.01</td>
<td></td>
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<tr>
<td>Physical fatigue (n=62)</td>
<td></td>
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<tr>
<td>T1 mean=15.22 (4.10)</td>
<td>T2 mean=20.47 (4.13)</td>
<td>T3 mean=18.12 (4.18)</td>
<td>−2.35 (95% CI=−3.44 to −1.26); d=−0.67</td>
<td></td>
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<tr>
<td>Mental fatigue (n=64)</td>
<td></td>
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<tr>
<td>T1 mean=8.86 (2.77)</td>
<td>T2 mean=11.45 (2.20)</td>
<td>T3 mean=10.92 (2.34)</td>
<td>−0.53 (95% CI=−1.17 to 0.11); d=−0.24</td>
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<tr>
<td>Depression (n=63)</td>
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<tr>
<td>T1 mean=13.65 (6.44)</td>
<td>T2 mean=6.27 (5.49)</td>
<td>T3 mean=9.23 (5.75)</td>
<td>2.96 (95% CI=1.64 to 4.29); d=0.87</td>
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<tr>
<td>Anxiety (n=65)</td>
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<tr>
<td>T1 mean=9.91 (5.47)</td>
<td>T2 mean=6.45 (4.47)</td>
<td>T3 mean=6.10 (5.23)</td>
<td>1.44 (95% CI=0.55 to 2.33); d=0.32</td>
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<tr>
<td>Self-efficacy (n=65)</td>
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<tr>
<td>T1 mean=25.29 (10.60)</td>
<td>T2 mean=37.96 (14.12)</td>
<td>T3 mean=34.68 (14.26)</td>
<td>−3.28 (95% CI=−7.17 to 0.60); d=−0.23</td>
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<tr>
<td>Avoidance (n=64)</td>
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<tr>
<td>T1 mean=13.27 (5.49)</td>
<td>T2 mean=10.85 (5.93)</td>
<td>T3 mean=12.12 (5.79)</td>
<td>1.27 (95% CI=−0.27 to 2.81); d=0.21</td>
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<tr>
<td>Physical function (n=63)</td>
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<tr>
<td>T1 mean=34.15 (8.23)</td>
<td>T2 mean=39.45 (8.72)</td>
<td>T3 mean=36.63 (9.69)</td>
<td>−2.82 (95% CI=−5.29 to −0.35); d=−0.32</td>
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<tr>
<td>Mental function (n=63)</td>
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<tr>
<td>T1 mean=38.52 (11.10)</td>
<td>T2 mean=46.75 (10.82)</td>
<td>T3 mean=44.78 (10.44)</td>
<td>−1.97 (95% CI=−5.22 to 1.29); d=−0.18</td>
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<tr>
<td>Quality of life (n=59)</td>
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<tr>
<td>T1 mean=0.43 (0.25)</td>
<td>T2 mean=0.60 (0.25)</td>
<td>T3 mean=0.51 (0.28)</td>
<td>−0.09 (95% CI=−0.14 to −0.03); d=−0.36</td>
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</tbody>
</table>

Pain (Numerical Rating Scale 0-10), Physical/mental fatigue (Chalder Fatigue Questionnaire), Depression (Patient Health Questionnaire-9), Anxiety (Generalised Anxiety Disorder-7), Self-efficacy (Pain Self-Efficacy Questionnaire), Avoidance (Escape and avoidance subscale of the Pain Anxiety Symptoms Scale-20), Physical/mental function (Short-Form 12), Quality of life (EQ-5D-5L EuroQol five-dimensions, five levels index score).
through setting meaningful and realistic goals towards activity, rather than stopping activities with the aim of reducing/avoiding symptoms as per energy conservation approaches. Similarly, in an RCT comparing an operant approach with energy conservation, Racine et al.\(^\text{30}\) found the operant approach, but not energy conservation was associated with reduced avoidance among patients with fibromyalgia. This, together with greater improvements in depressive symptoms following the operant approach over energy conservation, led to recommendations towards the operant approach for patients with fibromyalgia.\(^\text{30}\)

The current study found that pre-post treatment (T1-T2) improvements in both avoidance and physical function showed some decline at 3months’ follow-up. The authors suggest that physical function may be a component of rehabilitation in which patients feel least confident, especially those with avoidant behaviours.\(^\text{20}\) This may have implications for future programmes to integrate follow-up sessions to encourage longer-term maintenance of physical activity. In comparison, Racine et al.\(^\text{30}\) found improvements in physical activity following both operant pacing and energy conservation approaches. Similarly to this study, Racine et al.\(^\text{30}\) implemented handouts, homework and goal setting to encourage patients’ uptake of activity pacing. However, both of the interventions explored by Racine et al.\(^\text{30}\) were of greater duration than the current study, comprising of 10 2hour stand-alone pacing sessions with a 3-month booster session. Within the current study, improvements in mental function between T1 and T2 (mean change=7.3) were better maintained between T1 and T3 (mean change=5.95); and both higher than the minimally clinically important change (3.77).\(^\text{51}\) Quality of life also improved between T1 and T2 (mean change=0.13) and much of this improvement was maintained between T1 and T3 (mean change=0.07); both changes exceeded the minimally important difference (0.037±0.008).\(^\text{52}\)

The activity pacing framework additionally aims to increase patients’ self-efficacy. Improvements in self-efficacy were found between T1 (mean=25.29) and T2 (mean=36.29), which were well maintained at T3 (mean=34.68). Scores were lower than the ≥40 cut-off. However, an improvement of ≥5.5 was attained which is considered a minimally important change.\(^\text{53}\) Both physical and mental fatigue improved, and improvements in mental fatigue appeared to be better maintained at T3. Comparisons to minimally important changes are unavailable.

Psychological health improved following the rehabilitation programme, including reduced depression scores from moderate to mild (T1=13.7, T2=7.1, T3=9.1); with a clinically significant reduction (≥5) between T1 and T2.\(^\text{40}\) Mean anxiety scores reduced (T1=9.9, T2=5.4 and T3=6.10), and remained within the classification of mild anxiety.\(^\text{41}\) Although reductions in pain were not a direct aim of the current treatment, lower pain severity was reported. Despite the increased intensity of pacing sessions contained within the RCT comparing the operant approach to energy conservation, Racine et al.\(^\text{30}\) found that neither pacing approach effectively reduced symptoms of pain or fatigue.

**Strengths and limitations**

This study was an early feasibility study that primarily aimed to explore whether a new activity pacing framework could be implemented in the clinical setting. While this study fulfilled its original aims, it is limited by the absence of a priori progression criteria. However, the findings from this study will help to inform the progression criteria that are used to determine whether to progress to a full clinical trial from a future pilot RCT. Despite recruiting to target, this sample was not powered with a control arm to determine treatment effectiveness. As per other studies exploring activity pacing, activity pacing was instructed as one component of the rehabilitation programme.\(^\text{5}\) Therefore, improvements in symptoms may have resulted from any combination of coping strategies. A future RCT will implement a suitable control to explore the effects of activity pacing, while implementing the activity pacing framework in a clinically relevant setting, including alongside other coping strategies.

The generalisability of this study is limited to a sample of predominantly females and white ethnic origin. Recruitment occurred only at one Pain Service and this service had an existing rehabilitation programme for both chronic pain and fatigue. Bias may have arisen through the lead researcher delivering the healthcare professionals’ training and undertaking the observations. Further work will test the activity pacing framework and study protocol across other healthcare services and explore feasibility and fidelity over wider geographical locations.

It is unknown what potential bias was caused by the attrition rate. However, there were no differences at baseline between those who completed the programme and those who dropped out. It is possible that patients who completed T2 and T3 possibly felt greater benefits from the treatment and were more motivated to respond to the follow-up questionnaires. The attrition rate may be reflective of some of the clinical challenges and missed appointments surrounding the complexity of chronic pain/fatigue. Further research could explore whether providing a follow-up treatment session improves commitment to activity pacing.

**Modifications for future study**

Since more patients completed the T1 questionnaires during the rehabilitation sessions than at home, this may be the preferable mode of distribution of paper questionnaires. To lessen the time taken to complete the questionnaires, the PASS-20 may be considered for exclusion in future study. The whole 20-item PASS scale was included for reliability and validity, but data specifically from the Escape and Avoidance subscale was explored. Modifications to the inclusion criteria may include patients with any chronic spinal pain, including cervical/thoracic pain due to the frequent and similar presentation at rehabilitation services.
Conclusion

To the authors’ knowledge, this is the first study to explore the clinical utility of a comprehensive activity pacing framework developed for both chronic pain and chronic fatigue. The newly developed activity pacing framework proved feasible to use clinically by healthcare professionals. Patients with both chronic pain and fatigue implemented greater activity pacing strategies following treatment, alongside reporting improvements in quality of life, psychological well-being, self-efficacy, pain and fatigue. Physical function and avoidance improved to a lesser extent and for the shorter-term. Future study will use the activity pacing framework in an effectiveness RCT to explore the effects of activity pacing on symptoms.

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Contributors

DA, AMK, PK, SW and LM all contributed to the conception and design of the study. DA undertook the acquisition of the data. DA, AMK, PK, SW and LM all contributed to the analysis and interpretation of data. DA, AMK, PK, SW and LM contributed to drafting the manuscript and revising it critically for important intellectual content and have approved the final version for publication. DA, AMK, PK, SW and LM are in agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. DA is the guarantor for this work.

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Competing interests

None declared.

Patient consent for publication

Not applicable.

Ethics approval

Ethical approval was granted by the London-Surrey Research Ethics Committee (18/L/00655).

Provenance and peer review

Not commissioned; externally peer reviewed.

Data availability statement

Data are available on reasonable request. All data relevant to the study are included in the article or uploaded as online supplemental information. Comprehensive data are presented in the manuscript tables, including participant demographics, baseline measures and post-treatment measures. Deidentified participant data may be available from the corresponding author. (Deborah.Antcliff@nhs.net) on reasonable request. Reuse is permitted for health and care research as long as the original authors are acknowledged. The protocol can also be requested from the author or accessed at ClinicalTrials.gov (NCT03497585).

Supplemental material

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