Do Behaviour-Change Techniques Contribute to the Effectiveness of Exercise Therapy in Patients with Intermittent Claudication? A Systematic Review

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WHAT THIS PAPER ADDS
This review provides the first systematic evaluation of behaviour-change techniques in addition to exercise therapy on walking capacity and behaviour in patients with intermittent claudication. It identifies 11 behaviour-change techniques that have been applied to individuals with intermittent claudication in order to increase walking. Barrier identification with problem solving, self-monitoring and feedback on performance are behaviour-change techniques that could be easily applied in clinical practice when prescribing exercise or giving advice to walk. There is a need for high-quality trials examining the effectiveness of behaviour-change techniques in addition to exercise therapy for improving patient outcomes.

This systematic narrative review of randomised controlled trials (RCTs) identifies and evaluates the efficacy of behaviour-change techniques explicitly aimed at walking in individuals with intermittent claudication. An electronic database search was conducted up to December 2012. RCTs were included comparing interventions incorporating behaviour-change techniques with usual care, walking advice or exercise therapy for increasing walking in people with intermittent claudication. Studies were evaluated using the Cochrane Collaboration risk of bias tool. The primary outcome variable was maximal walking ability at least 3 months after the start of an intervention. Secondary outcome variables included pain-free walking ability, self-report walking ability and daily walking activity. A total of 3,575 records were retrieved. Of these, six RCTs met the inclusion criteria. As a result of substantial heterogeneity between studies, no meta-analysis was conducted. Overall, 11 behaviour-change techniques were identified; barrier identification with problem solving, self-monitoring and feedback on performance were most frequently reported. There was limited high-quality evidence and findings were inconclusive regarding the utility of behaviour-change techniques for improving walking in people with intermittent claudication. Rigorous, fully powered trials are required that control for exercise dosage and supervision in order to isolate the effect of behaviour-change techniques alongside exercise therapy.

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INTRODUCTION
Intermittent claudication (IC) caused by lower-extremity peripheral arterial disease (PAD) is a debilitating condition, affecting walking ability, health status and quality of life.1–3 In addition to adequate treatment of the underlying arteriosclerotic disease, improving walking ability is an important clinical aim.

Exercise, and particularly walking, is a key component of disease management,4,5 with gains of up to 200% in maximal walking ability achieved following supervised exercise therapy (SET).6 SET is frequently treadmill-based and conducted in facilities where patients are supervised by healthcare professionals. Guidelines recommend SET on at least 3 days per week for at least 30 minutes.4 Over the long term, SET might be more effective than standard pharmaceutical therapy,7,8 and endovascular treatment or surgical treatment6,7 in improving walking ability.

However, the long-term effectiveness of SET relies on adherence to exercise, which is variable,9 and the impact on long-term unsupervised walking behaviour in the community is unclear.6 Moreover, recent international data suggest that less than one-third of vascular surgeons have access to SET to which patients can be referred.9 As a result of these resource limitations, individuals often receive only instruction to walk in their community, although fewer than one-half of IC patients follow such advice.10 People with IC
report lack of specific instructions, uncertainty regarding the outcome of walking exercise, the presence of comorbidities and pain tolerance among barriers to engaging in regular walking.10,11

Adherence to a home-based exercise prescription requires the individual to change their behaviour, either by adopting a new regimen or altering their current exercise. Increasing walking behaviour in people with IC presents a particular challenge, as walking gives rise to pain and may seem neither logical nor necessary to the individual. Although walking advice or SET may support behaviour change, for example, by providing information on how to perform walking exercise or through the provision of social support, data on activity levels among individuals with IC10,12 suggest that more deliberate strategies are necessary for lifestyle changes to occur. Therefore, skills for regulating thoughts and actions must be learned.13

Specific behaviour-change techniques (BCTs) based on existing psychosocial models of health-related behaviours have been identified, which could be implemented in clinical practice in order to increase unsupervised exercise, such as walking.14 These target individual motivation, and range from simple tasks, such as keeping a diary to monitor activity or setting behavioural goals, to complex psychological techniques including motivational interviewing (discussing and exploring ways to minimise resistance and ambivalence towards behaviour change with the individual)15 and action planning (detailed preparation of when, where and how the individual will engage in a behaviour).16 Therefore, if it is possible to identify techniques, or combinations of techniques, that have been successfully applied to increase walking in people with IC, then these could be applied in addition to walking prescriptions (that is, walking advice or SET) in order to achieve greater outcomes.

To date, evidence from interventions employing BCTs among individuals with IC has not been systematically evaluated. We conducted a systematic review of randomised controlled trials (RCTs) to evaluate whether BCTs improve measures of functional walking or walking behaviour among individuals with IC, and to identify if any particular techniques were successful.

METHODS

Eligibility criteria

Studies were eligible for inclusion if they were RCTs of individuals diagnosed with PAD and IC.9 Intervention groups must have received treatment incorporating at least one BCT, as defined by Michie et al.,14 that explicitly targeted walking behaviour. Walking advice was considered as part of usual care and was not included as a behaviour-change technique. Eligible control groups included patients receiving walking advice alone, usual care or attention placebo, but no administration of BCTs. Studies were excluded if both intervention and control groups received BCTs or if outcome variables were not reported at least 3 months following the start of an intervention.

Primary outcome

The primary outcome variable was maximal walking ability (MWA) assessed by treadmill or corridor walk test. MWA is a reliable quantitative marker of ambulatory performance in people with IC,17 and represents the distance or duration an individual can walk before they need to stop and rest.

Secondary outcomes

Secondary outcome variables included: pain-free walking ability (PFWA) assessed by treadmill or corridor walk test, which represents the distance or duration an individual can walk before they report the onset of pain; self-report walking ability, assessed by distance and speed scores on the Walking Impairment Questionnaire (WIQ),18 and daily walking activity, assessed by self-report or using an activity monitor. All outcome variables were evaluated at least 3 months following the start of an intervention, with the longest follow-up assessment reported.

Data sources and search strategies

An electronic database search (Supplementary Fig. 1) was conducted using Medline, PsychINFO, Embase, CINAHL and Web of Science and by cross-checking reference lists of retrieved full-text articles. The OpenSINGLE database was searched for any appropriate grey literature and the active register of the metaRegister of Controlled Trials was searched for in-progress and unpublished trials. No language restrictions were imposed and databases were searched from their earliest records to December 2012. Search results were downloaded into bibliographic software (EndNote X6; Thompson Reuters, New York, NY, USA).

Search terms included MeSH, keyword and wild-card terms located in the title or abstract for three broad concepts reflecting the disease (e.g., intermittent claudication, peripheral arterial disease), psychological interventions or variables (e.g., behaviour modification, motivation, intervention) and outcome (e.g., walking, exercise).

Study selection

Titles and abstracts of records were screened for eligibility by two investigators (MG and LB), and the full texts of retained articles were reviewed by two investigators (MG and LB) independently using a bespoke screening tool that was designed and piloted a priori. Disagreement between reviewers was resolved following discussion.

Data collection and computation

A data extraction tool was developed based on a template from the Cochrane Peripheral Vascular Diseases Review Group. This was pilot-tested on a selection of studies and refined as necessary. Data were collected on methods, study design, participants, intervention components and key outcome variables. At least two of four reviewers (MG, CW, LB and SJB) extracted data from all included studies. Disagreement was resolved by discussion.
Mean differences (MD) and 95% CIs were calculated for data on MWA, PFWA and daily walking activity, where possible, using Review Manager 5 (Cochrane IMS); if sufficient data to calculate MD were unavailable, percentage change scores were calculated: ([baseline score – follow-up score]/baseline score) × 100. Scores for self-report walking ability were converted from ratio or percentage values to reflect a range from 0 to 100 on the WIQ.

**Risk of bias in individual studies and level of evidence**

Study quality was evaluated using the Cochrane Collaboration tool for assessing risk of bias. Individual RCTs were rated as having high risk of bias (i.e., “low-quality” trials) or low to moderate risk of bias (i.e., “high-quality” trials) if there was evidence for the presence of ≥3 or <3 sources of bias respectively. In addition, RCTs were appraised using a 27-item checklist developed by Downs and Black, which provided a broader evaluation of study quality, including reporting, internal and external validity, and power. The maximum possible score for study quality using this scale is 31. The cumulative level of evidence from multiple studies, defined as “strong”, “moderate”, “limited”, “conflicting” or “none”, was determined for each outcome variable in accordance with recommendations by van Tulder et al.

**RESULTS**

**Study selection**

Six studies were identified for inclusion in the review. The initial database search resulted in 3,575 identified records. After duplicates were removed, 2,328 records remained, of which 2,200 studies were excluded based on the content of their titles and abstracts. Full texts of the remaining 128 articles were reviewed, of which a further 122 articles were excluded (Fig. 1).

Because of the heterogeneity of behaviour-change interventions, exercise prescriptions and outcome measures...
used, a narrative synthesis of the six included studies was conducted without meta-analysis.

Characteristics of included studies

Study design and participants. Six RCTs evaluating BCTs to increase walking in IC, with a total of 434 participants, were included (Table 1). Two RCTs were pilot studies26,27 and one was a PhD thesis.25 The number of participants ranged from 2327 to 145.23 Mean age was 67.3 years and 64% (n = 277/434) were male, reflecting the age and gender distribution of PAD in the general population. Baseline clinical measures were similar between control and intervention groups in all included studies, with the exceptions that one study reported a significantly higher MWA25 and one reported greater medication use for IC23 among the control group participants.

Intervention composition and setting. BCTs were administered in conjunction with walking advice in four studies,23,25–27 and with walking advice plus SET in two studies.23,24 Interventions ranged in the number of BCTs applied from one24,27 up to seven.23 Two interventional studies were delivered through group sessions24,25 and four during individual consultation.23,25,26 Among the interventions delivered on an individual basis, two were delivered at a research centre or hospital,23,25 one included a baseline consultation plus telephone follow-up25 and one was delivered in participants’ homes.26

Identified behaviour-change techniques. Overall, 11 BCTs14 were identified in the included studies (Table 2). The most frequent techniques reported were prompting self-monitoring of behaviour (n = 3),23,25,26 feedback on performance (n = 3),23,25,26 and barrier identification and problem solving (n = 3).23,25,26 Other BCTs included motivational interviewing (n = 2),24,26 providing follow-up prompts (n = 2),23,25 information on the consequences of the behaviour in general (n = 2),24,26,27 utilising goal setting (n = 2),23,25,26 and planning social support (n = 2).23,25,26 Action planning,26 use of a behavioural contract,25 and prompting practice of the behaviour25 were each reported once.

Control groups. Control groups received walking advice in four studies,23,25,26,27 and walking advice or usual care plus attention placebo in two studies.23,26 One study23 was a three-arm trial comparing home-based exercise therapy with SET or walking advice; for the purposes of this review, we report results of comparisons between home-based exercise therapy and walking advice only, as the home-based exercise therapy group were engaged in self-monitoring and received feedback on performance as BCTs, as per the inclusion criteria.

Outcome. Three studies evaluated walking ability (MWA or PFWA) by treadmill protocol using a graded progressive treadmill test,23,25,26 and one used a constant load treadmill test.24 Two RCTs included data on self-reported walking ability using the WIQ.23,26 Three studies reported daily walking activity, two which used step activity monitors,8,26 and one which used a standard questionnaire (International Physical Activity Questionnaire) to assess self-reported walking activity (Table 1).

Risk of bias in individual studies

The mean (range) score using the quality assessment tool by Downs and Black20 was 20 (12–26). Possible bias occurred in several studies because of inadequate allocation concealment23–25,27 and none of the included studies blinded outcome assessment (Table 3).

Effect of interventions

Maximal walking ability at least 3 months after the start of an intervention. Four studies reported data on MWA (Table 4 and Supplementary Table 1).23,25–27 One high-quality trial reported significantly greater improvements in MWA at 3 months in the intervention versus control groups (MD Δ 134.0 seconds [95% CI: 39.7 to 228.3]; p = .005).8 That study compared walking advice plus BCTs with walking advice alone. Among low-quality trials, one study reported improvements in 3-month MWA following BCTs plus walking advice and weekly SET versus walking advice alone (median Δ 130% vs. control 70%; p < .001).24 Two low-quality RCTs demonstrated no benefit of interventional versus control on MWA. One showed no difference 3 months following BCTs plus walking advice compared with walking advice alone (MD −3.9 minutes [95% CI: −8.2 to 1.1]; p = .13),25 and one showed no difference at 6 months following BCTs plus walking advice and weekly SET versus a non-exercise attention placebo group (MD 14.7 metres [95% CI: −69.0 to 39.6]; p = .60).23

Pain-free walking ability at least 3 months following the start of an intervention. Three studies reported data on PFWA (Table 4 and Supplementary Table 1). One high-quality trial8 reported greater improvements in PFWA at 3 months following BCTs plus walking advice compared with walking advice alone (MD Δ 150.0 seconds [95% CI: 65.5 to 234.5]; p = .0005). Among low-quality trials, there was no difference in PFWA at 3 months following BCTs plus walking advice compared with walking advice alone (MD −2.0 minutes [95% CI: −5.7 to 1.7]; p = 0.29)25 or at 6 months following BCTs plus walking advice and weekly SET versus an attention placebo group (MD 14.4 metres [95% CI: −47.5 to 76.3]; p = .65).23

Self-report walking ability at least 3 months following the start of an intervention. Data on self-report walking ability was available from two studies (Table 4 and Supplementary Table 1). One high-quality trial found no difference at 3 months in self-report walking ability following BCTs plus walking advice (mean ± SD Δ for distance 10.0 ± 25.0 and speed 11.0 ± 22.0) versus walking advice alone (mean ± SD Δ for distance 1.0 ± 34.0 and speed 4.0 ± 25.0; both p = NS).8 One low-quality trial reported mixed findings. There was a greater improvement in self-report walking speed (mean ± SE Δ 5.7 ± 2.2 versus control 1.9 ± 2.8;
Table 1. Characteristics of randomised controlled trials included in the systematic review.

<table>
<thead>
<tr>
<th>First author</th>
<th>Participants</th>
<th>Exercise intervention</th>
<th>BCTs used</th>
<th>BCT delivery</th>
<th>Control</th>
<th>Outcome measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cunningham²⁶</td>
<td>n = 58 (67% M), mean 65.3 y, 36% current smokers, mean ABI 0.70, early IC</td>
<td>Walking advice + BCT</td>
<td>Information on consequences of walking exercise, behavioural goal setting, action planning, barrier identification/problem solving, motivational interviewing</td>
<td>Individual consultation with a trainee health psychologist (2 × 1 h, 1 wk apart) delivered at home</td>
<td>Walking advice plus attention placebo at 4 mo</td>
<td>DWA (step activity monitor)</td>
</tr>
<tr>
<td>Gardner⁸</td>
<td>n = 119 (48% M), mean 65 y, 10% current smokers, mean ABI 0.73, established IC</td>
<td>Walking advice + BCT</td>
<td>Self-monitoring, performance feedback</td>
<td>Individual consultation with an exercise physiologist (7 × 15 min, 2 × /mo)</td>
<td>Walking advice²⁶</td>
<td>MWA and PFWA (graded progressive treadmill test), SRWA and DWA (step activity monitor) at 3 mo</td>
</tr>
<tr>
<td>Cheetham²⁴</td>
<td>n = 59 (73% M), mean 67 y, 100% current or ex-smokers, mean ABI 0.69, established IC</td>
<td>Walking advice and SET (1 × 30 min/wk for 6 mo) + BCT</td>
<td>Information on consequences of walking exercise</td>
<td>Motivation class (1 × 5–10 min/wk for 6 mo) delivered in conjunction with SET</td>
<td>Walking advice</td>
<td>MWA (constant-load treadmill test) up to 12 mo</td>
</tr>
<tr>
<td>Christman²⁵</td>
<td>n = 30 (55% M), mean 66.9 y, 47% current smokers, mean ABI 0.61, established IC</td>
<td>Walking advice + BCT</td>
<td>Barrier identification/problem solving, self-monitoring, performance feedback, behavioural contract, follow-up prompts, planning social support</td>
<td>Small group counselling (1 × 1 h/wk for 12 wk)</td>
<td>Walking advice</td>
<td>MWA and PFWA (graded progressive treadmill test) up to 6 mo</td>
</tr>
<tr>
<td>Collins²³</td>
<td>n = 145 (69% M), mean 66.5 y, 14% current smokers, mean ABI 0.95, DM and established IC</td>
<td>Walking advice and SET (1 × 50 min/wk for 6 mo) + BCT</td>
<td>Behavioural goal setting, barrier identification/problem solving, self-monitoring, performance feedback, prompt practice of walking, follow-up prompts, planning social support</td>
<td>Individual consultation (1 × at baseline), practice exercise sessions (2 × 1 h), follow-up telephone consultation (1 × biweekly for 6 mo)</td>
<td>Usual care plus attention-placebo</td>
<td>MWA (graded progressive treadmill test) and SRWA at 6 mo</td>
</tr>
<tr>
<td>Quirk²⁷</td>
<td>n = 23 (74% M), mean 73.2 y, 32% current smokers, mean ABI not reported, established IC</td>
<td>Walking advice + BCT</td>
<td>Motivational interviewing</td>
<td>Individual consultation (up to 4 × 1 h)</td>
<td>Walking advice²⁷</td>
<td>DWA (self-report)²⁷</td>
</tr>
</tbody>
</table>

Note. ABI = ankle-brachial index; BCT = behaviour-change technique; DM = diabetes mellitus; DWA = daily walking activity; h = hour; IC = intermittent claudication; M = male; min = minute; mo = month; MWA = maximal walking ability; PFWA = pain-free walking ability; SET = supervised exercise therapy; SRWA = self-report walking ability (assessed by the Walking Impairment Questionnaire); wk = week; y = years.

²⁶ This was a three-arm trial and included a group receiving SET for which data are not presented.

²⁷ Gardner maximal treadmill test: 42 3.2 km/h (2.0 mph) constant speed, baseline 0% grade, increasing 2% every 2 min up to 14% at 16 min; maximum distance 0.8 km (0.5 mi).

²⁸ 3.0 km/h at a 12% grade up to 15 min.⁴²

²⁹ Baseline 1.6 km/h (1.0 mph) and 5% grade, increasing in 5 min intervals to 4.0 km/h (2.5 mph) and 10% grade.

³⁰ Confirmed by personal communication with author.

³¹ International Physical Activity Questionnaire, brief version.
Daily walking activity at least 3 months following the start of an intervention. Data on daily walking activity was available from three studies, including two high-quality trials (Table 4 and Supplementary Table 1). In one high-quality study, change in mean 6-day step count was greater following BCTs plus walking advice versus an attention placebo plus walking advice (MD 1,674.2 steps [95% CI: 156.0 to 3,188.4]; \( p = .03 \)).\(^{26} \) In a second high-quality study, there was no difference in mean 7-day activity time following BCTs plus walking advice versus walking advice alone (MD -1 min/day [95% CI: -41.1 to 39.1]; \( p = .96 \)).\(^{27} \) In a low-quality pilot RCT, BCTs did not affect self-reported daily walking activity.\(^{27} \)

**DISCUSSION**

This systematic review is the first evaluation of BCTs alongside exercise therapy for improving walking in individuals with IC. The existing evidence is limited to a small number of mostly low-quality trials using 11 BCTs, and there is insufficient evidence to draw conclusions on the effectiveness of these strategies for improving maximal walking ability. Given that access to SET and adherence to walking advice is limited among individuals with IC,\(^{9,10} \) this is an important finding as it highlights the need for more rigorous trials of behaviour-change interventions for this population.
Although data from two high-quality trials demonstrate that BCTs supplementary to exercise prescription improved maximal and pain-free walking ability and increased daily walking activity, further evidence from four low-quality trials was conflicting. The high-quality trials were more recent publications, and may reflect improvements in study design and reporting, and a growing recognition of the need to support behaviour-change among IC patients. However, findings of both trials were at risk of bias as a result of lack of blinding of the outcome assessor, which may be important given that treadmill walking performance could be influenced by interaction with personnel. In addition, one trial was at risk of selection bias because there was no indication of allocation concealment.

Although RCTs are considered the gold-standard for systematically evaluating the existing evidence, poor design and possible bias can reduce the robustness of data. In addition, RCTs often lack ecological validity, limiting the transferability of their findings to the clinical setting. Interestingly, before-and-after studies and audits of BCTs consistently report improvements in MWA among people with PAD.

Possible explanations for the conflicting findings include the use of unstandardised treadmill testing protocols for Table 4.

### Table 3. Risk of bias in randomised controlled trials.

<table>
<thead>
<tr>
<th>First author</th>
<th>Source of bias</th>
<th>Random sequence generation</th>
<th>Allocation concealment</th>
<th>Participant and personnel blinding</th>
<th>Blinded outcome assessment</th>
<th>Incomplete outcome data</th>
<th>Selective reporting</th>
<th>Summary risk of bias</th>
<th>Quality index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cheetham</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>High</td>
<td>21</td>
</tr>
<tr>
<td>Christman</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>High</td>
<td>15</td>
</tr>
<tr>
<td>Collins</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>High</td>
<td>23</td>
</tr>
<tr>
<td>Cunningham</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Low</td>
<td>24</td>
</tr>
<tr>
<td>Gardner</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Low</td>
<td>26</td>
</tr>
<tr>
<td>Quirk</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>High</td>
<td>12</td>
</tr>
</tbody>
</table>

The presence or potential presence of a source of bias is indicated as ‘yes’.

a Summary risk of bias was determined using the Cochrane Collaboration tool for assessing risk of bias.

b Studies were rated as having high risk of bias (i.e., ‘low-quality’ trials) or low to moderate risk of bias (i.e., ‘high-quality’ trials) if there was evidence for the presence of ≥3 or <3 sources of bias respectively.

c Quality index scores were determined using the quality appraisal tool developed by Downs and Black; scores range from 0 to 31, with higher scores indicating higher study quality and a lower risk of bias.

### Table 4. Data extracted from included studies.

<table>
<thead>
<tr>
<th>First author</th>
<th>Maximal walking ability</th>
<th>Pain-free walking ability</th>
<th>Outcome</th>
<th>Self-report walking ability</th>
<th>Daily walking activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cunningham</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gardner (vs. walking advice)</td>
<td></td>
<td>Greater change in walking time in intervention group</td>
<td>(124 ± 193 s) vs. control (−10 ± 176 s); p &lt; .05</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cheetham</td>
<td></td>
<td>Greater change in walking distance in intervention group</td>
<td>(median 304 m) vs. control (175 m); p &lt; 0.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Christman</td>
<td></td>
<td>p = NS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collins</td>
<td></td>
<td>p = NS</td>
<td></td>
<td>Greater change in score for intervention group</td>
<td>(Δ 5.7 ± 18.7) vs. control (−1.9 ± 23.9); p = 0.034a</td>
</tr>
<tr>
<td>Quirk</td>
<td></td>
<td>p = NS</td>
<td></td>
<td></td>
<td>p = NS</td>
</tr>
</tbody>
</table>

Note. NS = non-significant; s = seconds. Data are presented as intervention versus control and represent mean ± SD unless indicated otherwise.

a SD derived from data published as SE.
measuring outcome,25 and heterogeneous patient samples, for example patients in one trial concomitantly had diabetes mellitus,23 which could influence exercise response.38,39 Moreover, although four23,25–27 of the included studies were designed with the primary objective of examining the effect of BCTs on walking, two studies8,24 did not deliberately evaluate BCTs, thus compromising their quality appraisal in this review.

Patient perceived walking performance is an important clinical outcome, as pain-related symptoms are largely subjective and because no minimal clinically important differences for changes in PFWA or MWA have been established. In the current review, one high-quality study8 reported no change in self-report walking ability, despite improvements in PFWA and MWA, suggesting that BCTs might improve walking performance, but not patient perceptions of their walking ability, which may be more meaningful to them. Future studies evaluating BCTs should incorporate outcome measures reflecting the patient perception of walking capacity, together with more objective measures.

This review identifies a total of 11 BCTs, which were applied to increase walking in individuals with IC. Successful BCTs included self-monitoring, for example encouraging the patient to keep a diary of walking behaviour, providing feedback on walking performance, and helping the patient to identify barriers to walking and solutions to overcoming them. These techniques are useful for increasing an individual’s confidence in their ability to perform walking exercise and can be easily incorporated into clinical practice by healthcare professionals when discussing exercise, particularly home-based walking advice among people with IC. However, there are at least 29 additional theory-based techniques classified by Michie et al.,14 and possibly more unclassified techniques, that have not been applied to increase walking among individuals with IC, which warrant investigation.

Limitations to the included studies meant statistical synthesis of the data could not be performed because of a high degree of clinical and methodological heterogeneity, primarily as a result of variations in intervention protocol and setting between studies, and lack of control for these factors within studies. In addition, in two studies,23,24 where BCTs were provided alongside SET, it was difficult to distinguish the effects of BCTs above and beyond the benefits of the exercise alone. However, both studies provided only one supervised exercise session per week, which is a suboptimal exercise dose that does not meet guidelines for SET for patients with IC.4,40 Thus, it is possible that the change in walking ability is not solely attributable to SET in these studies, and that BCTs targeting self-directed walking activity might influence outcomes. Data from the study by Gardner et al.,8 which applied BCTs to increase self-directed walking, demonstrate that BCTs have the potential to increase participation such that individuals achieve gains in walking ability that are at least comparable with SET.

BCTs are intended to target and modify known motivational factors, for example, a person’s beliefs about walking and the outcome of performing it, or their ability to carry out walking as exercise. In order to evaluate the effectiveness of BCTs, it is necessary to determine whether the targeted psychosocial constructs change over the course of an intervention. Because the studies included in this review did not evaluate the psychosocial constructs underpinning the BCTs implemented, it was not possible to determine whether the intervention successfully altered the psychosocial variables or if other factors influenced walking. Moreover, as most interventions combined multiple BCTs, the independent effects of each could not be determined.

In summary, there is limited evidence from one high-quality RCT supporting BCTs for increasing MWA and PFWA, and from one high-quality RCT suggesting that BCTs might be beneficial for increasing daily walking activity among people with IC. Eleven BCTs were identified and several, in particular self-monitoring, feedback on performance and barrier identification with problem solving, could be easily combined with exercise prescription and walking advice in clinical practice. Future high-quality trials should explore these and other BCTs, and should evaluate changes in psychosocial variables that are targeted by specific techniques.

ACKNOWLEDGEMENTS

MG, LB and JW contributed to the original idea and study design. MG and LB conducted study searches and screened articles for inclusion. MG, CW and LB extracted data and completed quality appraisal. MG, JW and CW were involved in data interpretation and statistical analysis. MG, LB, CW and JW contributed to manuscript preparation.

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CONFLICT OF INTEREST

None.

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APPENDIX A. SUPPLEMENTARY MATERIAL

Supplementary material related to this article can be found at http://dx.doi.org/10.1016/j.ejvs.2013.03.030.

REFERENCES


