

# Behaviour change and self-management interventions in persistent low back pain

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**Abstract (144/150 words)**

Self-management interventions for persistent low back pain (LBP) promote the active involvement of the patient in managing their condition. Such interventions can be characterised as behaviour change interventions in that they are designed to help the patient learn and adopt a set of health behaviours they can use in everyday life to benefit their condition by reducing or managing their symptoms. Self-management interventions are recommended in several key guidelines for the treatment of persistent LBP, but the evidence for the effectiveness of these types of interventions is inconclusive. In this article we discuss the existing literature within self-management interventions for persistent LBP and make suggestions for how research in this area can be improved, specifically addressing areas where evidence is currently lacking. Existing definitions of self-management are examined, and the importance of the choice of an underlying theory and appropriate outcome measures are discussed.

**Key words:**

Self-management; low back pain; treatment effectiveness; behaviour change

## **Introduction**

Chronic or persistent low back pain (LBP) is a condition that is characterised by long-term, persistent pain that interferes with work and activities of daily living, reduces the person's quality of life, and increases the disease and economic burden [1,2]. There are no known cures for persistent LBP and the array of available passive treatments (e.g. injections, massage therapy) provide only small to moderate effects for pain relief and improved function (e.g. [3,4,5]). The most recent clinical guidelines developed by the National Institute for Clinical Excellence (NICE) promote the use of self-management interventions for this population to aid in the long-term management of symptoms [6].

Self-management has been variably defined in the literature, with no commonly accepted or consensus definition for this concept [7,8,9]. For the purposes of this paper we define self-management interventions to be those that promote the active involvement of the patient in managing their condition. Typically these interventions help the patient learn and adopt a set of health behaviours they can use in everyday life to reduce or manage their symptoms. Importantly, self-management interventions are a type of behaviour change intervention. Behaviour change interventions are more clearly defined in the literature as 'coordinated sets of activities designed to change specified behaviour patterns' [10,11].

In this article we discuss what is known about self-management interventions for persistent LBP and make suggestions for how research can be improved. The article addresses:

1. Clinical effectiveness of current self-management interventions for persistent LBP;
2. Design, conduct and evaluation of studies of self-management interventions for persistent LBP with respect to: (a) self-management definition; (b) use of theoretical rationale; (c) intervention

components; (d) choice of outcome measures; and (e) reporting of studies of self-management interventions.

### **1. Clinical effectiveness of current self-management interventions for persistent LBP**

The effectiveness of self-management interventions for patients with persistent LBP has been evaluated within four recent systematic reviews [7,12,13,14]. Of these, two included a range of persistent musculoskeletal conditions such as osteoarthritis or fibromyalgia [13,14] and two included patients with LBP specifically [7,12]. This section provides an overview of the findings of these reviews, focusing solely on the results of studies that included people with persistent LBP.

21 unique studies across the four reviews compared a self-management intervention with a minimal or no intervention control; a further 12 studies compared a self-management intervention to another intervention (e.g. physiotherapy, exercise, acupuncture, yoga, massage). Compared to minimal or no intervention, the effectiveness of self-management interventions on pain and disability at short-term (approximately three months post-treatment) ranged from no effect to small statistically significant effects. Most studies had wide confidence intervals which decreases the certainty around the actual effect (see Figures 1a and 1b). Only five studies assessed outcomes at a long-term (approximately 12 month) follow-up point, reporting the same pattern of effects. Similarly, when compared with other interventions such as yoga or massage, general physiotherapy or exercise, the effectiveness of self-management on pain and disability at short and long-term was uncertain [7,12]. Additionally, the methodological quality of most studies ranged from low to moderate. Patients and providers were never blinded, allocation was often not concealed, only some studies reported intention-to-treat analysis, and follow-up rates were commonly less than 85%. These limitations mean that effectiveness outcomes should be interpreted with caution.

From the reviews, it is clear that there is considerable heterogeneity in the self-management interventions with respect to aim, rationale, components, provider, mode and intensity. It appears that there is potential for this type of intervention to have long-term benefits for patients in outcomes of pain and disability. However, the differing effect estimates, combined with wide confidence intervals and issues with methodological quality, make it hard to interpret the findings for use in clinical practice. In order to have greater confidence in the effectiveness of self-management, interventions need to be designed and evaluated with better methodological rigour.

## **2. Design, conduct and evaluation considerations for studies of self-management interventions**

### *2a. Self-management definitions*

To date, self-management has been variably defined in the literature, with no commonly accepted or consensus definition [7,8]. Self-management typically appears to be referred to either in terms of the process or content of self-management (i.e. what must be done or delivered), or in terms of the aims and behavioural outcomes. This lack of consensus hampers the assessment and comparison of studies, as it is likely that these different definitions will lead to different interventions and targets for treatment. Future studies should therefore consider adopting a definition which includes the aim, components and outcomes. As an example, we refer readers to a detailed definition by Hurley et al [9] and Toomey et al [14] that incorporates each of these elements based on a consolidation of existing definitions from self-management reviews.

### *2b. Use of theoretical rationale*

Few self-management interventions for LBP have reported developing their intervention using theory. For example, Keogh et al's [15] review of behaviour change theories and techniques in group-based self-

management interventions for persistent LBP and osteoarthritis found that only three of their 22 included studies were classified as “theory informed”. Lack of theoretical rationale has been recognised as an important issue for developing effective interventions [16,17,18] and may explain some of the heterogeneity in the effectiveness. Interventions developed using a theoretical rationale facilitate understanding of how and why the intervention influenced outcomes (or not), thereby enabling researchers to focus on understanding mechanisms of change, and allowing theories to be empirically tested and ultimately improved [16,19]. There are many theories that explain behaviour in the context of self-management [9,10]. We provide an overview of two psychological theories, the Fear Avoidance Model (FAM) and Social Cognitive Theory (SCT), that are commonly used in the field of LBP research. Recent evidence from self-management intervention studies that have specifically targeted elements included in these models shows some promise (e.g. [20,21]), but more evidence is needed to provide strong evidence for causal links between these factors and outcomes. Several key reviews of theories relevant to persistent pain are available, and we refer readers to those reviews for further information in this area (e.g. [9,22]).

### 2b – i Fear avoidance model

The fear-avoidance model (FAM) states that when a person experiences pain, negative thought processes such as catastrophising (an exaggerated negative perception of the pain [23]) leads to fear of movement, and avoidance of behaviours that the person feel may cause further damage or more pain. This may be further exacerbated by hypervigilance to perceived threats, and leads to disuse, further disability and depression [24]. This becomes a cycle in which further experiences of pain lead to further catastrophising and avoidance [24]. In contrast, people who do not catastrophise and do not avoid certain behaviours are more likely to recover. In the context of self-management interventions for persistent LBP, this would suggest that teaching people that 1) movement will not lead to further

damage and 2) movement is key to improved function, will help patients achieve self-management goals such as reduced disability and improved physical function. There has been some criticism of the FAM, with longitudinal studies suggesting that the model components do not necessarily work in the order hypothesised [e.g. 25], but there is evidence that the individual components are important to target during self-management interventions. For example, targeting of fear-avoidance as part of a cognitive-behavioural self-management intervention (the Back Skills Training (BeST) trial [26]) was found to lead to significant improvements in disability outcome compared to a control intervention of usual care. The Self-management of Osteoarthritis and Low back pain through Activity and Skills (SOLAS) intervention [9] also identified these constructs (among others) as being important to target in order to increase physical function.

### 2b – ii Social Cognitive Theory

Social cognitive theory (SCT) [27] states that three factors: self-efficacy; outcome expectancies (what people believe will be the consequences of their actions); and the person's environment, will impact on their behaviour [28]. Self-efficacy, in the context of LBP self-management, suggests that people who are confident that they are capable of performing self-management strategies (i.e. high self-efficacy) have better outcomes than those who have low self-efficacy [28]. Outcome expectancies can be split into situation-outcome expectancies (beliefs about consequences which are not down to an individual's actions) and action-outcome expectancies (beliefs about whether or not performing a particular behaviour will lead to a given outcome) [29]. In the context of self-management, good outcome expectancies might be achieved if patients believed that a particular self-management strategy will actually help improve their outcomes, and having easy access to walkways and parkland (environment) might motivate patients to exercise outdoors. The SCT component of self-efficacy in particular has been found to be a strong predictor and mediator of disability and pain outcomes in LBP populations (e.g.

[30,31]). Bandura describes how self-efficacy can be targeted through accomplishment of new skills; modelling of behaviour; verbal persuasion of others; and emotional arousal [27].

### 2b – iii How to apply theory

While the Medical Research Council (MRC) among others recommends the basing interventions on a theoretical model, it provides little information on what theories to use and how to apply them. Michie and colleagues [10,32] have drawn together different theoretical models and focus on the application of theory in changing behaviour through a series of interacting frameworks: the COM-B (Capability, Opportunity, Motivation – Behaviour); the Theoretical Domains Framework (TDF); and the Behaviour Change Techniques (BCT) Taxonomy [10,32,33]. The COM-B components are designed to bring together factors necessary for Behaviour change (B in COM-B) to occur [10]. Capability (C) is defined as a person's physical and psychological capacity to engage in the behaviour; Opportunity (O) as factors external to the individual that make the behaviour possible (such as their environment); and Motivation (M) as brain processes which "energise and direct" behaviour, including habits and emotional responses. The TDF consists of 14 domains, which make links between 36 theories of behaviour change and the constructs that are represented within them [32]. Examples of domains include *knowledge, skills, beliefs about capabilities, social influences, emotion and intentions*. The Behaviour Change Technique (BCT) Taxonomy [33] provides a list of 93 techniques that can be used to change behaviour such as *information about outcomes, modelling, rehearsal, monitoring, feedback, and credible source*. Michie et al [10] have linked the BCTs to each of the 14 domains in the TDF based on available evidence or expert consensus. The BCTs can be used as guidance for coding of all elements of a behaviour change intervention, so they can be properly recorded and addressed.



These frameworks provide researchers with a path from a broad theoretical perspective on what might influence a specific outcome (COM-B), to specific behaviour change components that can be included in an intervention (TDF), and then specific ways in which that intervention components can target the behaviour in order to improve the outcome of interest (BCT). This requires postulating hypothesised causal pathways [17,34] and also provides a guide for the development of behaviour change interventions. When designing an intervention, the domains most likely to be effective in changing behaviour have been selected from the TDF, these domains can then be linked to specific BCTs to help achieve the behaviour required to impact on the desired outcome. While these frameworks are designed for behaviour change interventions generally, they can be readily applied to self-management interventions, as the example in Figure 2 illustrates.

### *2c. Self-management intervention content*

Content of self-management interventions for persistent low back pain is varied. Common content of the four aforementioned systematic reviews includes pain education, activity in relation to pain, and specific strategies or resources to use in flare-ups. However, some interventions also included strategies such as goal-setting and practical exercise or problem-solving sessions, or included cognitive-behavioural strategies such as cognitive restructuring, pacing and relaxation. Variation in content is possibly due to differences in the definition of self-management, where definitions that include different aims may likely include different strategies. Additionally, other aspects of the intervention, such as frequency, duration, mode of delivery and provider, varied substantially between the studies included in the reviews. For example, most intervention sessions were delivered face-to-face but others were either delivered online or via a self-help booklet. Some interventions involved a single lay-provider; others included interventions delivered by multiple health professionals from different disciplines. The modes of delivery included group sessions ( $n=12$ ), individual sessions ( $n=5$ ) or a combination of the two ( $n=3$ ),

with a wide range in frequency in terms of number of sessions (1-13 sessions) and the duration of the intervention (over 1 to 12 weeks). It is to be expected that the wide variations in intervention content, frequency, duration and delivery methods likely influence the variations in effectiveness on outcome.

An issue related to this is that of intervention fidelity, or the degree to which the content of these interventions are implemented as intended [35], both in relation to the providers and participants. Fidelity of treatment delivery specifically refers to the degree that intervention components and delivery modes/methods were implemented as intended (e.g. all components such as pain education, coping skills, and strategies to increase self-efficacy for physical activity were actually delivered by the treatment provider), whereas fidelity of treatment receipt refers to the participants actually receiving the intervention content and being able to understand and apply it [36]. By evaluating the fidelity of an intervention, results may be interpreted with respect to how well it was delivered and received, increasing confidence that the results were indeed due to the intervention [37,38,39]. An important precursor to fidelity assessment is the use of strategies to enhance or improve fidelity, such as producing intervention manuals or protocols for providers to improve fidelity of delivery [37,40]. However, fidelity of self-management interventions for persistent LBP has been poorly enhanced, assessed and reported to date, potentially contributing towards explaining the variability in effectiveness outcomes (e.g. [41,42]). We refer readers to Borrelli's [36] framework as a guide to understanding the different components of fidelity within behaviour change research, and to a recent studies by Toomey et al [40,43] which provides an example of how to improve and assess fidelity within a self-management intervention for people with persistent LBP and osteoarthritis.

### *2d. The choice of outcome*

Following on from specifying a theoretical basis for a self-management intervention is the need to choose a relevant outcome. There are two broad categories of outcomes which are important to studies of self-management interventions; general clinical outcomes (e.g. pain, disability, health status) and behaviours specific to the aims of the intervention (e.g. physical activity, learning new coping/problem solving strategies, relaxation techniques). Many studies of self-management for persistent LBP include outcomes in the categories of clinical improvements (pain, disability) and, to a lesser degree, health status improvements (global improvement, satisfaction, quality of life). However, measurements of learning (of knowledge and self-management skills) or behaviour does not appear to be common practice within self-management interventions to date [12,14]. Assessing both categories of outcomes would appear to be beneficial, as clinical outcomes can tell us if the intervention worked and the behaviour outcomes can tell us how it worked [44]. We suggest that future self-management interventions report a logic model as presented in Figure 2 to illustrate the proposed process of how the intervention should change behaviour and clinical outcomes.

### *2e. Reporting of self-management interventions*

Poor reporting is a common problem, particularly in complex interventions which include multiple components and techniques [45,46]. For example, in the four aforementioned reviews, under-reporting of intervention content and procedural information was evident in most studies of self-management for persistent LBP. This is problematic as without adequate intervention descriptions, replication is not possible. Guidance such as the Template for Intervention Description and Replication (TIDieR) [47] which includes 12 categories for reporting including name, why (rationale), what (materials, procedures), who (providers), how (modes of delivery), where (delivery location), when and how much (dose, duration), tailoring, modifications, and intervention fidelity, may help to enhance reporting within these

interventions. The specific intervention content can be reported using the BCT taxonomy to help with transparency and replication. This process for reporting has been used by several behaviour change interventions [48,49] and more recently by two study protocols describing trials of self-management interventions for persistent musculoskeletal pain including LBP; SOLAS [9] and COPERS [50].

## **Conclusion**

We aimed to give an overview and suggest recommendations for the clinical effectiveness of current self-management interventions for persistent LBP, and the design, conduct and evaluation of these interventions in this population. The results of four systematic reviews of clinical effectiveness suggest that while self-management interventions may be of benefit, there are a number of inconsistencies which preclude strong recommendations. The article highlights several possible reasons for these inconsistencies and ways in which they could be improved, i.e. use of a consistent, inclusive definition of self-management; clearly stating the components included in the self-management intervention, including the mode, mechanism and fidelity of delivery; basing the intervention on a theoretical rationale which allows clear hypotheses to be developed as to how the intervention should work; the inclusion of both clinical and behaviour change outcomes; and clear reporting of the intervention to aid transparency and replication.

### **Summary (240/250 words)**

Self-management interventions are currently recommended as a treatment for people with persistent LBP, but evidence for their effectiveness is limited, most likely due to the heterogeneity of current interventions. This heterogeneity includes how self-management is defined, and a lack of a clear theoretical rationale for why and how the intervention is proposed to affect the intended outcomes. Several recently developed frameworks which propose to bring together different theoretical models and help researchers select specific targets for treatment have been described above and are illustrated in Figure 2.

Two recent RCTs of self-management interventions for musculoskeletal pain (including back pain) [9,13] provide examples of how to use a theory-informed approach to developing and reporting self-management interventions for persistent LBP. Both studies assessed the barriers to achieving the target behaviour with participants from the target user group and analysed them using theory, listed the specific behaviour change techniques used, and presented a logic model to depict how the intervention is proposed to work. We refer readers to these papers for more information.

Overall, self-management interventions have clear potential to impact on clinical outcomes, but consistency is needed in terms of what they involve, what they target, and what they measure in order to provide the best possible evidence for their effectiveness. There is a shift in research in self-management interventions for persistent LBP towards addressing these issues, and the recommendations set out in this Chapter can provide practical guidance to further this progress.

**WORD COUNT**

**3264 – main body of text (inc. practice points and research agenda (195))**

**1397 – references**

**450 - 3 figures (150 words allowed for each)**

**TOTAL WORD COUNT = 5,111**

## **Practice points**

- Interventions that require a change in patient behaviour, such as self-management interventions, are recommended as a treatment for persistent LBP.
- The current evidence to support this recommendation is inconsistent and highlights the variability of treatment effects.
- This variability of effects may be due to unstandardised definitions of self-management, a lack of a clear theoretical rationale underlying the intervention, or a focus on clinical rather than behavioural outcomes.
- Recent protocols of trials of self-management interventions and their development suggest that improvements in design of such interventions are being made, however it is not yet clear whether they will be effective or not.

## **Research agenda**

- A clear definition of self-management, including detailed information on what components will be included/focused on, is required so that interventions can be compared/included in meta-analyses.
- The inclusion of a theoretical rationale for the intervention should be explicit, stating exactly how the proposed intervention will impact on specific behaviours, why these behaviours are important to target for change, and how this change will lead to improvement in the stated outcomes.
- Outcomes should include not only clinical outcomes (pain and disability) but also behavioural outcomes related to the goals of the intervention.

Figure 1a. Effect sizes on pain (SMD, 95%CI) of individual studies

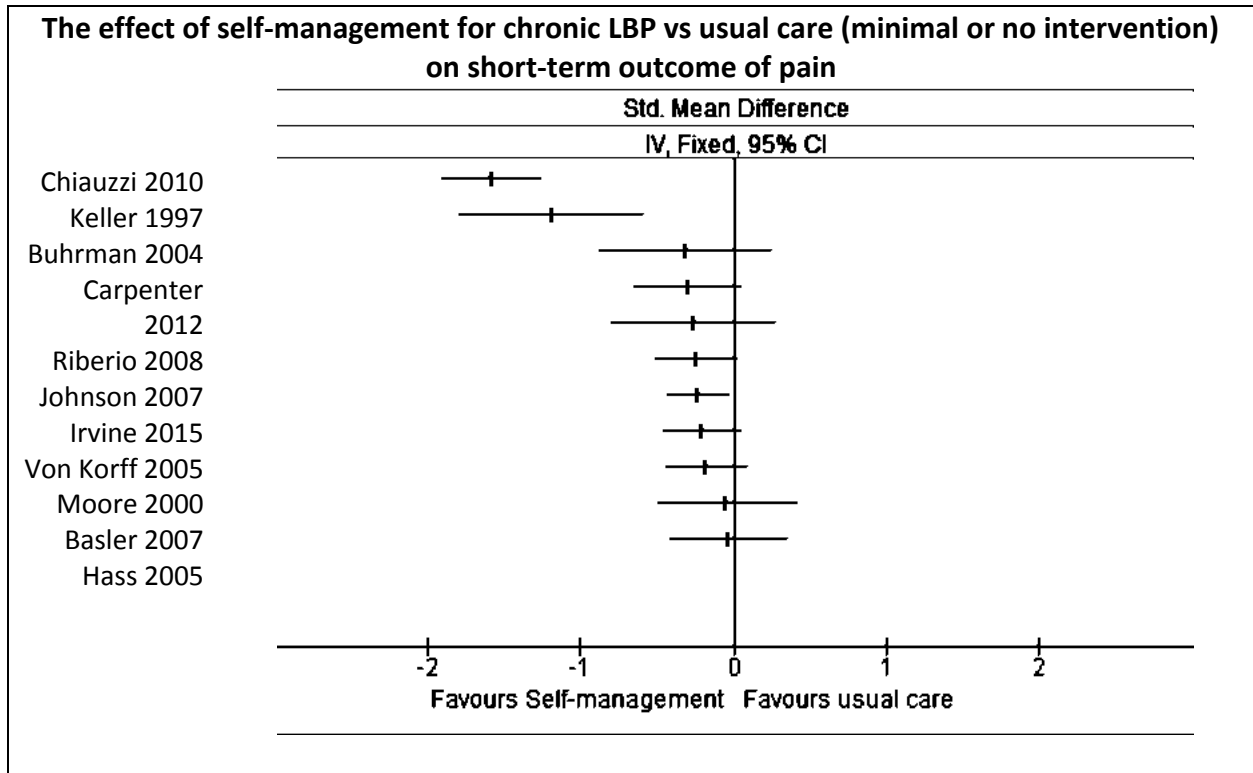




Figure 1b. Effect sizes on disability (SMD 95% CI) of individual studies

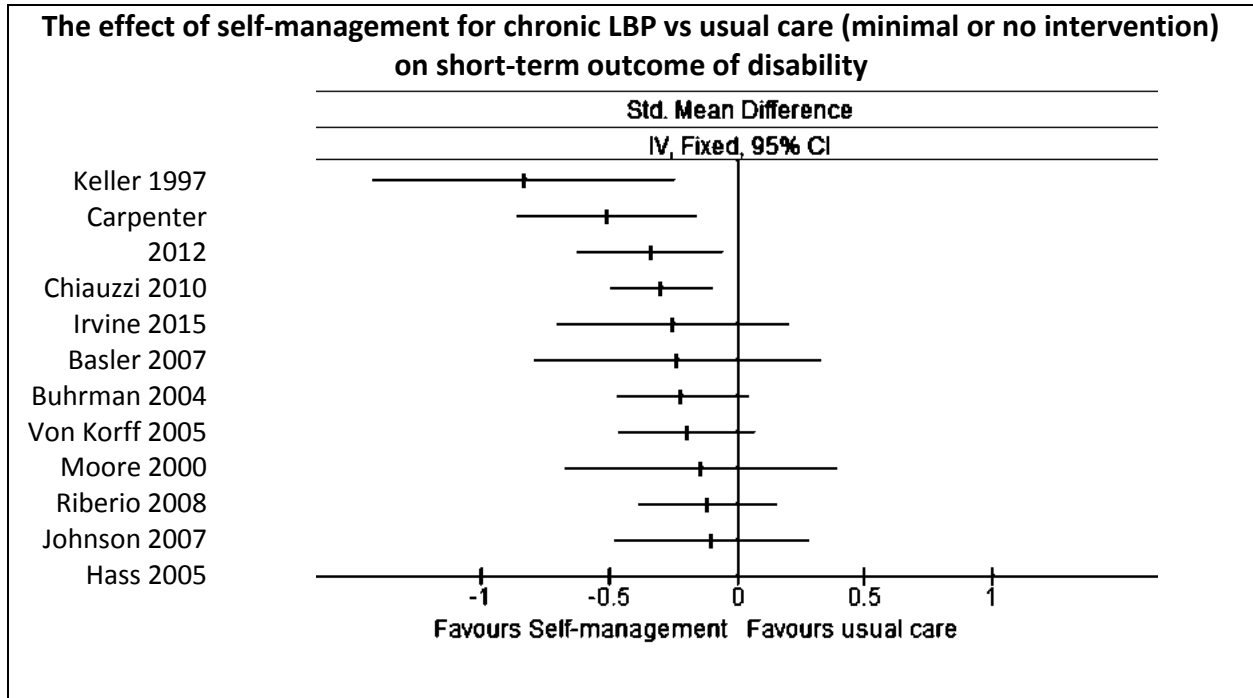
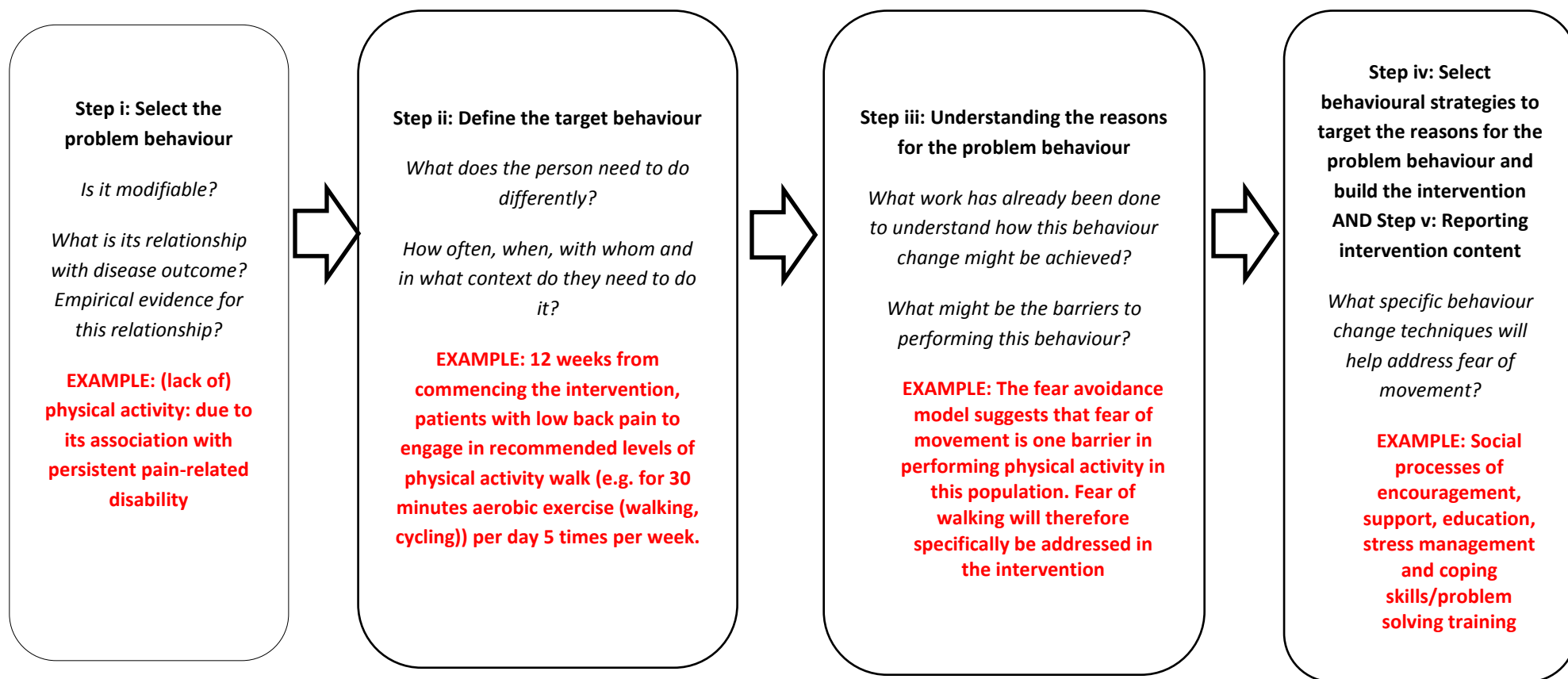


Figure 2. Using a theory-informed stepped approach to developing a complex self-management intervention



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## **Conflict of interest statement**

The authors declare no conflict of interest.

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