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# Interventions to Improve Long-term Adherence to Physical Rehabilitation Among Those with Hip or Knee Osteoarthritis or Chronic Low Back Pain: A Systematic Review

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The findings and conclusions in this document are those of the author(s) who are responsible for its contents and do not necessarily represent the views of the Department of Veterans Affairs or the United States government. Therefore, no statement in this article should be construed as an official position of the Department of Veterans Affairs. No investigators have any affiliations or financial involvement (eg, employment, consultancies, honoraria, stock ownership or options, expert testimony, grants or patents received or pending, or royalties) that conflict with material presented in the report.

## PREFACE

The VA Evidence Synthesis Program (ESP) was established in 2007 to provide timely and accurate syntheses of targeted health care topics of importance to clinicians, managers, and policymakers as they work to improve the health and health care of Veterans. These reports help:

- Develop clinical policies informed by evidence;
- Implement effective services to improve patient outcomes and to support VA clinical practice guidelines and performance measures; and
- Set the direction for future research to address gaps in clinical knowledge.

The program comprises four ESP Centers across the US and a Coordinating Center located in Portland, Oregon. Center Directors are VA clinicians and recognized leaders in the field of evidence synthesis with close ties to the AHRQ Evidence-based Practice Center Program. The Coordinating Center was created to manage program operations, ensure methodological consistency and quality of products, interface with stakeholders, and address urgent evidence needs. To ensure responsiveness to the needs of decision-makers, the program is governed by a Steering Committee composed of health system leadership and researchers. The program solicits nominations for review topics several times a year via the [program website](#).

The present report was developed in response to a request from the Rehabilitation Research & Development Service (RR&D). The scope was further developed with input from Operational Partners (below), the ESP Coordinating Center, the review team, and the technical expert panel (TEP). The ESP consulted several technical and content experts in designing the research questions and review methodology. In seeking broad expertise and perspectives, divergent and conflicting opinions are common and perceived as healthy scientific discourse that results in a thoughtful, relevant systematic review. Ultimately, however, research questions, design, methodologic approaches, and/or conclusions of the review may not necessarily represent the views of individual technical and content experts.

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### Operational Partners

Operational partners are system-level stakeholders who help ensure relevance of the review topic to the VA, contribute to the development of and approve final project scope and timeframe for completion, provide feedback on the draft report, and provide consultation on strategies for dissemination of the report to the field and relevant groups.

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**Technical Expert Panel**

To ensure robust, scientifically relevant work, the TEP guides topic refinement; provides input on key questions and eligibility criteria, advising on substantive issues or possibly overlooked areas of research; assures VA relevance; and provides feedback on work in progress. TEP members are listed below:

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The Coordinating Center sought input from external peer reviewers to review the draft report and provide feedback on the objectives, scope, methods used, perception of bias, and omitted evidence (see Appendix E for disposition of comments). Peer reviewers must disclose any relevant financial or non-financial conflicts of interest. Because of their unique clinical or content expertise, individuals with potential conflicts may be retained. The Coordinating Center works to balance, manage, or mitigate any potential non-financial conflicts of interest identified.

## ABBREVIATIONS TABLE

<b>Abbreviation</b>	<b>Definition</b>
BCT	Behavior change technique
CBT	Cognitive behavior therapy
CI	Confidence interval
COE	Certainty of evidence
COM-B	Capability, opportunity, and motivation
ESP	Evidence Synthesis Program
GRADE	Grading of Recommendations Assessment, Development, and Evaluation
KOOS	Knee and Osteoarthritis Outcome Score
KQ	Key question
LBP	Low back pain
NRS	Numeric rating scale
OA	Osteoarthritis
OECD	Organisation for Economic Co-operation and Development
OR	Odds ratio
PRESS	Peer Review of Electronic Search Strategies
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta Analyses
PT	Physical therapy
ROB	Risk of bias
RR&D	Rehabilitation Research and Development
SD	Standard deviation
SEE	Self-Efficacy for Exercise Scale
SMD	Standardized mean difference
VHA	Veterans Health Administration
WOMAC	Western Ontario and McMaster Universities Osteoarthritis Index



## EXECUTIVE SUMMARY

### Key Findings

- We identified 10 studies that evaluated adjunct adherence-enhancing interventions: 6 were delivered concurrent to an index rehabilitation program and 4 were delivered sequentially.
- Most (7) studies targeted patients with knee and/or hip osteoarthritis.
- Of the 3 studies that reported a positive effect on long-term adherence, only 1 was a low risk of bias study.
- Only 1 study described the use of specific behavior change techniques and related theory for the explicit promotion of behavioral maintenance versus initiation of behavior change.
- There was often similarity in the behavior change techniques used in intervention and comparator groups, and no studies provided a rationale for this overlap.
- Identified adjunct adherence interventions do not appear to have a meaningful treatment effect of adjunct adherence interventions on long-term physical function, self-efficacy, or adverse events.

## INTRODUCTION

Chronic pain, often caused by musculoskeletal dysfunction, results in billions of dollars in US health care spending annually. In the Veterans Health Administration, 25% of patients with musculoskeletal conditions receive care for low back pain (LBP) annually, and an additional 21% of Veterans receiving musculoskeletal care have osteoarthritis (OA). One approach to managing symptoms for individuals with chronic LBP or OA is physical rehabilitation, which uses clinician-prescribed, tailored exercise and activity. Despite the effectiveness of rehabilitation in reducing pain and disability, adherence to rehabilitation interventions has been measured to be as low as 13%. Poor adherence is a concern especially when the patient is no longer under direct clinical supervision.

Adjunct interventions have been proposed to address low rates of long-term adherence to musculoskeletal rehabilitation by targeting the maintenance of, rather than the initiation of, behavior changes required for long-term success. Examples of adjuncts include psychological interventions (*eg*, cognitive behavioral therapy and motivational interviewing) and performance feedback interventions (*eg*, coaching, peer support, activity tracking). However, it is currently unknown which of these adjunct interventions, and in what combinations, have the greatest impact on patient motivation, long-term adherence to rehabilitation, or ultimate physical function outcomes.

This review aims to evaluate the impact of physical rehabilitation interventions supplemented with 1 or more adherence-enhancing adjunct components, on the following outcomes among adults with hip or knee OA or chronic LBP: (1) adherence, (2) functional improvements, and (3) self-efficacy at  $\geq 3$  months after completing an index rehabilitation program. As part of our analysis, we seek to provide insights into how future interventions might be optimized through the selection of behavior change techniques (BCTs) that maximize patient benefit.

## METHODS

### Data Sources and Searches

We conducted a primary search from inception to July 27, 2021 in MEDLINE (via Ovid), CINAHL Complete (via EBSCO), and Embase (via Elsevier). We used database-specific controlled vocabulary as well as relevant keywords to search titles and abstracts.

### Study Selection

In brief, eligible studies were randomized and non-randomized trials evaluating adherence-focused intervention components conducted in addition to usual care or usual-care-like physical rehabilitation programs among adults with hip or knee OA or chronic LBP. Studies were required to use a comparator arm featuring the same physical rehabilitation intervention without the adjunct adherence components, and to measure outcomes at least 3 months after the rehabilitation course.

All citations classified for possible inclusion based on title and abstract by at least 1 investigator underwent full-text review. Citations designated for exclusion by 1 investigator at the title-and-abstract level underwent screening by a second investigator. The study was excluded if both investigators agreed on exclusion. All articles reviewed during full-text review were evaluated independently by 2 investigators and all articles meeting eligibility criteria were included for data abstraction.

### Data Abstraction and Assessment

Data elements included descriptors to assess applicability, quality elements, intervention details, and outcomes including adverse events. Study risk of bias (ROB) was assessed by the revised Cochrane Risk of Bias for randomized trials and cluster-randomized trials (RoB 2) and the ROBINS-I for non-randomized studies. Quality assessment was completed in duplicate by 2 investigators. Disagreements were resolved by consensus between those 2 investigators or, as needed, with arbitration by a third.

### Synthesis

We summarized the following key study characteristics of the included studies: study design, patient demographics, details of the index rehabilitation program, adjunct adherence intervention and comparator, outcomes measures, and timing of outcomes assessment. We considered the feasibility of completing a quantitative synthesis (*ie*, meta-analysis) to estimate summary effects given the volume of relevant literature, conceptual homogeneity of the studies, and completeness of results reporting. We did not conduct a meta-analysis due to incomparability in intervention characteristics, outcome measures, and outcome timing. As an alternative, we report the standardized mean difference for studies reporting similar outcome categories using continuous data. Since meta-analysis was not feasible, we analyzed the data narratively by focusing on identifying patterns in efficacy across included studies by outcome category.

Since the follow-up time points of interest for this review are limited to outcomes  $\geq 3$  months after completing the rehabilitation program, we estimated the time point of each outcome as the time since the end of the rehabilitation program. In addition, for each included study, we coded the BCTs employed in all experimental and comparator arms using a BCT taxonomy derived

from included studies and any published protocols we identified. The certainty of evidence (COE) was assessed using the approach described by the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) working group. These domains were considered qualitatively, and a summary rating was assigned after discussion as high, moderate, low, or very low COE.

## RESULTS

### Results of Literature Search

We identified 5,512 citations, of which 81 were reviewed at the full-text stage. Of these, 10 unique studies met eligibility criteria. There were 1 non-randomized trial, 2 cluster-randomized trials, and 7 randomized controlled trials. They were conducted in the United States, Canada, Australia, Europe, and Israel.

### Summary of Results for Key Question

#### *Intervention Characteristics*

Of the 10 included studies, 6 delivered adjunct interventions concurrently to an index rehabilitation program, and 4 delivered adjunct interventions sequentially. Rehabilitation programs varied in type (*eg*, submaximal graded exercise program, strength training), duration (1.5–6 months), and number of sessions (median = 5, range = 2–156). Similarly, the adjunct interventions varied in content delivered (*eg*, mean = 5.5 BCTs, range = 2–15), duration (median = 6 months, range = 1–24), and number of contacts (median = 7, range = 2–42). Of the studies that reported the type of professional who delivered the adjunct intervention, all were physical therapists or similarly trained clinicians. Only 3 studies provided details of clinician training, and they addressed standard of care rather than intervention training. Five studies focused on populations with knee OA alone, 3 focused on LBP, 1 focused on hip OA, and 1 focused on both knee and hip OA.

#### *Behavior Change Techniques*

We identified BCTs described by each study across both comparator and intervention arms; none of the included studies commented on clinician knowledge about, familiarity with, or training specifically regarding BCTs. A total of 38 BCTs were identified across the included studies out of the 93 possible BCTs, representing 14 of the 16 BCT clusters. The number of BCTs in index rehabilitation programs ranged from 5 to 11 (mean = 8.8), while adherence interventions included 2 to 15 unique BCTs (mean = 6.2). BCTs included in the index rehabilitation programs generally reflect typical clinical practice using BCTs such as goal setting, instruction on how to perform a behavior, demonstration of the behavior, and behavioral practice/rehearsal. Adjunct interventions varied in complexity with 10 BCT clusters present in  $\leq 3$  adjunct adherence-enhancing interventions.

#### *Outcomes of Interest*

##### *Adherence to prescribed home rehabilitation program*

Ten studies reported on long-term adherence outcomes. Six of these studies evaluated the effect of concurrently delivered adjunct components on adherence to home rehabilitation and 4 studies evaluated sequentially delivered components. Overall, there was no evidence of benefit with

concurrently delivered adjunct interventions at 3 to 6 months (SMD range = 0.05–0.06) or 9 months and longer (SMD range = 0.06–0.20) among those studies with continuous outcome measures. Similarly, only 1 sequentially delivered intervention from a low ROB study reported beneficial effects among patients with knee OA at 9 months post-rehabilitation program (SMD = 0.42, 95% CI [0.02, 0.82]). There was no effect of the intervention across the other 4 studies at 3 to 6 months (SMD range = 0.18–0.42) and 9 months and longer (SMD = -0.12). When adherence is reported as percent completion of prescribed home rehabilitation, only 1 study showed a benefit of adjunct interventions (SMD = 0.50, 95% CI [0.09, 0.90]).

### *Physical function*

All but 1 of the 10 included studies reported on function as an outcome to evaluate intervention impact. Five of these studies evaluated the effect of concurrently delivered adjunct components on physical function and 4 studies evaluated sequentially delivered components. Among concurrently delivered interventions, there was no evidence of benefit at 3 to 6 months (SMD range = -0.12– -0.02) or 9 months or longer (SMD range = -0.23–0.20). Similarly, there was no evidence of beneficial effect among sequentially delivered adjunct interventions at 3 to 6 months (SMD range = -0.04–0.02) or 9 months or longer (SMD range = -0.04–0.10). Of note, there was no evidence of intervention effect on function at 6 months for the 1 low-ROB study by Bennell et al that demonstrated improved adherence among participants receiving 24 weeks of sequentially delivered behavior change text messages.

### *Self-efficacy*

Five studies reported self-efficacy for exercise or related constructs as an intermediate outcome of interest due to its role as an important determinant of long-term adherence. The 2 studies reporting validated measures of self-efficacy found no intervention effect.

### *Adverse events*

Four studies reported adverse events associated with interventions to improve long-term adherence to rehabilitation programs. Overall, there was no evidence of increased adverse events among patients receiving adjunct adherence interventions.

## **DISCUSSION**

### **Key Findings and Strength of Evidence**

We found limited evidence of benefit across the included adjunct adherence-enhancing interventions on long-term adherence and no evidence of benefit on functional outcomes. Six adjunct interventions were delivered concurrently to an index rehabilitation program and 4 were delivered sequentially. Some health behavior models (*ie*, Precaution Adoption Process Model, Transtheoretical Model) suggest that initiation of physical therapy (PT) and long-term adherence to PT are conceptually distinct behaviors that require different skills and psychological processes for support. Designing interventions that disentangle behavioral initiation and maintenance (*ie*, sequential interventions) and target distinct content to support these behaviors may lead to improved results. Moreover, the majority of interventions from studies in our review included BCTs from clusters already represented in the comparator arm (such as goal setting, feedback and monitoring, and repetition and substitution). None of the included studies addressed a

rationale for this overlap, though only 1 study (Bennell et al 2020) specifically refers to the BCTs as a part of intervention development.

Of the 10 studies reporting adherence outcomes, 3 had evidence of a positive effect on the primary outcome of long-term adherence to recommended home rehabilitation programs across endpoints within included studies. However, when considering the difference in adherence at follow-up between intervention and comparator arms, only the study by Bennell et al had a beneficial effect on both measures of long-term adherence. Overall, based on GRADE criteria, we found low certainty of evidence that there is no effect of adjunct intervention components on adherence at 3 to 6 months or 9 months across concurrent and sequential intervention types.

All but 1 included study measured functional outcomes, and all used at least 1 established self-report measure of function. To evaluate sustained functional improvement, we considered the difference in change of function from the end of rehabilitation to follow-up. Overall, there was no evidence of intervention effect (low COE) at any time point regardless of the timing of the adjunct components.

Of the 5 studies reporting self-efficacy, only 2 used validated measures specifically related to self-efficacy of any type and found no effect of the intervention. Only 1 high ROB study found a significant difference using a non-validated measure assessing confidence-like attitudes. Four studies reported adverse events, though none found any difference in events by receipt of adjunct adherence interventions and most reported were minor musculoskeletal discomforts.

## Applicability

While none of the included studies were conducted in the VA or specifically sought to include Veterans, the identified studies were conducted in settings *similar* to the VA Health Care System, and it is reasonable to expect similar outcomes from the Veteran population. In addition, the participants in the included studies are similar in age and comorbidities to Veterans cared for in the VA.

## Future Research

We identified 5 key areas in which future research on this topic could fill existing gaps and/or improve the approach. First, future research seeking to promote long-term adherence to prescribed home rehabilitation programs should leverage theoretical/conceptual approaches to promoting behavioral maintenance (*ie*, beyond the initiation of behavior change) and should more generally be grounded in a sound theoretical/conceptual framework. Second, as current rehabilitation practice employs many behavior change techniques as part of standard of care, adherence-enhancing adjunct interventions should consider the use of different BCTs for promoting adherence to prescribed home exercise regimens and patient long-term outcomes. Third, adherence innovations could target both the rehabilitation provider and patient simultaneously and/or take advantage of the flexibility of virtual and/or asynchronous technology to improve long-term engagement. Fourth, the field would also benefit from well-described usual care comparators that define standards of care and identify any BCTs. Additionally, studies should include objective functional and adherence outcomes and validated measures of self-efficacy. Continued reporting of outcomes at least 6 months after the rehabilitation program would enable comparisons across studies. Lastly, research is needed on important subpopulations, including underrepresented racial and ethnic populations and younger

adults with knee and hip OA and LBP, to ensure that studied approaches are effective despite any distinct challenges and needs for incorporating long-term adherence strategies.

## Conclusions

Long-term sustainment of functional improvements gained by short-term rehabilitation programs requires ongoing adherence to recommended home rehabilitation programs well past the end of direct clinical treatment. We found that there is inadequate evidence evaluating rigorously designed adherence-enhancing interventions for the specific promotion of long-term adherence to home rehabilitation programs. As long-term adherence represents a distinct behavioral target (*ie*, behavioral maintenance), future studies may want to consider testing interventions specifically built to target behavioral maintenance of home rehabilitation programs. Future development of interventions to promote long-term or sustained adherence to prescribed home rehabilitation programs could benefit from use of theoretically informed approaches and successful behavioral maintenance interventions for similar conditions. In the meantime, rehabilitation clinicians and referring providers should be aware that long-term commitment to prescribed home rehabilitation programs is necessary to realize ongoing health benefits.