



STUDY PROTOCOL

REVISED **Can behavioural change interventions improve self-efficacy and exercise adherence among people with Parkinson’s? A systematic review protocol [version 2; peer review: 2 approved]**

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V2 **First published:** 23 Feb 2022, 5:15
<https://doi.org/10.12688/hrbopenres.13474.1>
Latest published: 22 Aug 2022, 5:15
<https://doi.org/10.12688/hrbopenres.13474.2>

Abstract

Background: People with Parkinson’s (PwP) have a higher tendency to adopt sedentary lifestyle behaviours and have lower physical activity levels compared to their healthy peers. Previous research has indicated that personal factors including poor outcome expectation and low self-efficacy are stronger predictors of exercise adherence than disease severity.: The purpose of this review is to synthesize the best available evidence on interventions that encompass self-management strategies to overcome barriers to exercise and improve self-efficacy and exercise adherence among PwP.

Methods: The following databases will be searched using a comprehensive search strategy: EBSCO, Medline, CINAHL, Web of Science, PubMed, Embase, Scopus, Google Scholar and Cochrane Library from database inception to 2020. Interventional studies including behavioural change interventions will be included in this review. The title, abstract and full-text screening will be conducted by two independent reviewers. The Joanne Briggs Institute Checklist will be used to assess the quality of each included study. Data will be extracted by two independent reviewers. The outcomes of interest will be self-efficacy outcomes and measures of exercise adherence. A systematic narrative synthesis will be conducted using a framework analysis, applying the Theoretical Domains Framework and Behaviour Change Wheel, producing findings focusing on practice-orientated outcomes. Presentation of data will include tables and text summarizing the characteristics and findings of the eligible studies. Data synthesis and statistical analysis will be performed in Review manager 5.3. The quality of evidence will be reviewed using the

Open Peer Review

Approval Status

	1	2
version 2 (revision) 22 Aug 2022	 view	
version 1 23 Feb 2022	 view	 view

- Katherine Baker**, Northumbria University, Newcastle upon Tyne, UK
 - Ailish Malone** , RCSI University of Medicine and Health Sciences, Dublin, Ireland
- Any reports and responses or comments on the article can be found at the end of the article.

GRADE criteria.

Discussion: The review will comprehensively synthesize the available evidence on interventions to enhance self-efficacy, improve quality of life, physical function, ultimately improving exercise adherence among PwP and provide invaluable information for healthcare professionals.. This review will make recommendations for appropriate self-management strategies for maximum effect and may have implications for policy and practice regarding enhancing self-efficacy and long-term exercise adherence among PwP.

Keywords

Parkinson's, exercise self-efficacy, behavioural change interventions, quality of life, exercise adherence

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Author roles: **Ahern L:** Conceptualization, Formal Analysis, Methodology, Writing – Original Draft Preparation; **Timmons PS:** Conceptualization, Supervision, Writing – Review & Editing; **Lamb PSE:** Supervision, Writing – Review & Editing; **McCullagh DR:** Conceptualization, Methodology, Supervision, Writing – Review & Editing

Competing interests: No competing interests were disclosed.

Grant information: LA is funded under the Irish Research Council Enterprise Partnership Scheme (in conjunction with the Cork Parkinson's Association.

The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

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How to cite this article: Ahern L, Timmons PS, Lamb PSE and McCullagh DR. **Can behavioural change interventions improve self-efficacy and exercise adherence among people with Parkinson's? A systematic review protocol [version 2; peer review: 2 approved]** HRB Open Research 2022, 5:15 <https://doi.org/10.12688/hrbopenres.13474.2>

First published: 23 Feb 2022, 5:15 <https://doi.org/10.12688/hrbopenres.13474.1>

REVISED Amendments from Version 1

Amendments that have been included in the new version are rephrasing and more in-depth descriptions of specific components to improve the readers' understandability. For example, firstly, in the introduction, a section on "physical activity" has been added, as we felt it was important to differentiate between exercise and physical activity as both are an outcome of interest for this review.

Secondly, another section discussing the Theoretical Domains Framework (with the addition of [Table 1](#)) was also added to the introduction to provide a better understanding for readers who are not familiar with this framework.

Thirdly, we adjusted our eligibility criteria (inclusion of a comparator criteria)-this decision was made as we wanted interventions that focused on the exercise and/or physical activity component.

Fourthly, we rephrased the data analysis and synthesis section following advice from the peer-reviewers that our methods were difficult to understand as they were conflicting with our eligibility criteria.

Lastly, we added our proposed methods for conducting a meta-analysis.

Any further responses from the reviewers can be found at the end of the article

Introduction

Parkinson's is the second most common neurological condition globally. This neurodegenerative condition affects the basal ganglia, leading to progressive movement disorders which with time become more disabling¹. Key motor features associated with Parkinson's are tremor, rigidity (muscle stiffness), akinesia (difficulty initiating movement), bradykinesia (slow movements) and postural instability². There are also many non-motor features associated with Parkinson's including apathy, depression, pain, fatigue, sleep disorders, cognitive impairment, and autonomic dysfunction³. The combination of these motor and non-motor features can result in reduced mobility, reduction in quality of life and loss of function⁴. As a result, people with Parkinson's (PwP) have a higher tendency to adopt sedentary lifestyle behaviours and have lower levels of physical activity compared to their healthy peers^{4,5}.

Exercise, physical activity, and Parkinson's

The advantages of regular physical activity are extensive with research suggesting that PwP benefit from physical activity in multiple ways including improvements in general health, disease-specific improvements and potentially disease-modifying effects⁶.

Physical activity is characterized as any bodily movement produced by skeletal muscles resulting in energy expenditure⁷ including unstructured or incidental movement. The term exercise often interchangeably used with physical activity⁸. However, exercise is a subcategory of physical activity⁷. Exercise is physical activity that is planned, structured, repetitive and purposeful with the aim to improve or maintain one or

more components of physical fitness (cardiorespiratory endurance, muscular strength, muscular endurance, flexibility and body composition)⁷.

The role of exercise in the management of Parkinson's is well-documented. The majority of exercise interventions for PwP focus on resistance training, balance, aerobic exercise, and flexibility conducted in an exercise or rehabilitative setting⁹. A meta-analysis conducted by Choi *et al.*¹⁰ investigated the effects of exercise therapies on PwP. Exercise therapies including walking¹¹⁻¹³, strength and flexibility¹⁴⁻¹⁷, balance^{18,19}, aerobic²⁰⁻²³ and combined exercise²⁴⁻²⁸ were shown to improve balance, walking speed, exercise tolerance, gait function, aerobic capacity, motor control, physical functioning, muscular strength and flexibility among PwP¹⁰. However, exercise therapies did not show a significant effect on the non-motor symptoms. They concluded that exercise therapy is more effective for the motor symptoms rather than the non-motor symptoms of PwP¹⁰.

However, Tennigkeit *et al.*²⁹ conducted a systematic review including 24 studies which discussed the benefits of exercise and self-management education for PwP from Sweden and Germany. Self-management education interventions included interactive group sessions, education sessions for PwP and family members, educational video clips, role playing and handouts and self-monitoring techniques (using diaries for fluctuation in symptoms). They reported positive outcomes for health-related and general quality of life (QoL)³⁰⁻⁴⁰, depression^{30,31,33,35-39,41,42}, self-efficacy^{30,35,41,43}, and functional mobility^{33,43,44}, suggesting the benefit of behavioural change interventions for improving the non-motor symptoms of PwP.

Despite the clear benefits of exercise and physical activity for PwP, only 30% achieve recommended activity levels, some are inactive for 70% of the day and most are less active than their age-matched peers⁴⁵. Recently, studies have shown that exercise may have protective effects associated with the basal ganglia (known as neurogenesis) which results in improvement in dopamine transmission, increased cerebral blood flow and new formation of neuronal synapses which in turn can improve motor function⁴⁶. Neurogenesis can result in a slowed progression of Parkinson's and improvements in motor control, particularly when exercise is carried out at vigorous intensities⁴⁶⁻⁴⁸.

In addition to this, a study conducted by Sajatovic *et al.*⁴¹ investigated the changes in depression in PwP (with depression) between a combined group exercise and self-management program and a self-directed individual exercise and self-management program. They reported no significant changes in apathy or anxiety in both groups. However, both groups displayed modest within group improvement in cognition, while the combined group showed additional significant improvements in depression⁴¹. There were no significant differences between groups. This indicates that behavioural self-management strategies such as group education and peer support may improve non-motor features such as depression in PwP.

Barriers to exercise in PwP

While good compliance can be achieved with prescribed exercise programmes with supervision within a clinical trial this does not completely translate to similar compliance during everyday life. Schootemeijer *et al.*⁴⁹ conducted a comprehensive review discussing the various barriers to exercise faced by PwP. They discussed barriers including non-motor factors (anxiety, depression, fatigue, and apathy), personal factors (low self-efficacy, fear of falling, low outcome expectation and lack of time) and environmental factors (lack of social support, lack of exercise partner, poor accessibility, bad weather, financial burden, cultural challenges, awareness of moving in a crowded environment, and discomfort of seeing advancing symptoms of peers)⁴⁹.

Although PwP experience increasing difficulties engaging in exercise as the disease progresses, previous research has indicated that personal factors including poor outcome expectation and low self-efficacy are stronger predictors of exercise adherence than disease severity⁵⁰.

In terms of exercise, self-efficacy is an individual's confidence or belief that they can successfully engage in physical activity or exercise^{51,52}. Exercise self-efficacy can be categorized into performance self-efficacy (beliefs about performing exercises) or beliefs in overcoming barriers^{53,54}. Exercise self-efficacy determines the type of exercise an individual partakes in, their effort level, and their long-term exercise adherence when they face barriers to participation^{53,55}. A meta-analysis conducted by Higgins *et al.*⁵⁴ reported that short-term exercise interventions (duration between two - eight weeks) were more effective for enhancing performance efficacy. In contrast interventions that included long-term strategies providing opportunities for individuals to experience and successfully conquer barriers over a longer period were more effective for enhancing confidence in overcoming barriers to exercise⁵⁴. This indicates the potential benefits of integrating long-term strategies into behavioural change interventions to promote long-term adherence to physical activity and exercise among PwP.

Behavioural change

Adapting health behaviour in terms of changing from a sedentary lifestyle to a more physically active lifestyle is a complex process⁵⁶. Merely informing individuals about the benefits of physical activity has been shown as inadequate to maintaining behavioural change^{56,57}. In order to assist behavioural change in PwP disease-specific counselling and coaching may be required⁵⁸. Behavioural change interventions are complex and involved many cooperating components⁵⁹. These psychology-focused interventions try to facilitate more constructive health behaviours⁶⁰. Particular strategies are utilized to promote behaviour change; some interventions are tailored to enhancing physical activity engagement by identifying barriers and problem solving⁶¹. While others prompt individuals to track their sedentary behaviour as a method of changing behaviour⁶¹. These interventions utilize theories of behaviour and behaviour change to inform particular therapeutic strategies⁶².

Speelman *et al.*⁶³ studied the long-term effect of including behavioural change interventions (coaching, goal setting, use

of activity monitors) into a multi-facet exercise program for PwP. They reported improvements in physical activity level for all subgroups of PwP⁶³. While Ellis *et al.*⁶⁴ investigated the effects of short daily interactions (five minutes/day) with a virtual exercise coach to encourage walking (monitored by a pedometer) among PwP. The interactions discussed progression of short- and long-term goals, collaborative problem solving to overcome barriers and positive support⁶⁴. They reported excellent retention rate in the walking program and improvements in gait after one month. However, due to the short duration of the intervention the long-term effects of adherence and occurrence of behaviour change are unknown⁶⁴.

Theoretical Domains Framework (TDF)

The TDF is a combined theoretical framework which was created from 128 theoretical constructs and 33 behaviour theories⁶⁵. The TDF has been used in implementation research⁶⁵ to perform a process evaluation of randomized trials to further understand the effect of implementing evidence⁶⁶, as guidance on identifying behaviour change techniques^{62,67}, to identify influences on behaviours⁶⁸⁻⁷², and systematic intervention design⁷³⁻⁷⁵.

The TDF consists of 14 domains subcategorized into personal factors, social factors and environmental factors (Table 1). The TDF has previously been correlated with a simpler model of behaviour known as the COM-B^{67,76}. The main principle of this model is that capability, opportunity, and motivation interact to produce behaviour. Whereas the TDF provides a more in-depth insight of psychological capability and reflective motivational processes⁶⁵.

In order to motivate individuals with Parkinson's to remain physically active outside a clinical setting it is important to identify self-management strategies to overcome these barriers, improve self-efficacy and promote physical activity among PwP. To the best of our knowledge this is the only review exploring the effectiveness of behaviour change interventions on self-efficacy and long-term exercise adherence among PwP. The findings of this review will make recommendations for appropriate self-management strategies and may have implications for policy and practice.

Review objectives

The purpose of this review is to comprehensively synthesize the best available evidence on behaviour change interventions that encompass self-management strategies to overcome barriers to exercise and improve exercise adherence among PwP.

Specifically, the objectives are to:

- Examine self-management strategies to overcome barriers to exercise among PwP.
- Determine the effectiveness of behavioural change interventions aimed to improve exercise self-efficacy, QoL and physical function and exercise adherence among PwP.
- Identify strategies to promote long-term exercise adherence among PwP.

Table 1. Theoretical Domains Framework domains and definitions⁶⁵.

TDF Domain	Definition
Knowledge	Awareness of the existence of something
Skills	Ability or proficiency acquired through practice
Memory, attention, and decision processes	Ability to retain information, focus selectively on aspects of the environment and choose between two or more alternatives
Behaviour regulation	Anything aimed at managing or changing objectively observed or measured actions
Beliefs about capabilities	Acceptance of the truth, reality or validity about an ability, talent, or facility that a person can put to constructive use
Beliefs about consequences	Acceptance of the truth, reality, or validity about outcomes of a behaviour in a given situation
Social/ professional role and identity	Behaviours and displayed personal qualities of an individual in a social or work setting
Emotion	A complex reaction pattern, involving experiential, behavioural, and physiological elements, by which the individual attempts to deal with a personally significant matter or event
Intentions	Conscious decision to perform a behaviour or a resolve to act in a certain way
Reinforcement	Increasing the probability of a response by arranging a dependent relationship, or contingency, between the response and a given stimulus
Goals	Mental representations of outcomes or end states that an individual wants to achieve
Optimism	Confidence that things will happen for the best or that desired goals will be attained
Environmental context resources	Any circumstance of a person's situation or environment that discourages or encourages the development of skills and abilities, independence, social competence, and adaptive behaviour
Social Influences	Interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviours

Research question

Specially, this review is aimed to answer the following questions:

1. Do behavioural change interventions improve exercise self-efficacy among PwP?
2. Do behavioural change interventions improve QoL and/or physical function among PwP?
3. Do behavioural change interventions improve exercise adherence/increase levels of physical activity among PwP?

Methods

This protocol was designed in line with the methodological framework provided by the Joanna Briggs Institute (JBI) Reviewer's Manual⁷⁷ and the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines⁷⁸. This review is registered with PROSPERO (ID: CRD42021293057). *Extended Data: PRIMSA-P Checklist*

Inclusion and exclusion criteria

Studies to be included in this review must satisfy the inclusion criteria outlined in [Table 2](#).

Search strategy. Two independent reviewers (LA and RMcC) will conduct a search using the following electronic databases:

EBSCO, Medline, Cinhal, Web of science, PubMed, Embase, Scopus, Google Scholar, Cochrane Library. Databases will be searched from inception to 2020. The search strategy was developed by the primary author (LA) and supported by a librarian with systematic review experience (VC). Two independent reviewers (LA and RMcC) will search the databases using the search terms showed in [Table 3](#). Reference lists of related articles and relevant reviews will be checked to identify further eligible studies.

Study records. Articles identified from the literature search will be uploaded to Endnote X8, a citation manager. Duplicates will be removed using the "remove duplicates" function, and manual screening of the results will be conducted to ensure accuracy (LA). Titles and abstracts of the identified articles will then be exported to Rayyan (LA), an electronic software designed to support article screening and allows collaboration between reviewers during the study selection process.

Study selection. Two independent reviewers (LA and RMcC) will be involved in the study selection process through each phase of the review. Following the removal of duplicates, LA and RMcC will independently screen all titles and abstracts of the articles identified by the literature search. Studies not meeting the inclusion criteria will be excluded. Prior to the formal

Table 2. Inclusion and exclusion criteria.

Study Characteristics	Inclusion Criteria	Exclusion Criteria
(i) Population, or participants and conditions of interest	<ul style="list-style-type: none"> Community dwelling independently mobile people with Parkinson's. No limitations will be placed on the length of time since diagnosis or age. Studies including people with Parkinson's diagnosed with other comorbidities (e.g anxiety, depression, and diabetes) can be included. However, outcomes must focus on exercise self-efficacy and/or exercise uptake/adherence and not changes in the comorbidity. Population will not be restricted to Ireland or the UK, articles from all countries will be examined. 	<p>If recruited participants:</p> <ol style="list-style-type: none"> Do not have a diagnosis of Parkinson's, or have a diagnosis of Atypical Parkinson's Are current inpatients or had a recent hospital admission within the last 3 months. Are immobile or wheelchair-users, Involve severe visual or auditory impairment, serious medical conditions in major organs (heart, lung, or kidney) or other illnesses which prevent independent ambulation. Involve people with Parkinson's who are identified as a high falls risk (fallers)
(ii) Intervention	<ul style="list-style-type: none"> Any form of behavioural change intervention (e.g education, behavioural technology, or support groups) or support strategy to improve QoL, exercise self-efficacy or exercise uptake. <p>For the purpose of this review <i>behavioural change intervention</i> will be defined as any psychology-focused intervention (used in conjunction with exercise or alone)⁵⁰. While <i>exercise self-efficacy</i> is defined as an individual's confidence or belief that they can successfully engage in physical activity or exercise^{51,52}</p>	<ul style="list-style-type: none"> The intervention does not include self-efficacy strategies or behavioural change interventions. The intervention focuses solely on falls prevention
(iii) Comparator	<ul style="list-style-type: none"> Comparator groups must include people with a Parkinson's diagnosis A specific intervention type will not be defined for the purpose of inclusive. Comparator groups including but not limited to exercise alone, usual care or waiting list will be included 	<ul style="list-style-type: none"> Comparator group including non-Parkinson's individuals.
(iv) Outcomes of interest	<ul style="list-style-type: none"> Outcomes reported at every time-points will be considered for this review. Primary outcomes are self-efficacy measures (e.g Self-efficacy for exercise scale, Physical Activity Assessment Inventory), QoL (e.g PDQ-39, PDQ-8), physical function (e.g 6MWT, gait velocity), and measures of exercise adherence (e.g self-log, activity monitors). 	Outcomes reported are not related to exercise adherence/uptake (i.e medication adherence, changes in anxiety and depression)
(v) Setting	Studies conducting interventions in the following settings will be included; community gyms/halls, community outpatient facilities, acute hospitals (if the intervention is conducted with community dwelling people with Parkinson's), home environment or in any geographical setting globally.	Acute hospitals (if intervention is conducted with inpatients), Long-term care facilities.
(vi) Study design	Interventional studies: RCTs, quasi-experimental trials, pilot interventional studies, pre- and post- interventional studies, and feasibility studies.	Qualitative studies, observational studies, or systematic reviews
		Other: <ul style="list-style-type: none"> Full-text articles are not available. Papers are not published in English
(vii) Phenomenon of interest	The review will include studies that explore behavioural change strategies to enhance exercise self-efficacy, improve QoL, physical function and ultimately improve adherence to exercise among community dwelling individuals with Parkinson's, including but not limited to behavioural interventions (motivational interviewing, goal setting and cognitive re-framing) and support strategies (peer and family education and support sessions).	

screening process, test screening questions will be developed based on the inclusion/exclusion criteria.

Subsequently, LA and RMCC will independently screen the full text articles identified from the previous stage to select the

suitable studies. Reference lists of the included articles and previously conducted reviews in the area will be checked to identify any additional studies. Both LA and RMCC will independently screen any additional articles to determine their suitability. Any disagreement regarding inclusion will be

Table 3. Search strategy.

Databases:
<ul style="list-style-type: none"> - EBSCO (Academic search complete and Psycinfo) - Medline - Cinahl - Web of Science - PubMed - Embase - Scopus - Google Scholar - Cochrane Library
Search keywords:
1. ["behavioural change intervention*" OR "behavioral change intervention*" OR "behaviour change technique*" OR "behavior change technique*" OR "cognitive behavioural therapy" OR "cognitive behavioral therapy" OR psychology OR "psychological therapy" OR "health behaviour*" OR "health behavior*"]
2. [self-efficacy OR "self efficacy" OR "physical activity self-efficacy" OR "physical activity self efficacy" OR "exercise self-efficacy" OR "exercise self efficacy" OR self-management]
3. 1 AND 2
4. ["physical activit*" OR recreation OR sport OR exercise OR training OR fitness OR "physical therap*" OR rehabilitation]
5. 3 AND 4
6. ["Parkinson's Disease" OR "Parkinsons Disease" OR "Parkinson Disease" OR Parkinson's OR Parkinson]
7. 5 AND 6

resolved by a third reviewer (ST). A Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) flow diagram will display the study selection process and summarise the inclusion and exclusion of studies at each stage of the review by providing reason for exclusion.

Data collection and extraction

Two independent reviewers (LA and RMcC) will extract data from each eligible study and conduct the risk of bias assessment. Reviewers will perform practice extraction exercises prior to the formal extraction to ensure consistency. Any disagreement regarding extraction will be resolved by a third reviewer (ST) and a consensus achieved. If required, primary authors of studies will be contacted to provide further details. A data extraction template will be designed a priori. Data including study design, sample characteristics (size, gender, mean age) specific details about the intervention (type, duration and follow-up) and implementation methods, pre- and post-intervention outcome results, and theoretical framework used (if applicable) will be extracted.

Methodological quality of studies

To assess the potential risk of bias The Joanne Briggs Institute Checklist⁷⁷ for the corresponding study designs will be used for each eligible study.

Two independent reviewers (LA and RMcC) will assess the potential risk of bias of each article. Any disagreements will

be resolved by a third reviewer (ST). In the incidence where data is missing, or information is not clear the primary authors will be contacted for clarification. Following the assessment, studies will be classified as a high, medium, low, or unclear risk of bias.

Assessing the quality of evidence

The quality of evidence will be assessed using the Grades of Recommendation, Assessment, Development and Evaluation (GRADE) approach⁷⁹. This involves assessing the quality of evidence using a specific points system to upgrade or downgrade the ratings for each quality characteristic. Evidence can be downgraded one level for serious limitations or two levels for very serious limitations depending on the assessment for five characteristics: limitation in study design and conduct, inconsistent results across studies, indirectness of evidence with respect to study design, populations, interventions, comparisons or outcomes, imprecision of the estimates of the effect and publication bias. Evidence can be upgraded depending on the assessment of the following three characteristics; large magnitude of effect, plausible confounding that would reduce the effect, and dose-response gradient⁸⁰⁻⁸³.

Two independent reviewers will assess the quality of each eligible articles (LA and RMcC). Any disagreement will be resolved by a third reviewer (ST) and a consensus achieved. In the incidence where information is not clear the primary authors will be contacted for clarification.

Narrative synthesis and analysis of the data

Initially, a narrative analysis will be completed. If data is missing or incomplete, we will contact the author by email for the information. Data will be presented using tables and text summarizing the characteristics and findings. A narrative synthesis of the findings will be completed to investigate the association and findings between the included studies. Patterns demonstrating the effectiveness of the interventions will be discussed, including the participants, the intervention, and its impact on the outcomes. Outcomes will include subjective measures of impact including self-efficacy and quality of life, as well as objective measures of physical / functional gains (e.g 6MWT, gait velocity), and measures of exercise adherence (e.g self-log, activity monitors).

The interventions will be mapped to the Theoretical Domains Framework (TDF) and Behaviour Change Wheel (BCW), producing findings focusing on practice-orientated outcomes. The TDF includes fourteen domains related to the psychology of behaviour change⁸⁴. While the BCW focuses on the success of implementing interventions by coordinating change interventions with behavioural barriers; a person's opportunity, capability and motivation interconnects and influence their behaviour (COM-B)⁸⁵. The effectiveness of the mapped interventions will be evaluated further in the context of the models.

The data will be assessed for eligibility for meta-analysis, exploring heterogeneity of populations, interventions, and outcome.

Meta-analytical approach. Statistical analysis will be performed by using the Cochrane Review Manager (RevMan 5.3) software. The mean difference and the 95% confidence interval (CI) will be used as an effective size for the combined analysis, with $p \leq 0.05$ considered as statistically significant.

Assessment of heterogeneity

If significant methodological, statistical, and clinical heterogeneity is detected, results will not be reported as the pooled effect estimate in a meta-analysis. Heterogeneity will be identified by visual inspection of the forest plots and by conducting a χ^2 test with a significance level of $\alpha = 0.1$. Heterogeneity will also be examined using the I^2 statistic as recommended by Higgins^{86,87}. The I^2 statistic will quantify inconsistency across the included studies in order to assess the impact of heterogeneity on the meta-analysis. An I^2 statistic $\geq 75\%$ signifies a substantial level of inconsistency⁸⁸. If heterogeneity is determined, individual studies and subgroup characteristics will be examined to identify potential reasons.

Data will be summarized by means of a random-effects model with due consideration of the whole distribution of effects by presenting a prediction interval. Analyses will be conducted according to the guidelines outlined in the Cochrane Handbook for Systematic Reviews of Interventions⁸⁸.

Subgroup analysis

Subgroup analyses will be completed to determine the effectiveness of behavioural change strategies on quality of life based on the type of strategy.

Assessment of reporting biases

If ten or more of the included studies investigate the same outcome, funnel plots will be used to assess small study effects and evaluate potential publication bias using the Egger test in Stata 13.

Sensitivity analysis

A sensitivity analyses will be performed to explore the influence of the following factors (if applicable) on effect sizes.

- Restricting analysis to high-powered, larger studies
- Restricting analysis to low risk of bias studies
- Restricting analysis to studies including a control group.

To test the robustness of the results analysis will be repeated using different statistical models (random-effects and fixed-effect models) and different measures of effect size (odds ratio and relative risk).

Dissemination of results

The systematic review will be disseminated in a peer-reviewed journal and the results will be presented both locally to physiotherapy clinical colleagues, and at international conferences. The dataset created during the study will be available from the corresponding author upon request.

Amendments

Any amendments to this protocol will be described in a table including the date of each amendment as well as a description of and rationale, this will be documented in a note to a later publication (section "Differences between protocol and review"). The PROSPERO register will remain updated with the protocol and any amendments made.

Ethics approval and consent to participate

Ethical approval is not required for this study as it will not involve conducting experimental research or include identifying personal data.

Study status

The systematic review protocol was finalised in November 2021 and the database search was conducted in December 2021. Full-text screening will be completed in January 2022. It is anticipated the review will be completed in September 2022.

Discussion

Self-efficacy and attitudes towards exercise are linked in a linear relationship^{55,89}. Exercise self-efficacy increases with mastery experiences, as individual become more experienced with exercise. However, self-efficacy also plays an important

role in maintaining motivation to exercise⁵². While the body of evidence supporting behavioural change interventions displays a positive effect of self-efficacy there is a need to pool evidence from trials to accurately determine the treatment effect of these different interventions.

This will be the first review of behavioural change interventions implemented to enhance self-efficacy and improve exercise adherence among PwP. By exploring this, the findings of

this review will provide invaluable information for healthcare professionals. Additionally, this review will make recommendations for appropriate self-management strategies for maximum effect and may have implications for future policy and practice regarding enhancing self-efficacy and long-term exercise adherence among PwP.

Data availability

No data are associated with this article.

References

- Baatile J, Langbein WE, Weaver F, et al.: **Effect of exercise on perceived quality of life of individuals with Parkinson's disease.** *J Rehabil Res Dev.* 2000; **37**(5): 529–34. [PubMed Abstract](#)
- Crizzle AM, Newhouse JJ: **Is physical exercise beneficial for persons with Parkinson's disease?** *Clin J Sport Med.* 2006; **16**(5): 422–5. [PubMed Abstract](#) | [Publisher Full Text](#)
- Kalia LV, Lang AE: **Parkinson's disease.** *Lancet.* 2015; **386**(9996): 896–912. [PubMed Abstract](#) | [Publisher Full Text](#)
- van Nimwegen M, Speelman AD, Hofman-van Rossum EJ, et al.: **Physical inactivity in Parkinson's disease.** *J Neurol.* 2011; **258**(12): 2214–21. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
- Fertl E, Doppelbauer A, Auff E: **Physical activity and sports in patients suffering from Parkinson's disease in comparison with healthy seniors.** *J Neural Transm Park Dis Dement Sect.* 1993; **5**(2): 157–61. [PubMed Abstract](#) | [Publisher Full Text](#)
- Bhalsing KS, Abbas MM, Tan LCS: **Role of Physical Activity in Parkinson's Disease.** *Ann Indian Acad Neurol.* 2018; **21**(4): 242–9. [PubMed Abstract](#) | [Free Full Text](#)
- Caspersen CJ, Powell KE, Christenson GM: **Physical activity, exercise, and physical fitness: definitions and distinctions for health-related research.** *Public Health Rep.* 1985; **100**(2): 126–31. [PubMed Abstract](#) | [Free Full Text](#)
- Wu PL, Lee M, Huang TT: **Effectiveness of physical activity on patients with depression and Parkinson's disease: A systematic review.** *PLoS One.* 2017; **12**(7): e0181515. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
- Goodwin VA, Richards SH, Taylor RS, et al.: **The effectiveness of exercise interventions for people with Parkinson's disease: A systematic review and meta-analysis.** *Mov Disord.* 2008; **23**(5): 631–40. [PubMed Abstract](#) | [Publisher Full Text](#)
- Choi HY, Cho KH, Jin C, et al.: **Exercise therapies for Parkinson's disease: a systematic review and meta-analysis.** *Parkinsons Dis.* 2020; **2020**: 2565320. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
- Canning CG, Allen NE, Dean CM, et al.: **Home-based treadmill training for individuals with Parkinson's disease: a randomized controlled pilot trial.** *Clin Rehabil.* 2012; **26**(9): 817–26. [PubMed Abstract](#) | [Publisher Full Text](#)
- Miyai I, Fujimoto Y, Yamamoto H, et al.: **Long-term effect of body weight-supported treadmill training in Parkinson's disease: A randomized controlled trial.** *Arch Phys Med Rehabil.* 2002; **83**(10): 1370–3. [PubMed Abstract](#) | [Publisher Full Text](#)
- Picelli A, Varalta V, Melotti C, et al.: **Effects of treadmill training on cognitive and motor features of patients with mild to moderate Parkinson's disease: a pilot, single-blind, randomized controlled trial.** *Funct Neurol.* 2016; **31**(1): 25–31. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
- Morris ME, Menz HB, McGinley JL, et al.: **A randomized controlled trial to reduce falls in people with Parkinson's disease.** *Neurorehabil Neural Repair.* 2015; **29**(8): 777–85. [PubMed Abstract](#) | [Publisher Full Text](#)
- Li F: **Clinical efficacy of Parkinson's physical exercise in patients with Parkinson's disease.** *International Journal of Neurology and Neurosurgery.* 2015; **42**(1): 247–50.
- Wang Y, Xie H, Jiang X, et al.: **Clinical study of Parkinson's rehabilitational exercise on motion control for Parkinson's disease at early stage.** *China Journal of Traditional Chinese Medicine and Pharmacy.* 2014; **29**(1): 2012–4. [Reference Source](#)
- Qian M, Li L, Dong T, et al.: **Effect of strengthening core muscle training on rehabilitation of Parkinson's disease.** *Guangdong Medical Journal.* 2015; **36**(1): 77–9.
- Conradsson D, Löfgren N, Nero H, et al.: **The effects of highly challenging balance training in elderly with Parkinson's disease: a randomized controlled trial.** *Neurorehabil Neural Repair.* 2015; **29**(9): 827–36. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
- Gu S, Song Z, Fan X, et al.: **Effect of PD-WEBB training on balance impairment and falls in people with Parkinson's disease.** *Zhong nan da xue xue bao Yi xue ban= Journal of Central South University Medical Sciences.* 2013; **38**(11): 1172–6. [PubMed Abstract](#) | [Publisher Full Text](#)
- Duncan RP, Earhart GM: **Randomized controlled trial of community-based dancing to modify disease progression in Parkinson disease.** *Neurorehabil Neural Repair.* 2012; **26**(2): 132–43. [PubMed Abstract](#) | [Publisher Full Text](#)
- Ma HI, Hwang WJ, Fang JJ, et al.: **Effects of virtual reality training on functional reaching movements in people with Parkinson's disease: a randomized controlled pilot trial.** *Clin Rehabil.* 2011; **25**(10): 892–902. [PubMed Abstract](#) | [Publisher Full Text](#)
- Romenets SR, Anang J, Fereshtehnejad SM, et al.: **Tango for treatment of motor and non-motor manifestations in Parkinson's disease: a randomized control study.** *Complement Ther Med.* 2015; **23**(2): 175–84. [PubMed Abstract](#) | [Publisher Full Text](#)
- Hashimoto H, Takabatake S, Miyaguchi H, et al.: **Effects of dance on motor functions, cognitive functions, and mental symptoms of Parkinson's disease: a quasi-randomized pilot trial.** *Complement Ther Med.* 2015; **23**(2): 210–9. [PubMed Abstract](#) | [Publisher Full Text](#)
- Ashburn A, Fazakarley L, Ballinger C, et al.: **A randomised controlled trial of a home based exercise programme to reduce the risk of falling among people with Parkinson's disease.** *J Neurol Neurosurg Psychiatry.* 2007; **78**(7): 678–84. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
- Goodwin VA, Richards SH, Henley W, et al.: **An exercise intervention to prevent falls in people with Parkinson's disease: a pragmatic randomised controlled trial.** *J Neurol Neurosurg Psychiatry.* 2011; **82**(11): 1232–8. [PubMed Abstract](#) | [Publisher Full Text](#)
- Ma C, Wu S, Zeng H, et al.: **Effects of comprehensive rehabilitation training on balance and walking ability in patients with Parkinson's disease.** *Chinese Journal of Rehabilitation Medicine.* 2006; **21**(1): 624–5.
- Frazzitta G, Maestri R, Ghilardi MF, et al.: **Intensive rehabilitation increases BDNF serum levels in parkinsonian patients: a randomized study.** *Neurorehabil Neural Repair.* 2014; **28**(2): 163–8. [PubMed Abstract](#) | [Publisher Full Text](#)
- Zhang J, Wang H: **Observation of exercise therapy on the treatment of Parkinson's disease.** *Hebei Journal of Traditional Chinese Medicine.* 2013; **35**(1): 144–5.
- Tennigkeit J, Feige T, Haak M, et al.: **Structured Care and Self-Management Education for Persons with Parkinson's Disease: Why the First Does Not Go without the Second—Systematic Review, Experiences and Implementation Concepts from Sweden and Germany.** *J Clin Med.* 2020; **9**(9): 2787. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
- Lyons KS, Zajack A, Greer M, et al.: **Benefits of a Self-Management Program for the Couple Living With Parkinson's Disease: A Pilot Study.** *J Appl Gerontol.*

- 2021; 40(8): 881–9.
[PubMed Abstract](#) | [Publisher Full Text](#)
31. Guo L, Jiang Y, Yatsuya H, *et al.*: **Group education with personal rehabilitation for idiopathic Parkinson's disease.** *Can J Neurol Sci.* 2009; 36(1): 51–9.
[PubMed Abstract](#) | [Publisher Full Text](#)
 32. Tickle-Degnen L, Ellis T, Saint-Hilaire MH, *et al.*: **Self-management rehabilitation and health-related quality of life in Parkinson's disease: a randomized controlled trial.** *Mov Disord.* 2010; 25(2): 194–204.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
 33. Horne JT, Soh D, Cordato DJ, *et al.*: **Functional outcomes of an integrated Parkinson's Disease Wellbeing Program.** *Australas J Ageing.* 2020; 39(1): e94–e102.
[PubMed Abstract](#) | [Publisher Full Text](#)
 34. Hellqvist C, Berterö C, Dizdar N, *et al.*: **Self-Management Education for Persons with Parkinson's Disease and Their Care Partners: A Quasi-Experimental Case-Control Study in Clinical Practice.** *Parkinsons Dis.* 2020; 2020: 6920943.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
 35. Chlond M, Bergmann F, Günthlin C, *et al.*: **Patient education for patients with Parkinson's disease: a randomised controlled trial.** *Basal Ganglia.* 2016; 6(1): 25–30.
[Publisher Full Text](#)
 36. Simons G, Thompson SB, Smith Pasqualini MC, *et al.*: **An innovative education programme for people with Parkinson's disease and their carers.** *Parkinsonism Relat Disord.* 2006; 12(8): 478–85.
[PubMed Abstract](#) | [Publisher Full Text](#)
 37. Macht M, Gerlich C, Ellgring H, *et al.*: **Patient education in Parkinson's disease: formative evaluation of a standardized programme in seven European countries.** *Patient Educ Couns.* 2007; 65(2): 245–52.
[PubMed Abstract](#) | [Publisher Full Text](#)
 38. Tiihonen S, Lankinen A, Viemerö V: **An evaluation of a cognitive-behavioral patient education program for persons with Parkinson's disease in Finland.** *Nord Psychol.* 2008; 60(4): 316–31.
[Publisher Full Text](#)
 39. A'Campo LE, Wekking EM, Spliethoff-Kamminga NG, *et al.*: **The benefits of a standardized patient education program for patients with Parkinson's disease and their caregivers.** *Parkinsonism Relat Disord.* 2010; 16(2): 89–95.
[PubMed Abstract](#) | [Publisher Full Text](#)
 40. A'Campo LE, Spliethoff-Kamminga NG, Roos RA: **An evaluation of the patient education programme for Parkinson's disease in clinical practice.** *Int J Clin Pract.* 2011; 65(11): 1173–9.
[PubMed Abstract](#) | [Publisher Full Text](#)
 41. Sajatovic M, Ridgel AL, Walter EM, *et al.*: **A randomized trial of individual versus group-format exercise and self-management in individuals with Parkinson's disease and comorbid depression.** *Patient Prefer Adherence.* 2017; 11: 965–973.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
 42. A'Campo LE, Wekking EM, Spliethoff-Kamminga NG, *et al.*: **Treatment effect modifiers for the patient education programme for Parkinson's disease.** *Int J Clin Pract.* 2012; 66(1): 77–83.
[PubMed Abstract](#) | [Publisher Full Text](#)
 43. Gruber RA, Elman JG, Huijbregts MP: **Self-management programs for people with Parkinson's disease: A program evaluation approach.** *Top Geriatr Rehabil.* 2008; 24(2): 141–50.
[Publisher Full Text](#)
 44. Sunvisson H, Ekman SL, Hagberg H, *et al.*: **An education programme for individuals with Parkinson's disease.** *Scand J Caring Sci.* 2001; 15(4): 311–7.
[PubMed Abstract](#) | [Publisher Full Text](#)
 45. Lord S, Godfrey A, Galna B, *et al.*: **Ambulatory activity in incident Parkinson's: more than meets the eye?** *J Neurol.* 2013; 260(12): 2964–72.
[PubMed Abstract](#) | [Publisher Full Text](#)
 46. Petzinger GM, Holschneider DP, Fisher BE, *et al.*: **The effects of exercise on dopamine neurotransmission in Parkinson's disease: targeting neuroplasticity to modulate basal ganglia circuitry.** *Brain Plast.* 2015; 1(1): 29–39.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
 47. Arcolin I, Pisano F, Delconte C, *et al.*: **Intensive cycle ergometer training improves gait speed and endurance in patients with Parkinson's disease: a comparison with treadmill training.** *Restor Neurol Neurosci.* 2016; 34(1): 125–38.
[PubMed Abstract](#) | [Publisher Full Text](#)
 48. Marxreiter F, Regensburger M, Winkler J: **Adult neurogenesis in Parkinson's disease.** *Cell Mol Life Sci.* 2013; 70(3): 459–73.
[PubMed Abstract](#) | [Publisher Full Text](#)
 49. Schootemeijer S, van der Kolk NM, Ellis T, *et al.*: **Barriers and motivators to engage in exercise for persons with Parkinson's disease.** *J Parkinsons Dis.* 2020; 10(4): 1293–1299.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
 50. Ellis T, Cavanaugh JT, Earhart GM, *et al.*: **Factors associated with exercise behavior in people with Parkinson disease.** *Phys Ther.* 2011; 91(12): 1838–48.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
 51. Penko AL: **PHYSICAL ACTIVITY AND SELF-EFFICACY IN INDIVIDUALS WITH PARKINSONS DISEASE WITH A HISTORY OF FALLS.** Kent State University; 2017.
[Reference Source](#)
 52. Stevens A, Stanton R, Rebar AL: **Helping people with Parkinson disease build exercise self-efficacy.** *Phys Ther.* 2020; 100(2): 205–8.
[PubMed Abstract](#) | [Publisher Full Text](#)
 53. McAuley E, Blissmer B: **Self-efficacy determinants and consequences of physical activity.** *Exerc Sport Sci Rev.* 2000; 28(2): 85–8.
[PubMed Abstract](#)
 54. Higgins TJ, Middleton KR, Winner L, *et al.*: **Physical activity interventions differentially affect exercise task and barrier self-efficacy: A meta-analysis.** *Health Psychol.* 2014; 33(8): 891–903.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
 55. Rhodes RE, Martin AD, Taunton JE, *et al.*: **Factors associated with exercise adherence among older adults. An individual perspective.** *Sports Med.* 1999; 28(6): 397–411.
[PubMed Abstract](#) | [Publisher Full Text](#)
 56. Abraham C, Kelly MP, West R, *et al.*: **The UK National Institute for Health and Clinical Excellence public health guidance on behaviour change: a brief introduction.** *Psychol Health Med.* 2009; 14(1): 1–8.
[PubMed Abstract](#) | [Publisher Full Text](#)
 57. National Institute for Health and Care Excellence: **Behaviour change: general approaches.** National Institute for Health and Care Excellence (NICE); 2007.
[Reference Source](#)
 58. Speelman AD, van de Warrenburg BP, van Nimwegen M, *et al.*: **How might physical activity benefit patients with Parkinson disease?** *Nat Rev Neurol.* 2011; 7(9): 528–34.
[PubMed Abstract](#) | [Publisher Full Text](#)
 59. Craig P, Dieppe P, Macintyre S, *et al.*: **Developing and evaluating complex interventions: the new Medical Research Council guidance.** *BMJ.* 2008; 337: a1655.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
 60. Brug J, Oenema A, Ferreira I: **Theory, evidence and Intervention Mapping to improve behavior nutrition and physical activity interventions.** *Int J Behav Nutr Phys Act.* 2005; 2(1): 2.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
 61. Webb TL, Joseph J, Yardley L, *et al.*: **Using the internet to promote health behavior change: a systematic review and meta-analysis of the impact of theoretical basis, use of behavior change techniques, and mode of delivery on efficacy.** *J Med Internet Res.* 2010; 12(1): e4.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
 62. Michie S, Johnston M, Francis J, *et al.*: **From theory to intervention: mapping theoretically derived behavioural determinants to behaviour change techniques.** *Applied psychology.* 2008; 57(4): 660–80.
[Publisher Full Text](#)
 63. Speelman AD, van Nimwegen M, Bloem BR, *et al.*: **Evaluation of implementation of the ParkFit program: A multifaceted intervention aimed to promote physical activity in patients with Parkinson's disease.** *Physiotherapy.* 2014; 100(2): 134–41.
[PubMed Abstract](#) | [Publisher Full Text](#)
 64. Ellis T, Latham NK, DeAngelis TR, *et al.*: **Feasibility of a virtual exercise coach to promote walking in community-dwelling persons with Parkinson disease.** *Am J Phys Med Rehabil.* 2013; 92(6): 472–81; quiz 482–5.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
 65. Atkins L, Francis J, Islam R, *et al.*: **A guide to using the Theoretical Domains Framework of behaviour change to investigate implementation problems.** *Implement Sci.* 2017; 12(1): 77.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
 66. Curran JA, Brehaut J, Patey AM, *et al.*: **Understanding the Canadian adult CT head rule trial: use of the theoretical domains framework for process evaluation.** *Implement Sci.* 2013; 8: 25.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
 67. Cane J, Richardson M, Johnston M, *et al.*: **From lists of behaviour change techniques (BCTs) to structured hierarchies: comparison of two methods of developing a hierarchy of BCTs.** *Br J Health Psychol.* 2015; 20(1): 130–50.
[PubMed Abstract](#) | [Publisher Full Text](#)
 68. Michie S, Pilling S, Garety P, *et al.*: **Difficulties implementing a mental health guideline: an exploratory investigation using psychological theory.** *Implement Sci.* 2007; 2: 8.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
 69. Patey AM, Islam R, Francis JJ, *et al.*: **Anesthesiologists' and surgeons' perceptions about routine pre-operative testing in low-risk patients: application of the Theoretical Domains Framework (TDF) to identify factors that influence physicians' decisions to order pre-operative tests.** *Implement Sci.* 2012; 7: 52.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
 70. Islam R, Tinnmouth AT, Francis JJ, *et al.*: **A cross-country comparison of intensive care physicians' beliefs about their transfusion behaviour: a qualitative study using the Theoretical Domains Framework.** *Implement Sci.* 2012; 7: 93.
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
 71. Francis JJ, Stockton C, Eccles MP, *et al.*: **Evidence-based selection of theories for designing behaviour change interventions: using methods based on theoretical construct domains to understand clinicians' blood transfusion behaviour.** *Br J Health Psychol.* 2009; 14(Pt 4): 625–46.
[PubMed Abstract](#) | [Publisher Full Text](#)

72. McSherry LA, Dombrowski SU, Francis JJ, *et al.*: **It's a can of worms: understanding primary care practitioners' behaviours in relation to HPV using the Theoretical Domains Framework.** *Implement Sci.* 2012; **7**: 73. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
73. French SD, Green SE, O'Connor DA, *et al.*: **Developing theory-informed behaviour change interventions to implement evidence into practice: a systematic approach using the Theoretical Domains Framework.** *Implement Sci.* 2012; **7**: 38. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
74. McKenzie JE, O'Connor DA, Page MJ, *et al.*: **Improving the care for people with acute low-back pain by allied health professionals (the ALIGN trial): A cluster randomised trial protocol.** *Implement Sci.* 2010; **5**: 86. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
75. Tavender EJ, Bosch M, Gruen RL, *et al.*: **Developing a targeted, theory-informed implementation intervention using two theoretical frameworks to address health professional and organisational factors: a case study to improve the management of mild traumatic brain injury in the emergency department.** *Implement Sci.* 2015; **10**: 74. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
76. Michie S, Atkins L, West R: **The behaviour change wheel: a guide to designing interventions.** 2014. [Reference Source](#)
77. Aromataris E, Fernandez R, Godfrey C, *et al.*: **The Joanna Briggs Institute reviewers' manual 2014: methodology for JBI umbrella reviews.** University of Adelaide: Joanna Briggs Institute, 2014. [Reference Source](#)
78. Moher D, Liberati A, Tetzlaff J, *et al.*: **Reprint—preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement.** *Phys Ther.* 2009; **89**(9): 873–80. [PubMed Abstract](#) | [Publisher Full Text](#)
79. Schünemann H, Brozek J, Oxman A: **Grade handbook for grading the quality of evidence and the strength of recommendations; Version 3.2.** The GRADE Working Group, 2009; [updated March 2009]. [Reference Source](#)
80. Schünemann H: **GRADE handbook for grading quality of evidence and strength of recommendation.** Version 3.2. 2008.
81. Balshem H, Helfand M, Schünemann HJ, *et al.*: **GRADE guidelines: 3. Rating the quality of evidence.** *J Clin Epidemiol.* 2011; **64**(4): 401–6. [PubMed Abstract](#) | [Publisher Full Text](#)
82. Falck-Ytter Y, Schünemann H, Guyatt G: **AHRQ series commentary 1: rating the evidence in comparative effectiveness reviews.** *J Clin Epidemiol.* 2010; **63**(5): 474–5. [PubMed Abstract](#) | [Publisher Full Text](#)
83. Atkins D, Best D, Briss PA, *et al.*: **Grading quality of evidence and strength of recommendations.** *BMJ.* 2004; **328**(7454): 1490. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
84. Cane J, O'Connor D, Michie S: **Validation of the theoretical domains framework for use in behaviour change and implementation research.** *Implement Sci.* 2012; **7**(1): 37. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
85. Michie S, van Stralen MM, West R: **The behaviour change wheel: a new method for characterising and designing behaviour change interventions.** *Implement Sci.* 2011; **6**(1): 42. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
86. Higgins JP, Thompson SG, Deeks JJ, *et al.*: **Measuring inconsistency in meta-analyses.** *Bmj.* 2003; **327**(7414): 557–60. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
87. Higgins JP, Thompson SG: **Quantifying heterogeneity in a meta-analysis.** *Stat Med.* 2002; **21**(11): 1539–58. [PubMed Abstract](#) | [Publisher Full Text](#)
88. Higgins J, Altman D, Sterne J: In: Higgins JPT, Green S (editors). **Cochrane Handbook for Systematic Reviews of Interventions Version 5.1. 0 [updated March 2011].** The Cochrane Collaboration, 2011. [Reference Source](#)
89. Williams SL, French DP: **What are the most effective intervention techniques for changing physical activity self-efficacy and physical activity behaviour—and are they the same?** *Health Educ Res.* 2011; **26**(2): 308–22. [PubMed Abstract](#) | [Publisher Full Text](#)

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Current Peer Review Status:  

Version 2

Reviewer Report 02 September 2022

<https://doi.org/10.21956/hrbopenres.14855.r32720>

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Katherine Baker

Department of Sport, Exercise and Rehabilitation, Northumbria University, Newcastle upon Tyne, UK

Thank you for sharing the revisions to your protocol. The additional detail and clarification have strengthened the article which is an important addition to the literature.

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Physiotherapy, Parkinson's, physical activity and exercise

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Version 1

Reviewer Report 25 April 2022

<https://doi.org/10.21956/hrbopenres.14686.r31803>

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Ailish Malone

RCSI University of Medicine and Health Sciences, Dublin, Ireland

Thank you for the invitation to review this systematic review protocol. The protocol addresses an important gap in current evidence synthesis and proposes robust methods to achieve its aims.

The Introduction clearly conveys the state of the evidence in favour of the myriad benefits of exercise in Parkinson's, and the problem of inactivity. The review refers almost exclusively to "exercise" but the interventions might have an effect on habitual physical activity, too. Does the review intend to focus exclusively on *exercise* (structured, planned, repetitive, intentional), as distinct from *physical activity* (also including unstructured / incidental movement)? (I see that "physical activity" is a search term but the rest of the review refers to "exercise".)

The last paragraph under the subheading "Exercise in Parkinson's" presents the Sajatovic study, which compared a **group**-based exercise and self-management program with an **individual** exercise and self-management program. Participants in the **group** program showed additional improvements in depression scores, but were these differences seen within-group or between-group? Is the key difference, then, the mode of delivery (group v individual) rather than the components of the intervention and if so, what bearing might this have on the review?

Section "Barriers to exercise in PwP" – this section clearly communicates the problems with the translation of evidence for exercise into the real-world setting. The last paragraph could include a summary sentence. What are the implications for the review from the outcomes of short-term and long-term strategies?

Methods

The methods are mostly clear and follow the expected process for a systematic review. Some clarifications:

- Inclusion and exclusion criteria

For (i) Population, exclusion criterion b: please amend "wheelchair-bound" to "wheelchair user" ("wheelchair user" is the preferred, more inclusive term)

(iv) Setting: The study excludes acute hospitals. I see the rationale for this for current hospital inpatients or people who had a recent admission. However, would this exclusion apply if an outpatient intervention for community-dwelling people with Parkinson's happened to be delivered at an acute hospital? The service arrangements for delivery of outpatient care to people with Parkinson's might vary among health services and interventions meeting criteria (ii) could occur at an acute, specialist neurological hospital. If a study's population, intervention, and outcome(s) meet the inclusion criteria, should it not be included, irrespective of where it took place?

- Data extraction – do the authors have a plan for identifying and handling duplicate data (for example, where the same trial produced multiple papers with secondary analyses?)

The final article needs a thorough proofread as several minor errors remain in this version.

Is the rationale for, and objectives of, the study clearly described?

Yes

Is the study design appropriate for the research question?

Yes

Are sufficient details of the methods provided to allow replication by others?

Yes

Are the datasets clearly presented in a useable and accessible format?

Not applicable

Competing Interests: No competing interests were disclosed.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Author Response 16 Jul 2022

Leanne Ahern, University College Cork, Cork, Ireland

Thank you so much for taking the time to review our manuscript, and for your constructive comments. Responses and subsequent changes to the manuscript are detailed below.

Comment: The Introduction clearly conveys the state of the evidence in favour of the myriad benefits of exercise in Parkinson's and the problem of inactivity. The review refers almost exclusively to "exercise" but the interventions might have an effect on habitual physical activity, too. Does the review intend to focus exclusively on exercise (structured, planned, repetitive, intentional), as distinct from physical activity (also including unstructured/incidental movement)? (I see that "physical activity" is a search term but the rest of the review refers to "exercise".)

Response: Thank you for this comment, with was a factor in which we overlooked

Action: Paragraph added to the introduction regarding physical activity. This review intends to focus on both exercise and physical activity

Comment: The last paragraph under the subheading "Exercise in Parkinson's" presents the Sajatovic study, which compared a group-based exercise and self-management program with an individual exercise and self-management program. Participants in the group program showed additional improvements in depression scores, but were these differences seen within-group or between-group? Is the key difference, then, the mode of delivery (group v individual) rather than the components of the intervention and if so, what bearing might this have on the review?

Response: Thank you for this comment as it is important that the information is clear for the readers. Upon further review of the paper, the differences that were reported in this review were within-group, therefore, highlighting that the differences are not solely related to mode of delivery.

Action: Rephrasing and more information provided to ensure clear message is conveyed regarding the results of this study

Comment: Section "Barriers to exercise in PwP" – this section clearly communicates the problems with the translation of evidence for exercise into the real-world setting. The last

paragraph could include a summary sentence. What are the implications for the review from the outcomes of short-term and long-term strategies?

Response: Thank you for this comment

Action: Included summary sentence at end of paragraph

Comment: The methods are mostly clear and follow the expected process for a systematic review. Some clarifications:

Inclusion and exclusion criteria

For (i) Population, exclusion criterion b: please amend “wheelchair-bound” to “wheelchair user” (“wheelchair user” is the preferred, more inclusive term)

(iv) Setting: The study excludes acute hospitals. I see the rationale for this for current hospital inpatients or people who had a recent admission. However, would this exclusion apply if an outpatient intervention for community-dwelling people with Parkinson’s happened to be delivered at an acute hospital? The service arrangements for delivery of outpatient care to people with Parkinson’s might vary among health services and interventions meeting criteria (ii) could occur at an acute, specialist neurological hospital. If a study’s population, intervention, and outcome(s) meet the inclusion criteria, should it not be included, irrespective of where it took place?

Response: Thank you for this comment, we agree that clarification is needed.

Action: The suggestions have been considered and amendments have been made regarding the inclusion criteria for the population and the setting.

Competing Interests: None

Reviewer Report 11 March 2022

<https://doi.org/10.21956/hrbopenres.14686.r31537>

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Katherine Baker

Department of Sport, Exercise and Rehabilitation, Northumbria University, Newcastle upon Tyne, UK

Thank you for the opportunity to review this manuscript. The proposed review will make an important contribution to the evidence base.

Abstract: Provides a useful summary and rationale for the review. Methods could include study designs that will be included.

Introduction: includes relevant and contemporary work in the area. This section clearly outlines the need to better understand ways of influencing behaviour change. As the Theoretical Domains Framework and Behaviour Change Wheel are proposed as the theoretical frameworks for the review, it would be appropriate to acknowledge them here.

Review objectives: exercise adherence is not identified as an outcome in the second objective, consider including this given the third objective which talks about the strategies but not adherence as an outcome.

Methodology: it is interesting that you propose a qualitative synthesis when the review inclusion criteria allows only quantitative study designs. Further explanation is needed on how this will be done.

There are typographical mistakes throughout, please review carefully.

Is the rationale for, and objectives of, the study clearly described?

Yes

Is the study design appropriate for the research question?

Yes

Are sufficient details of the methods provided to allow replication by others?

Partly

Are the datasets clearly presented in a useable and accessible format?

Not applicable

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Physiotherapy, Parkinson's, physical activity and exercise

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 16 Jul 2022

Leanne Ahern, University College Cork, Cork, Ireland

Thank you so much for taking the time to review our manuscript, and for your constructive comments. Responses and subsequent changes to the manuscript are detailed below.

Comment: Abstract: Provides a useful summary and rationale for the review. Methods could include study designs that will be included.

Response: We agree with this comment and believe it would provide important information to the readers

Action: Sentence "Interventional studies including behavioural change interventions will be included in this review" was included in the abstract

Comment: Introduction: includes relevant and contemporary work in the area. This section clearly outlines the need to better understand ways of influencing behaviour change. As the Theoretical Domains Framework and Behaviour Change Wheel are proposed as the theoretical frameworks for the review, it would be appropriate to acknowledge them here.

Response: We agree with this comment and admit it was an element which we overlooked. Thank you for this comment.

Action: Paragraphs regarding the Theoretical Domains Framework and Behaviour Change Wheel have been included in the introduction

Comment: Review objectives: exercise adherence is not identified as an outcome in the second objective, consider including this in the third objective which talks about the strategies but not adherence as an outcome.

Response: We agree with this comment as exercise adherence is referred to many times in the article.

Action: Exercise adherence included as an outcome in the second objective

Comment: Methodology: it is interesting that you propose a qualitative synthesis when the review inclusion criteria allows only quantitative study designs. Further explanation is needed on how this will be done.

Response: Thank you for this comment, we were not aware of the lack of transparency with regards to this.

Action: Methods section has been amended to a narrative synthesis with the addition of assessment for eligibility for meta-analysis

Competing Interests: No competing interests were disclosed.