Archives of Rehabilitation Research and Clinical Translation (2025) 7, 100447

ACRM
AMERICAN CONGRESS OF REHABILITATION MEDICINE

Archives of Rehabilitation Research and Clinical Translation

Archives of Rehabilitation Research and Clinical Translation 2025;7:100447

Available online at www.sciencedirect.com

Review Article

A Systematic Review of the Effects of Therapeutic Exercise With Psychological Interventions on Disability and Personal Outcomes in Older Adults

Grace A. Rose[a], Pietra T. Bruni, PhD [b], Mariana Wingood, PT, DPT, PhD, MPH [c], Selmi Kallmi, PhD [b], Elizabeth Finer, MA [d], Patricia M. Bamonti, PhD [a,e]

[a] *Research & Development, VA Boston Healthcare System, Boston, MA*
[b] *VA Boston Healthcare System, Boston, MA*
[c] *New England Geriatric Research Education and Clinical Center, VA Boston Healthcare System, Boston, MA*
[d] *Department of Psychology, Hofstra University, Hempstead, NY*
[e] *Department of Psychiatry, Harvard Medical School, Boston, MA*

KEYWORDS
Aged;
International Classification of Functioning, Disability, and Health;

Abstract *Objective:* To evaluate the effects of therapeutic exercise and psychological interventions on disability and personal outcomes in older adults.
Data Sources: Articles published from January 2013 to February 2025 are available in PubMed, Embase, ProQuest Health & Medical and Psychology, PsycINFO, and PsycArticles.

List of abbreviations: ACT, acceptance and commitment therapy; CBT, cognitive-behavioral therapy; CR, cardiac rehabilitation; ICF, International Classification of Functioning, Disability, and Health; MI, motivational interviewing; PA, physical activity; PR, pulmonary rehabilitation; PT, physical therapy; RoB, risk of bias.

Current affiliation for Author Bruni: VA Connecticut Healthcare System, West Haven, CT; Department of Psychiatry, Yale School of Medicine, New Haven, CT. Current affiliation for Author Wingood: Department of Implementation Science, Wake Forest University School of Medicine, Winston-Salem, NC; Sticht Center for Healthy Aging an Alzheimer's Prevention, Internal Medicine, Gerontology and Geriatric Medicine, Wake Forest University School of Medicine, Winston-Salem, NC. Current affiliation for Author Kallmi: VA North Texas Healthcare System, Dallas, TX.

This work was presented at the 2023 Gerontological Society of America conference (primary author: Grace A. Rose) in Tampa, FL and at Harvard Research Day and Mysell Lecture in 2023 (primary author: Pietra T. Bruni, PhD) in Boston, MA.
Patricia M. Bamonti is supported by the U.S. Department of Veteran Affairs Rehabilitation Research and Development Service Career Development Award-2 (CDA-2) Award 1IK2RX003527-01A2. This material is the result of work supported with resources and the use of facilities at the VA Boston Healthcare System. The contents do not represent the views of the U.S. Department of Veterans Affairs or the United States Government.
This systematic review was registered with Open Science Framework (DOI:10.17605/OSF.IO/F4W7J).
Cite this article as: Arch Rehabil Res Clin Transl. 2025;7:100447

https://doi.org/10.1016/j.arrct.2025.100447

Rehabilitation;
Review

Study Selection: Inclusion criteria were as follows: (1) intervention included therapeutic exercise combined or integrated with a psychological intervention; (2) randomized controlled trial; (3) sample mean age ≥60 years; (4) primary or secondary outcome(s) of disability. Two authors independently screened trials (n=7391) for inclusion; a third author verified results and resolved discrepancies.
Data Extraction: Data were extracted by a primary reviewer and verified by a second reviewer. The risk of bias assessment was performed using the risk of bias in randomized controlled trials.
Data Synthesis: Thirty-eight trials (n=18,550 participants) were included. Therapeutic exercise included: exercise programs (34%), physical activity counseling and monitoring (37%), rehabilitation (18%), or other (eg, Tai Chi; 13%). Psychological interventions were primarily motivational interviewing (53%) or cognitive-behavioral therapy/strategies (39%). Significant improvement in body functions and structures (n=14, 37%), activity (n=6, 16%), participation (n=20, 53%), and personal factors (n=11, 29%) was observed.
Conclusions: Therapeutic exercise with psychological interventions have a positive effect on disability and personal outcomes, especially in participation. Heterogeneity in the study design, intervention, and population challenged data synthesis. Nonetheless, the current review identified gaps within the literature and directions for future research. Testing the additive effect of these interventions compared to active comparators is a priority for future investigations.

By 2050, an estimated 120.4 million adults 60 years of age and older will have at least one chronic disease in the United States alone.[1] The burden of chronic disease increases with age, with 23% of the total global burden of disease attributed to chronic disease in older adults aged 60 years and older.[2] The World Health Organization's International Classification of Functioning, Disability, and Health (ICF), issued in 2002, provides a framework to understand the interaction between health conditions and contextual factors (ie, environmental and personal) within the individual.[3] According to the ICF framework, functioning within an individual can occur at multiple levels, including body functions and structures, activity, and participation.[3,4] Disability denotes a decrease or reduction in any of the 3 levels of functioning (ie, impairments, limitations, restrictions).[3,4] Personal factors are individual characteristics (eg, depression) that can influence an individual's experience of disability.[3] At an individual level, the presence of chronic disease increases the risk of disability, resulting in adverse health outcomes, including hospitalization, institutionalization, and mortality.[3,5,6] To improve the health and functioning of older adults, disrupting the chronological age-chronic disease association is necessary.[1]

Therapeutic exercises such as exercise programs, physical activity (PA) counseling and monitoring, physical therapy (PT), and rehabilitation are largely efficacious for improving health, as well as disability outcomes in adults of all ages.[7-10] Despite the well-established health benefits of therapeutic exercise, 91% of older adults do not meet the recommended levels of exercise or PA.[11,12] Moreover, adherence to therapeutic exercise is low, and long-term behavior change is challenging.[11-13] Therapeutic exercise interventions that combine or integrate psychological interventions such as cognitive-behavioral therapy (CBT) and motivational interviewing (MI) may optimize outcomes by addressing personal factors related to engagement, adherence, and long-term maintenance of behavior change.[11]

CBT is an evidence-based psychological intervention for a range of psychological disorders across the lifespan.[14,15] Given the evidence base for CBT, pairing CBT with therapeutic exercise may address multiple outcomes within the ICF framework, particularly in populations with co-occurring chronic disease and emotional distress. MI, unlike CBT, was developed specifically as either a stand-alone intervention or an adjunct to other interventions.[16] Early MI research focused on its use to increase readiness for substance use treatment.[16] MI is a dialog-based, patient-centered intervention that meets individuals where they are at in the behavior change process with the goal of increasing readiness for change.[16] In recent years, third-wave therapies such as acceptance and commitment therapy (ACT) have grown in popularity and empirical support.[17] ACT and other mindfulness-based interventions provide education and skills training on mindfulness, acceptance, and psychological flexibility.

Combined or integrated interventions may be best suited for certain ICF domain outcomes. For example, biologic processes more strongly underlie body functions and structures, whereas psychosocial processes exert more influence on activity and participation.[18] However, to our knowledge, no systematic reviews have been conducted to examine the effects of these interventions on disability and personal outcomes in older adults. Therefore, the purpose of this systematic review was to synthesize and evaluate trials examining the effects of therapeutic exercise with psychological interventions on disability outcomes and personal factors in older adults.

Methods

The protocol of this systematic review complies with the Preferred Reporting Items for Systematic Reviews and

Meta-Analyses guidelines.[19] The review was registered with Open Science Framework on October 24, 2022.

Search strategy

A systematic search was conducted with the assistance of a chief librarian from January 1, 2013 to February 5, 2025 with the following databases: PubMed, Embase, ProQuest Health & Medical and Psychology, PsycINFO, and PsycArticles. The final search strategy and results are provided in supplemental table S1.

Inclusion criteria

Trials were included if they met the following criteria: (1) the experimental intervention included a therapeutic exercise combined or integrated with a psychological intervention; (2) a formal randomized controlled trial, not defined as a "feasibility" or "pilot" study; (3) the sample was composed of adults with a mean age≥60 years; (4) disability outcomes were assessed as either primary or secondary outcomes. Disability outcomes were defined by the ICF framework and categorized into their relevant domains (eg, body functions and structures; see Data Synthesis for further details). Although results related to personal factors were synthesized, they were not inclusion criteria. Trials were excluded if they met the following criteria: (1) a literature, systematic, or scoping review, meta-analysis, study protocol, dissertation, poster, platform, or abstract; (2) not written in English, without available full-text in English; (3) participants were diagnosed with dementia and/or major neurocognitive disorder; (4) trial setting was an institutional setting (eg, nursing home). Systematic and scoping reviews were compiled and data mined for referenced articles meeting inclusion criteria. In order to balance thoroughness with feasibility, the literature search was restricted to a 12-year look-back focusing on recent developments in the field.

Selection of trials

Database search results were uploaded into EndNote,[a] and then Covidence[b] duplicates were removed at each step prior to screening for eligibility. The resulting titles/abstracts were compiled and independently reviewed by 2 authors (G.A.R. and P.T.B.). Those eligible for inclusion were double-reviewed by an additional author (P.M.B.) to provide certainty and confidence in the results. For titles/abstracts that were of unclear eligibility, full-text reviews were conducted to determine inclusion. Full texts were compiled and independently reviewed by 2 authors for eligibility. Disagreements regarding the inclusion of articles were discussed among co-authors until a consensus was reached.

Following the review of full-text articles, a consensus was reached among authors to make a distinction between psychological interventions and the use of behavior change techniques not within a specific psychological intervention (eg, goal setting, problem-solving). Psychological interventions may contain behavior change techniques within them in order to address both behavioral and psychological outcomes, but stand-alone behavior change techniques do not fully constitute a psychological intervention.[20,21] Because the focus of this review was on trials testing therapeutic exercise combined or integrated with psychological interventions, trials that only included single or multiple behavior change techniques not within a psychological intervention were excluded.

Data extraction and quality assessment

Data were independently extracted by the first author (G.A.R.) using a customized data extraction form. The extracted data were reviewed by accuracy by all other authors. Effect sizes were extracted when available. Extracted data were compiled and can be found in supplemental tables S2 and S3.

The risk of bias (RoB) was assessed using Cochrane revised tool for assessing RoB in randomized controlled trials.[22] Two authors (G.A.R. and P.T.B.) independently assessed RoB; an additional author (P.M.B.) was brought in for any discrepancies in assessments.

Data synthesis

Following the World Health Organization guidance, outcomes were organized by ICF domain through interdisciplinary discussion (ie, psychology, PT, health science) and consensus among authors (G.A.R., P.T.B., P.M.B., and M.W.). Data were then summarized based on the ICF framework and by the type of comparator (ie, active comparator or control). Narrative synthesis is provided later.

Results

Study selection

Database searches identified 7391 unique records for screening after the removal of duplicates. After a review of titles/abstracts, 7188 records were excluded because they did not meet inclusion criteria. The full-text review was performed on 203 articles and 38 trials[23-60] met the inclusion criteria. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow diagram is displayed in figure 1.

Risk of bias

Results of the RoB assessment are presented in figure 2. A total of 28 trials[24-31,33-37,40-43,47-49,53-60] had low RoB, 9 trials[23,32,38,44-46,50-53] had some concerns of bias, and 1 trial[39] had a high RoB.

Study characteristics

Sample sizes varied from 43[52] to 10,815[38] participants (median of 177 participants per study). Study participants' mean age was 69.99±6.66 years and the majority were women (55.57%). Persons with chronic disease constituted the sample of 44.74% of trials.[23,26,31-33,35,36,39-41,44,46,47,53,57-59] Trials were conducted in Europe (44.74%), Asia (26.32%), North America (21.05%), and Australia (7.89%). Sample characteristics are presented in supplemental table S3.

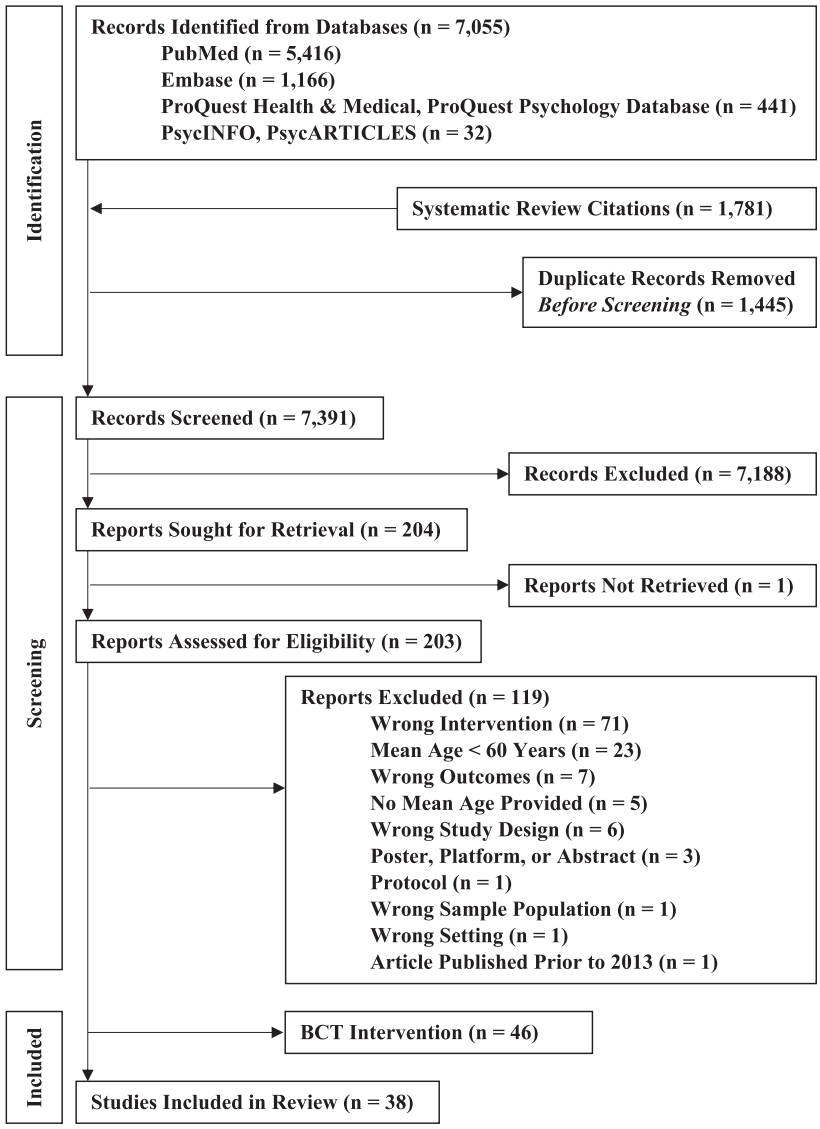

Fig 1 Systematic review methodology and results (PRISMA flowchart). PRISMA flow diagram illustrating the search methodology and results of this systematic review. Abbreviation: PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

Dropout rates and adverse events

The average dropout rate was 14.94% (range, 0%[33,57]-47.89%[38]). Dropout or attrition was primarily due to the inability to contact participants (85.91%), participant withdrawal (4.19%), reasons not provided (4.14%), and other reasons (eg, health concerns). Four trials reported study-related adverse events, including fatigue,[26] pain,[26,49,55,57,60] dyspnea,[26,36] new orthopedic symptoms,[36] falls,[26,60] and irritation from activity monitor.[47]

Intervention characteristics

As displayed in table 1, therapeutic exercise interventions included exercise programs (eg, brisk walking, aerobic, functional and high intensity exercises, stretch, and strength, resistance, and balance training; 31.58%),[24,28,29,34,35,40,42,44,49,50,52,53] PA counseling and monitoring (ie, PA plans and goals with an activity monitor; 31.58%),[25-27,30,32,37,38,41,43,46,48,57] exercise programs with PA monitoring (2.63%),[23] rehabilitation programs (21.05%),[31,33,39,47,54,56,58,59] walking programs (7.89%),[36,55,60] Baduanjin (2.63%),[45] and Tai Chi (2.63%).[51] Psychological interventions included MI (47.37%),[23,25,26,28-30,33,36,38,41,46,47,48,52,56-58,60] CBT (34.21%),[24,27,31,35,37,39,40,44,45,49,51,53,54] MI and CBT (5.26%),[32,42] mindfulness meditation (5.26%),[50,55] problem-solving therapy (PST; 2.63%),[34] and ACT (5.26%).[43,59]

Therapeutic exercise and psychological interventions were categorized as either *combined* or *integrated* interventions (supplemental table S2). Interventions were classified as *combined* when the therapeutic exercise and psychological intervention were distinguishable from each other,

A. Summary of Individual Trials

	Risk of Bias Domains					
Reference	**D1**	**D2**	**D3**	**D4**	**D5**	**Overall**
Allen KD et al. 2017[24]	+	+	+	+	+	+
Anderson AS et al. 2014[25]	+	+	+	+	+	+
Arbillaga-Etxarri A et al. 2018[26]	+	+	+	+	+	+
Archer KR et al. 2020[27]*	+	+	+	+	+	+
Arkkukangas M et al. 2019[28]*	+	+	+	+	+	+
Barberan-Garcia et al. 2018[29]	+	+	+	+	+	+
Blackford K et al. 2016[30]	+	+	+	+	+	+
Blumenthal JA et al. 2016[31]	+	+	+	+	+	+
Burtin C et al. 2015[32]	?	+	+	+	+	?
Chair SY et al. 2013[33]	+	+	+	+	+	+
Chan DD et al. 2017[34]	+	+	+	+	+	+
Cheng ST et al. 2022[35]	+	+	+	+	+	+
Collins TC et al. 2019[36]	+	+	+	+	+	+
de Vries NM et al. 2016[23]	+	?	+	+	+	?
Dorresteijn TA et al. 2016[37]	+	+	+	+	+	+
Dwinger S et al. 2020[38]	?	+	+	?	+	?
Farver-Vestergaard I et al. 2018[39]	+	+	−	−	+	−
Friedberg JP et al. 2015[40]	+	+	+	+	+	+
Gilbert AL et al. 2018[41]	+	+	+	+	+	+
Hattori S et al. 2019[42]	+	+	+	+	+	+
Hawkes AL et al. 2013[43]*	+	+	+	+	+	+

Fig 2 Quality assessment of included trials.

conducted either concurrently or subsequently. Interventions were classified as *integrated* when the therapeutic exercise and psychological intervention were conducted as 1 indistinguishable intervention package. A total of 16 trials (42.11%)[28,31-33,36,39,44-49,51,52,59,60] were combined and 22 trials (57.89%)[23-27,29,30,34,35,37,38,40-43,50,53-58] were integrated.

Active comparators were primarily therapeutic exercise, including exercise programs (23.81%),[28,34,44,53,55] PA counseling and monitoring (9.52%),[42,48] rehabilitation programs (33.33%),[31-33,39,47,54,59] PT (4.76%),[23] a walking program (9.52%),[36,60] Baduanjin (4.76%),[45] Tai Chi (4.76%),[51] and health education (ie, nontailored information about diet, medication, and exercise guidelines; 4.76%).[40] Psychological interventions were used as active comparators in only 3 trials (MI (9.52%) and CBT (4.76%), respectively).[45,52,60] Control groups consisted of usual or standard care (ie, locally defined standards of care or usual care of the specific health condition of the sample as well as PA recommendations; 52.17%),[24,26,29,31,37,38,42,50,52,56-58] educational sessions and/or brochures covering topics such as PA recommendations, chronic pain and other health conditions, nutrition, and safety (34.78%),[27,28,35,36,40,43,46,49] waitlist (8.70%),[30,53] or no further contact following baseline (4.35%).[25]

Outcomes

As illustrated in figure 3, study outcomes were organized using the ICF framework.

A detailed overview is provided in table 2.[23-60] Instruments used to measure ICF outcomes are summarized in supplemental table S3. Body functions and structures were assessed by 27 trials,[23-28,31-35,38-41,43-47,49,50,52,53,58-60] activity was measured by 22 trials,[23,24,26-29,31,32,34,36,41,42,44,47,49,51-56,60] and participation was assessed by 36 trials.[23-48,51-60] Personal factors were examined by 22 trials.[24-26,28,29,31,35,37-39,42-50,53-54,59]

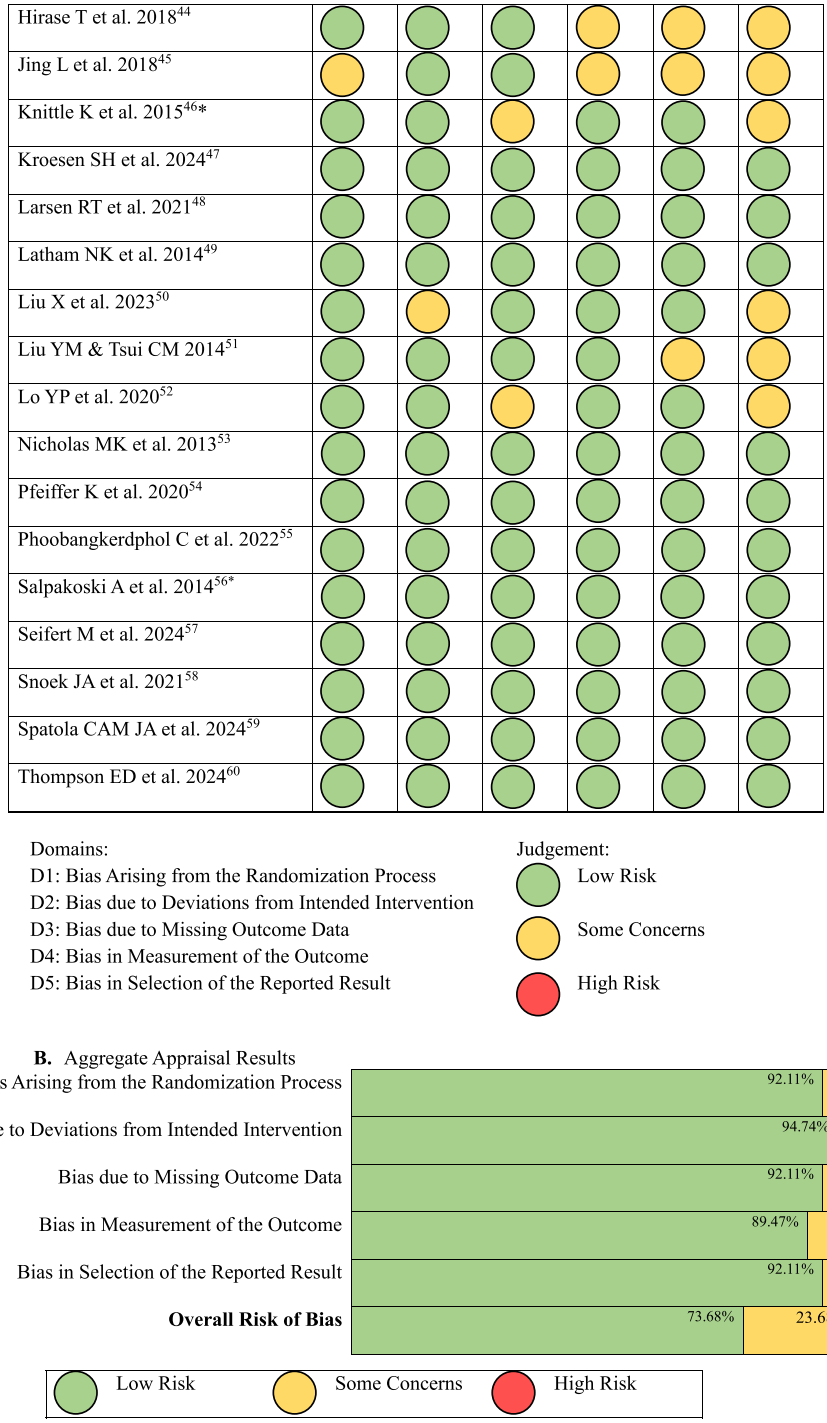

Fig 2 Continued.

Effects of combined or integrated interventions by ICF outcome

The effects of therapeutic exercise with psychological interventions on disability and personal outcomes are displayed in figure 4.

Supplemental table S3 displays the study characteristics, pattern of findings, and statistics for studies with statistically significant between-group effects. We summarize the results by ICF outcome in the following.

Body functions and structures

Active comparator

Fifteen trials[23,28,31-34,39,41,44,45,47,52,53,59,60] examined whether the intervention improved body functions and

Table 1 Therapeutic exercise and psychological intervention characteristics

Therapeutic exercise interventions	Psychological interventions	Combined		Integrated	
		N	%	N	%
Exercise programs	MI	2	5.26%	1	2.63%
	CBT	2	5.26%	4	10.53%
	MI and CBT	-	-	1	2.63%
	Mindfulness mediation	-	-	1	2.63%
	PST	-	-	1	2.63%
Exercise program and physical activity monitoring	MI	-	-	1	2.63%
Physical activity counseling and monitoring	MI	3	7.89%	6	15.79%
	CBT	-	-	2	5.26%
	MI and CBT	1	2.63%	-	-
	ACT	-	-	1	2.63%
Rehabilitation programs	MI	1	2.63%	2	5.26%
	CBT	2	5.26%	1	2.63%
	ACT	1	2.63%	-	-
Walking programs	MI	2	5.26%	-	-
	Mindfulness meditation	-	-	1	2.63%
Baduanjin	CBT	1	2.63%	-	-
Tai Chi	CBT	1	2.63%	-	-

Abbreviations: ACT, acceptance-commitment therapy; CBT, cognitive-behavioral therapy; MI, motivational interviewing; PST, problem-solving therapy.

structure outcomes compared with an active comparator. Twelve trials found no difference between groups on clinical outcomes,[31,33,59,60] muscle strength,[28,32,47,52] physical health status,[39] lung function,[32,52] frailty,[34] and/or pain intensity.[41,44] Six trials[23,34,45,47,52,53] found significant group differences benefiting the intervention compared with an active comparator. Lo et al[52] assessed exercise+MI versus MI versus standard care in older adults with multimorbidity. Improved work (watts) and anaerobic threshold (L/min) were observed in the exercise+MI group (vs. MI) at 12 weeks. Kroesen et al[47] examined cardiac rehabilitation (CR)+MI versus CR in CR patients. Improved HDL-cholesterol was observed in the CR+MI group at 12 weeks. Chan et al[34] evaluated high level care (exercise+PST) versus low level care (exercise+education) in older adults with frailty. Increased grip strength was observed in the high level care group at

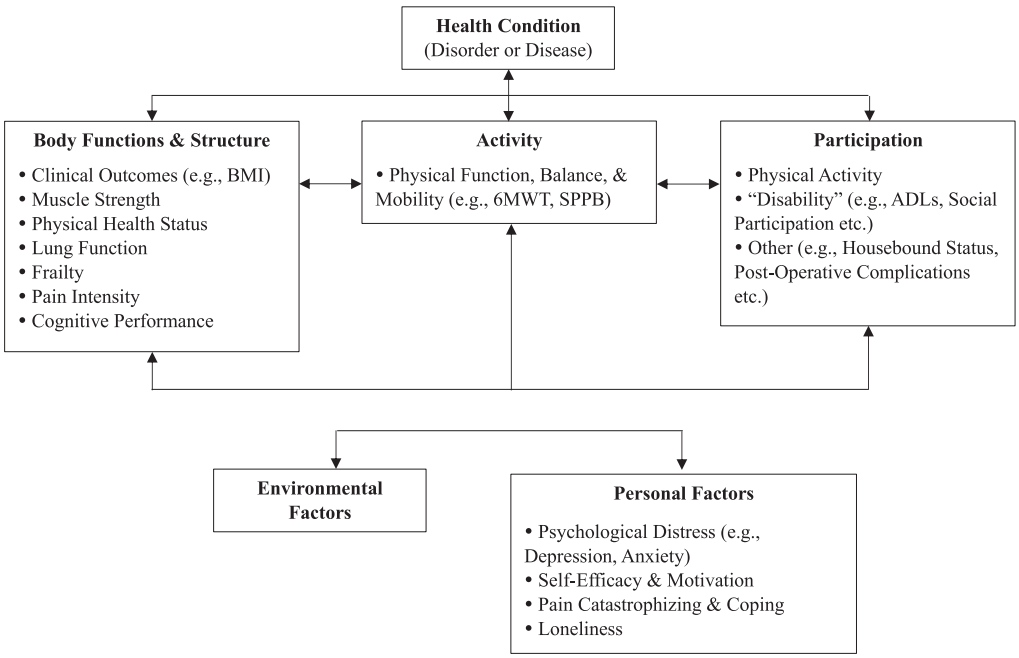

Fig 3 Adapted ICF framework of included disability outcomes and personal factors. Abbreviations: 6MWT, 6-minute walk test; ADLs, activities of daily living; BMI, body mass index; SPPB, Short Physical Performance Battery.

Table 2 Effects of therapeutic exercise with psychological interventions on disability and personal outcomes in older adults (N=38)

Reference	Sample	Intervention	Comparator	Follow-up	ICF framework components			
					Body functions and structures	Activity	Participation	Personal Factors
Intervention vs. active comparator (N=15)								
Burtin et al[32]	COPD	PR+PA counseling and monitoring+MI and CBT	PR	3 and 6-mo	• Muscle strength (quadriceps) • Lung function	• Physical function, balance, and mobility	• PA	
Chair et al[33]	CR patients with poor motivation	CR+MI	CR	6, 9, and 12 mo	• Clinical outcomes			• Psychological distress
Chan et al[34]	Frailty	Exercise program+problem-solving therapy	Exercise program	3, 6, and 12 mo	• Muscle strength (grip) • Frailty	• Physical function, balance, and mobility	• PA	
De Vries et al[23]	Mobility problems	Exercise program and PA monitoring+MI	Physical therapy	3 and 6 mo	• **Frailty**	• Physical function, balance, and mobility	• **PA**	
Farver-Vestergaard et al[39]	COPD	PR+CBT	PR	8-wk and 3 and 6 mo	• Physical health status		• PA	• **Psychological distress**
Gilbert et al[41]	Arthritis	PA counseling and monitoring +MI	PA counseling and monitoring	24 mo	• Pain intensity	• **Physical function, balance, and mobility**	• PA	
Hirase et al[44]	Chronic pain	Exercise program+CBT	Exercise program	12 wk	• Pain intensity	• Physical function, balance, and mobility	• **PA** • **"Disability"**	• Psychological Distress • **Pain catastrophizing and coping**
Jing et al[45]	Homebound	Baduanjin+CBT	Baduanjin or CBT	6 mo	• **Physical health status** • **Lung function**		• **"Disability"** • **Other**	• **Psychological distress** • **Loneliness**
Kroesen et al[47]	CR patients with poor motivation	CR+MI	CR	12 wk	• **Clinical outcomes** • **Muscle** Strength	• Physical function, balance, and mobility	• **PA**	• Self-efficacy and motivation
Larsen et al[48]	Community-dwelling	PA counseling and monitoring +MI	PA counseling and monitoring	12 wk			• PA	• Self-efficacy and motivation
Liu and Tsui[51]	Community-dwelling	Tai Chi+CBT	Tai Chi	8 wk and 2 mo		• Physical function, balance, and mobility	• PA • "Disability"	
Pfeiffer et al[54]	Hip and pelvic fracture	Rehabilitation+CBT	Rehabilitation	2 and 3 mo		• **Physical function, balance, and mobility**	• PA • **"Disability"** • Other	• **Self-efficacy and motivation**
Phoobangkerdphol et al[55]	Fall history	Walking program+mindfulness meditation	Exercise program	6 and 9 mo		• Physical function, balance, and mobility		• Psychological distress
Spatola et al[59]	CR patients	CR+acceptance-commitment therapy	CR	3 wk	• Clinical outcomes		• PA	• Psychological distress
Thompson et al[60]	Community-dwelling	Walking program+MI	Walking program or MI	12 wk	• Clinical outcomes	• Physical function, balance, and mobility	• **PA**	

(*continued*)

Table 2 (*Continued*)

Reference	Sample	Intervention	Comparator	Follow-up	ICF framework components			
					Body functions and structures	Activity	Participation	Personal Factors
Intervention vs. control condition (N=17)								
Allen et al[24]	Hip or knee osteoarthritis	Exercise program+CBT	Standard care	6 and 12 mo	• Clinical outcomes	• Physical function, balance, and mobility	• **PA**	• Psychological distress
Anderson et al[25]	Adenoma following Colorectal Cancer Screening	PA counseling and monitoring +MI	No further contact	3 and 12 mo	• **Clinical outcomes**		• **PA**	• *Self-efficacy and motivation*
Arbillaga-Etxarri et al[26]	COPD	PA counseling and monitoring +MI	Standard care	12 mo	• Clinical outcomes • Physical health status	• Physical function, balance, and mobility	• **PA**	• Psychological distress
Archer et al[27]	Back surgery	PA counseling and monitoring +CBT	Educational session/ brochure	6 and 12 mo	• Disability • Pain intensity	• Disability • Physical function, balance, and mobility	• Disability • PA	
Barberan-Garcia et al[29]	Elective major abdominal surgery	Exercise program+MI	Standard care	Posturgical hospital length of stay		• **Physical function, balance, and mobility**	• **PA** • **Other**	• Psychological distress
Blackford et al[30]	Metabolic syndrome	PA counseling and monitoring +MI	Waitlist	6 mo			• **PA**	
Cheng et al[35]	Chronic pain	Exercise program+CBT	Educational session/ brochure	10 wk, 3 and 6 mo	• **Muscle strength (hip and knee)** • **Pain intensity**		• **"Disability"**	• Psychological distress • **Self-efficacy and motivation** • Pain catastrophizing and coping
Dorresteijn et al[37]	Frailty	PA counseling and monitoring +CBT	Standard care	5 and 12 mo			• **"Disability"** • Other	• **Self-efficacy and motivation**
Dwinger et al[38]	Chronic conditions	PA counseling and monitoring +MI	Standard care	1, 2, and 3 y	• **Clinical outcomes**		• **PA**	• Psychological distress
Hattori et al[42]	Mild disability	Exercise program+MI and CBT	Standard care	3 mo		• *Physical function, balance, and mobility*	• *PA* • *Other*	• *Psychological distress*
Hawkes et al[43]	Colorectal cancer	PA counseling and monitoring +acceptance-commitment therapy	Educational session/ brochure	6 and 12 mo	• **Clinical outcomes** • Physical Health Status		• **PA**	• Psychological distress
Knittle et al[46]	Rheumatoid arthritis	PA counseling and monitoring +MI	Educational session/ brochure	6 and 32 wk	• Physical health status • Fatigue		• **PA** • "Disability"	• Psychological Distress • **Self-efficacy and motivation**
Latham et al[49]	Hip fracture	Exercise program+CBT	Educational session/ brochure	6 and 9 mo	• **Muscle strength (lower extremity)**	• **Physical function, balance, and mobility**		• **Self-efficacy and motivation**
Liu et al[50]	At risk for cognitive decline	Exercise program+mindfulness meditation	Standard care	9 mo and 1 y	• **Cognitive performance**			• **Psychological distress** • **Loneliness**

(*continued*)

Table 2 (*Continued*)

Reference	Sample	Intervention	Comparator	Follow-up	ICF framework components			
					Body functions and structures	Activity	Participation	Personal Factors
Salpakoski et al[56]	Hip fracture	Rehabilitation+MI	Standard care	3, 6, and 12 mo		• Physical function, balance, and mobility	• *PA* • **"Disability"**	
Seifert et al[57]	Atrial fibrillation (AF)	PA counseling and monitoring +MI	Standard care	2-wk, 6 and 12 mo			• **PA**	
Snoek et al[58]	Declined CR	Rehabilitation+MI	Standard care	6 and 12 mo	• **Clinical outcomes**		• **PA**	
Intervention vs. active comparator vs. control condition (N=6)								
Arkkukangas et al[28]	Aged ≥ 75	Exercise program+MI	Exercise program or educational session/ brochure	12 wk	• Muscle strength (Grip)	• Physical function, balance, and mobility	• PA • Other	• Self-efficacy and motivation
Blumenthal et al[31]	Coronary artery disease	CR+CBT	CR or no CR comparison group	12 wk	• Clinical outcomes	• Physical function, balance, and mobility	• PA	• **Psychological distress**
Collins et al[36]	African American patients with peripheral artery disease	Walking program+MI	Walking program+BCTs or educational session/ brochure	6 and 12 mo		• Physical function, balance, and mobility		• *Self-efficacy and motivation*
Friedberg et al[40]	Uncontrolled blood pressure	Exercise program+CBT	Health education or educational session/ brochure	6 mo	• **Clinical Outcomes**		• PA	
Lo et al[52]	Multimorbidity	Exercise program+MI	MI or standard care	12 wk	• **Clinical outcomes** • **Lung function** • **Muscle strength (grip)**	• Physical function, balance, and mobility	• PA	
Nicholas et al[53]	Chronic pain	Exercise program+CBT	Exercise program or waitlist	1 mo	• **Pain intensity**	• **Physical function, balance, and mobility**	• **"Disability"**	• **Psychological distress** • **Self-efficacy and motivation** • **Pain catastrophizing and Coping**

Abbreviations: BCTs, behavior change techniques; CBT, cognitive-behavioral therapy; COPD, chronic obstructive pulmonary disease; CR, cardiac rehabilitation; ICF, international classification of functioning, disability, and health; MI, motivational interviewing; PA, physical activity; PR, pulmonary rehabilitation.
Bold indicates statistical significance ($P<.05$) between-group difference; italic indicates results not reported. See supplemental table S3 for details.

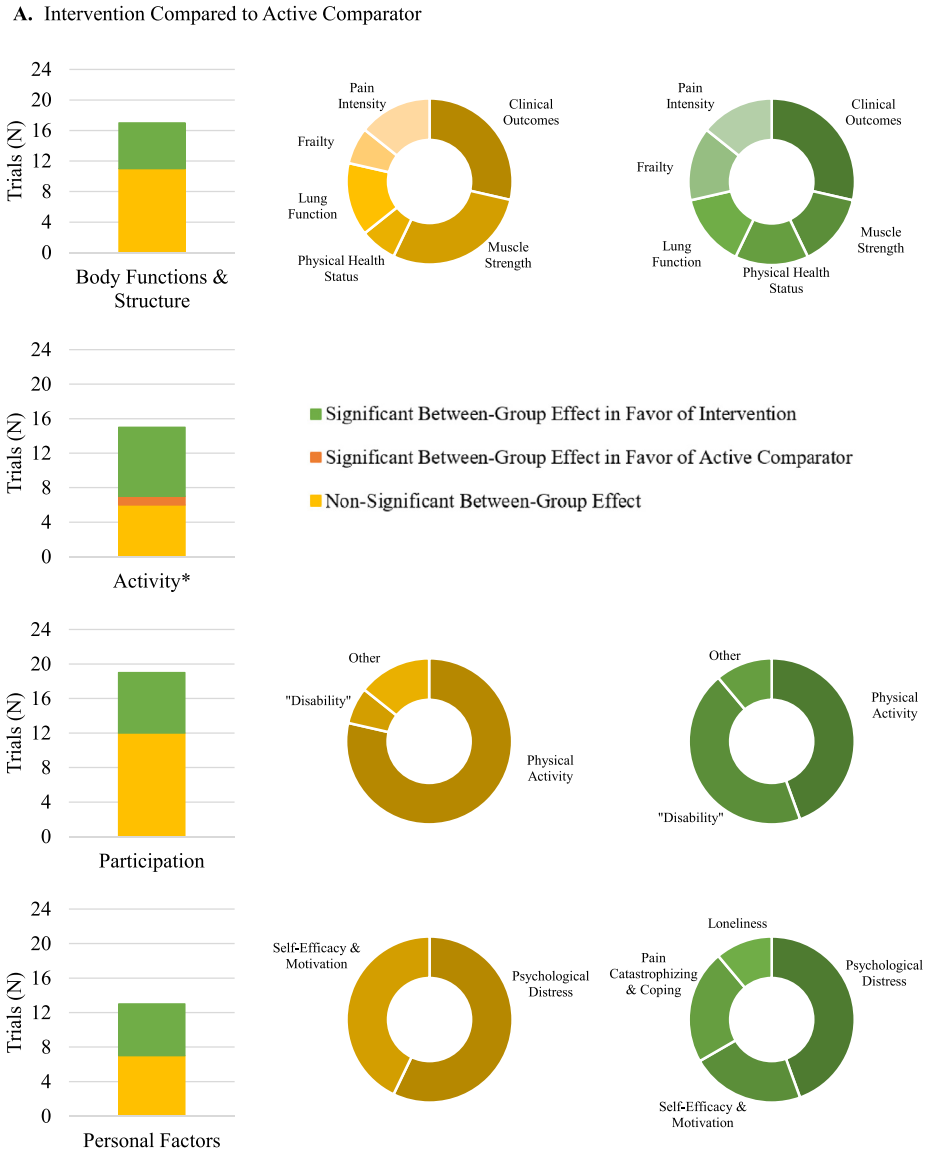

Fig 4 Effects of therapeutic exercise with psychological interventions on disability and personal outcomes in older adults. *All activity outcomes assessed physical function, balance, and mobility.

6 months. Jing et al[45] examined Baduanjin+CBT versus Baduanjin versus CBT in housebound older adults. Improved health status and lung function were observed in the Baduanjin+CBT group (vs. Baduanjin or CBT) at 6 months. De Vries et al[23] assessed Coach2Move (exercise and PA counseling and monitoring+MI) compared with PT in older adults with mobility problems. Improved frailty was observed in the Coach2Move group at 6 months. Nicholas et al[53] evaluated exercise+CBT versus exercise versus waitlist in older adults with chronic pain. Reduced pain intensity was observed in the exercise+CBT group (vs. exercise) at 1 month.

Control comparator

Sixteen trials[24-28,31,35,38,40,43,46,49,50,52,53,58] examined whether the intervention improved body functions and structure outcomes compared with a control condition. Seven trials found no difference between groups on clinical outcomes,[24,26,31] muscle strength,[28] physical health status,[26,43,46] fatigue,[46] and/or pain intensity.[27] Ten trials[25,35,38,40,43,49,50,52,53,58] found significant group differences benefiting the intervention compared with a control condition. Anderson et al[25] assessed BeWEL (PA counseling and monitoring+MI) compared with a no further contact control in older adults with a diagnosis of colorectal adenoma. Improved weight, waist circumference, and blood pressure were observed in the BeWEL group at 3 and 12 months. Dwinger et al[38] evaluated telephone-based health coaching (PA counseling and monitoring+MI) versus standard care in patients with chronic conditions. Reduced body mass index was observed in the telephone-based health coaching group at 3 years. Friedberg et al[40] examined exercise+CBT versus

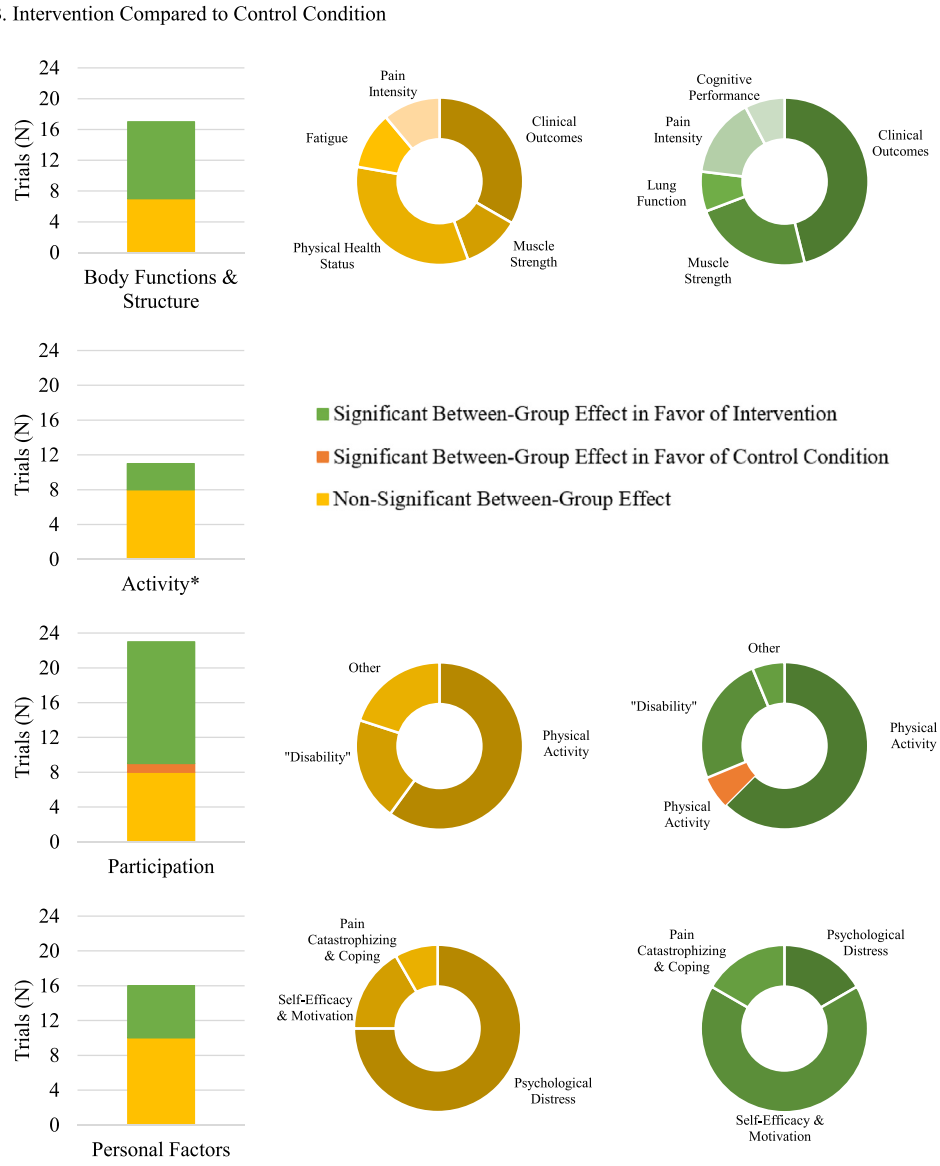

Fig 4 Continued.

exercise+education versus education in patients with uncontrolled blood pressure. Improved blood pressure was observed in the exercise+CBT group (vs. education) at 6 months. Hawkes et al[43] assessed health coaching (PA counseling and monitoring+ACT) versus education in colorectal cancer survivors. Reduced body mass index was observed in the health coaching group at 6 and 12 months. Snoek et al[58] evaluated home-based modified CR (CR+MI) versus standard care in patients who declined traditional CR. Improved blood pressure and VO_2 peak were observed in the CR+MI group at 6 months; improved hemoglobin and VO_2 peak observed in the CR+MI group at 12 months. Lo et al,[52] noted above, observed improvement in VO_2 max, VO_2 predicted, work (watts), anaerobic threshold (L/min), grip strength, and lung function in the exercise+MI group (vs. standard care) at 12 weeks. Latham et al[49] examined exercise+CBT versus education in older adults who have completed rehabilitation after hip fracture. Increased lower extremity strength was observed in the exercise+CBT group at 9 months. Cheng et al[35] assessed exercise+CBT versus education in older adults with chronic pain. Increased hip and knee strength and reduced pain intensity were observed in the exercise+CBT group at 10 weeks and 3 months. Nicholas et al,[53] noted above, observed reduced pain intensity in the exercise+CBT group (vs. waitlist) at 1 month. Liu et al[50] evaluated a multidomain intervention (exercise+mindfulness meditation) versus standard care in older adults at risk of cognitive decline. Better cognitive performance was observed in the multidomain group at 9 months.

Activity

Active comparator

Fifteen trials[23,28,31,32,34,36,41,44,47,51-55,60] examined whether the intervention improved activity compared with an active

comparator. Ten trials found no difference between groups on physical function, balance, or mobility.[23,28,31,32,44,47,51,52,55,60] Four trials[34,41,53,54] found significant group differences benefiting the intervention compared with an active comparator, whereas 1 trial[36] found a significant group difference benefiting the active comparator compared with the intervention. Chan et al,[34] noted above, observed improved timed Up and Go test and Leg Stand scores in the high level care group at 6 and 12 months. Collins et al[36] assessed walking+MI versus walking +Patient-Centered Assessment and Counseling for Exercise (PA counseling) versus education in African American patients with peripheral artery disease. Increased walking distance was observed in the walking+Patient-Centered Assessment and Counseling for Exercise group (vs. walking +MI) at 12 months. Gilbert et al[41] evaluated Improving Motivation for PA in Arthritis Clinical Trial (PA counseling and monitoring+MI) versus brief PA counseling in adults with arthritis. Improved physical function was observed in the Improving Motivation for PA in Arthritis Clinical Trial group at 24 months. Nicholas et al,[53] noted above, observed improved functional reach in the exercise+CBT group (vs. exercise) at 1 month. Pfeiffer et al[54] examined rehabilitation+CBT versus rehabilitation in patients with hip and pelvic fractures. Improvement in Short Physical Performance Battery scores was observed in the rehabilitation+CBT group at 3 months.

Control comparator

Twelve trials[24,26-29,31,36,42,49,52,53,56] assessed whether the intervention improved activity compared with a control condition. Eight trials found no difference between groups on physical function, balance, or mobility.[24,26-28,31,36,52,56] Three trials[29,49,53] found significant group differences benefiting the intervention compared with a control condition. One trial[42] did not report activity data. Barberan-Garcia et al[29] evaluated exercise+MI versus standard care in patients undergoing elective major abdominal surgery. Increased endurance was observed in the exercise+MI group postsurgery. Latham et al,[49] noted above, observed the improved Short Physical Performance Battery, Activity Measure for Post-Acute Care and Berg Balance Scale scores in the exercise+CBT group at 6 and 9 months, respectively. Nicholas et al,[53] noted above, observed improved functional reach in the exercise+CBT group (vs. waitlist) at 1 month.

Participation

Active comparator

Seventeen trials[23,28,31,32,34,39,41,44,45,47,48,51-55,59,60] assessed whether the intervention improved participation compared with a control condition. Twelve trials found no difference between groups on PA,[28,31,32,34,39,41,48,51,52,54,59] "disability,"[51] and/or other participation outcomes.[28,54] Seven trials[23,44,45,47,53,54,60] found significant group differences benefiting the intervention compared with an active comparator. De Vries et al,[23] noted above, observed the increased moderate intensity PA in the Coach2Move group at 6 months. Kroesen et al,[47] noted above, observed decreased sedentary behavior and increased light intensity PA in the CR +MI group at 12 weeks. Thompson et al[60] assessed a walking program+MI versus the walking program or MI alone in community-dwelling older adults. Improved daily step counts were observed for the walking+MI group (vs. walking) at 12 weeks. Hirase et al[44] evaluated exercise+CBT versus exercise in older adults with chronic pain. Increased daily step counts, light, moderate, and vigorous intensity PA, and improved activities of daily living were observed in the exercise+CBT group at 12 weeks. Jing et al,[45] noted above, observed improved activities of daily livings and housebound status in the Baduanjin+CBT group (vs. Baduanjin or CBT) at 6 months. Nicholas et al[53] noted above, observed reduced pain-related "disability" in the exercise+CBT group (vs. exercise) at 1 month. Pfeiffer et al,[54] noted above, observed improvement in the perceived ability to manage falls in the rehabilitation+CBT group at 3 months.

Control comparator

Twenty trials[24-31,35,37,38,40,42,43,46,52,53,56-58] examined whether the intervention improved participation compared to a control condition. Eight trials found no difference between groups on PA,[24,27-29,31,40] "disability,"[27,46] and/or other participation outcomes.[28,37] Fourteen trials[25,26,29,30,35,37,38,43,46,52,53,56-58] found significant group differences benefiting the intervention compared to a control; whereas 1 trial[27] found a significant group difference benefiting the control compared to the intervention. Anderson et al,[25] noted above, observed increased daily step counts, total activity, and moderate intensity PA in the BeWEL group at 12 months. Arbillaga-Etxarri et al[26] evaluated urban training (PA counseling and monitoring+CBT) versus education in patients with chronic obstructive pulmonary disease. Increased daily step counts were observed in the urban training group at 12 months. Archer et al[27] examined CBT for pain (PA counseling and monitoring +CBT) versus education in patients who underwent back surgery. Increased light intensity PA was observed in the education group at 12 months. Blackford et al[30] assessed the Albany PA and Nutrition program (PA counseling and monitoring+MI) versus waitlist in older adults at risk of metabolic syndrome. Increased moderate intensity PA was observed in the Albany PA and Nutrition program group at 6 months. Dwinger et al,[38] noted above, observed increased self-reported PA in the telephone-based health coaching group at 3 years. Hawkes et al,[43] noted above, observed increased moderate intensity PA in the health coaching group at 12 months. Knittle et al[46] evaluated PA counseling and monitoring+MI versus educational sessions in patients with rheumatoid arthritis. Increased light intensity PA and days with at least 30 minutes of PA were observed in the PA counseling and monitoring+MI group over 32 weeks. Lo et al,[52] noted above, observed increased total activity and vigorous intensity PA in the exercise+MI group (vs. standard care) at 12 weeks. Increased walking and decreased sedentary time were observed in the MI group (vs. standard care) at 12 weeks. Seifert et al[57] examined PA counseling and monitoring+MI versus standard care in older adults with atrial fibrillation. Improved daily step counts and walking distance were observed for the PA counseling and monitoring+MI group at 2 weeks and 12 months. Snoek et al,[58] noted above, observed increased moderate-vigorous intensity PA in the CR +MI group at 12 months. Cheng et al,[35] noted above, observed reduced pain-related "disability" in the exercise

+CBT group at 3 and 6 months. Dorrestejin et al[37] examined "A Matter of Balance" home-based program (PA counseling and monitoring+CBT) versus standard care in older adults with frailty. Improvement in activities of daily living was observed in the "A Matter of Balance" home-based program group at 5 and 12 months. Salpakoski et al[56] assessed a promotion mobility rehabilitation program (rehabilitation+MI) versus standard care in patients with hip fracture. Reduced perceived difficulty in navigating stairs was observed in the promotion mobility rehabilitation program group at 6 and 12 months. Nicholas et al,[53] noted above, observed reduced pain-related "disability" in the exercise+CBT group (vs. waitlist) at 1 month. Barberan-Garcia et al,[29] noted above, observed a decreased incidence of postoperative complications in the exercise+MI group at 1 month.

Personal factors

Active comparator

Thirteen trials[28,31,33,36,39,44,45,47,48,53-55,59] evaluated whether the intervention improved personal factors compared with an active comparator. Seven trials found no difference between groups on psychological distress[33,44,55,59] and self-efficacy and motivation.[28,47,48] Six trials[31,39,44,45,53,54] found significant group differences benefiting the intervention compared with an active comparator. One trial[36] did not report personal factors data. Blumenthal et al[31] examined CR+CBT versus CR versus no further contact in patients with coronary artery disease. Reduced depression, anxiety, anger, perceived stress, and general psychological distress were observed in the CR+CBT group (vs. CR) at 12 weeks. Farver-Vestergaard et al[39] assessed pulmonary rehabilitation (PR)+CBT versus PR in patients with chronic obstructive pulmonary disease. Reduced depression and anxiety were observed in the PR +CBT group across 6 months. Jing et al,[45] noted above, observed reduced depression and loneliness in the Baduanjin+CBT group (vs. Baduanjin or CBT) at 6 months. Nicholas et al,[53] noted above, observed reduced depression, increased pain-related self-efficacy, and reduced pain catastrophizing in the exercise+CBT group (vs. exercise) at 1 month. Pfeiffer et al,[54] noted above, observed increased fall-related self-efficacy in the rehabilitation+CBT group at 3 months. Hirase et al,[44] noted above, observed reduced pain catastrophizing in the exercise+CBT group at 12 weeks.

Control comparator

Sixteen trials[24-26,28,29,31,35-38,42,43,46,49,50,53] evaluated whether the intervention improved personal factors compared with a control condition. Ten trials found no difference between groups on psychological distress,[24,26,29,31,35,38,43,46,53] self-efficacy and motivation,[28,53] and/or pain catastrophizing and coping.[35] Six trials[35,37,46,49,50,53] found significant group differences benefiting the intervention compared with a control condition. Three trials[25,36,42] did not report personal factors data. Liu et al,[50] noted above, observed increased satisfaction with life, improved attitudes toward one's own aging, and reduced depression and anxiety in the exercise+mindfulness meditation group at 9 months. Cheng et al,[35] noted above, observed increased pain-related self-efficacy in the exercise +CBT group at 3 and 6 months. Dorrestejin et al,[37] noted above, observed increased fall-related self-efficacy in the "A Matter of Balance" home-based program group at 5 and 12 months. Knittle et al,[46] noted above, observed increased self-efficacy for exercise and treatment self-regulation in the PA counseling and monitoring+MI group over 32 weeks. Latham et al,[49] noted above, observed increased self-efficacy for exercise in the exercise+CBT group over 9 months. Nicholas et al,[53] noted above, observed reduced pain catastrophizing in the exercise+CBT group (vs. waitlist) at 1 month.

Discussion

This systematic review evaluated the evidence of findings from 38 eligible trials that examined the effects of therapeutic exercise with psychological interventions on ICF outcomes. A range of therapeutic exercise interventions was used with exercise programs (32%) and PA counseling and monitoring (32%) most common. Psychological interventions were primarily CBT (34%) and MI (47%). When compared with an active comparator and/or control group, the intervention demonstrated significant improvement in body functions and structures (n=14, 37%), activity (n=6, 16%), participation (n=20, 53%), and personal factors (n=11, 29%). As previously theorized, results are indicative of the greater utility of therapeutic exercise with psychological interventions on participation and personal factors, reflecting the underlying psychosocial nature of these outcomes.[18] Although CBT appears more promising for addressing personal factors such as psychological distress compared with MI, MI appears more promising for addressing participation compared with CBT.

Cognitive-behavioral therapy

When paired with therapeutic exercise, CBT produced positive results in 10 trials (83%), with 3 trials[44,45,51] including some RoB and 1 trial[39] with a high RoB. CBT showed positive results in 5 trials (40%)[35,40,45,49,53] assessing body functions and structures, 3 trials (38%)[49,53,54] assessing activity, 6 trials (50%)[35,37,44,45,53,54] assessing participation, and 9 trials (90%)[31,35,37,39,44,45,49,53,54] assessing personal factors. Studies were heterogeneous regarding population, therapeutic exercise intervention, and design (ie, length and dosage of CBT). The populations that primarily received CBT were those with chronic pain or vulnerable subgroups (ie, older adults who were frail and housebound), and those receiving PR or CR. These findings suggest that CBT interventions may be well-suited for patients with hip fracture and chronic pain because positive trials within these populations primarily used CBT. CBT emphasizes the connection between a stressor and an individual's appraisal and interpretation of that stressor by examining the connection between thoughts, behavior, and emotions.[14] This approach benefits patients with hip fracture and chronic pain who face clear stressors during their treatment and recovery. Negative results were found in 3 trials[24,27,51] likely due to specific limitations. For example, Archer et al[27] found no group differences after back surgery, but sensitivity analyses showed improvement in select outcomes for those who completed all 6 CBT sessions compared with the control condition.

CBT skills can be incorporated into therapeutic exercise with varying intensities in terms of exposure to CBT content during the session, dose (ie, frequency and duration of sessions), and purpose (ie, to decrease pain-related cognitions to increase PA, to increase values-aligned pleasant events as part of increasing PA).[61] Furthermore, CBT is effective in addressing co-occurring primary outcomes, such as depression and/or anxiety and low PA.[62] Despite published cognitive-behavioral coaching protocols, there is a lack of provider training, materials, and resources for everyday clinical practice, limiting the dissemination of CBT skills in therapeutic exercise.[63]

Motivational interviewing

When paired with therapeutic exercise, MI produced positive results in 16 trials (89%), with 4 trials[23,38,46,52] having some RoB. MI showed positive results in 6 trials (50%)[23,25,38,47,52,58] assessing body functions and structures, 2 trials (20%)[29,41] assessing activity, 13 trials (72%)[23,25,26,29,30,38,46,47,52,56-58,60] assessing participation, and 1 trial (10%)[46] assessing personal factors. These results align with the broader literature supporting MI for promoting health behaviors, including smoking cessation and PA, but less utility for impacting personal factors such as emotional distress.[16] Study heterogeneity was noted with respect to population, design, and interventions. Two MI trials[28,48] with negative results had small sample sizes, a contributor in the nonsignificant results. Findings suggest that MI may be valuable adjunct to therapeutic exercise, particularly for participation outcomes.

Clinicians working with older adults are encouraged to incorporate MI into practice, particularly among patients ambivalent about therapeutic change (eg, low adherence to exercise plans). Brief action planning, an MI-based tool, can facilitate patient self-management and health behavior change with less training than full MI. Brief action planning has seen an increasing uptake in North America since its early 2000s creation.[64]

Limitations

Eligible trials were heterogeneous in design, methods, and interventions, preventing conclusions on the findings' certainty. Our review organized results using the ICF framework; however, it is possible that other frameworks could handle ambiguity in the ICF framework for outcome measures such as health-related quality of life which we excluded due to overlap across ICF domains.[65,66] We selected to use the ICF framework because it is an established framework of function, disability, and health within the individual endorsed as the international standard to describe and measure health and disability.[3] The review was restricted to a 12-year look-back to focus on recent developments in the field and to balance thoroughness with feasibility. Trial eligibility was restricted to stand-alone psychological interventions combined or integrated with therapeutic exercise; thus, the results cannot be generalized to trials that combined or integrated therapeutic exercise interventions with behavioral change techniques. Over half of the trials provided no data on adverse events and dropouts. Nine trials (24%)[23,32,38,44-46,50-52] warranted some concern for RoB, and 1 trial (3%)[39] raised high concern. The quality assessment showed bias due to concerns regarding the blinding of outcome assessment and limited details regarding randomization methodology. Sample sizes ranged from 43 to over 10,000. Small sample sizes may bias estimates and reduce generalizability. Trials tested primary and secondary outcomes, for example, pain levels, strength, and blood pressure in the same study. We opted to include all relevant outcomes in accordance with the original trials rather than restrict to primary outcomes only, to capture all outcomes under disability and personal outcomes. Given the number of outcomes, only statistically significant results were captured with effect size estimates when available. Clinically meaningful differences were not presented in this review. The current review is subject to publication bias. Attempts were made by email and through clinicaltrials.gov to locate missing information for 3 trials.[25,36,42] We were unable to locate missing information for those 3 trials.

Future directions

We restricted trials to community-dwelling samples to enhance the homogeneity of the sample because individuals living in the community are typically healthier with better overall functioning compared with individuals in long-term care. Future reviews are needed in long-term care settings to better understand the effects of combined or integrated intervention on ICF outcomes in this population. As more trials emerge, it will be important to further synthesize the literature by diagnosis or specific ICF outcome, which may allow for conclusions on the certainty of evidence by reducing the heterogeneity of trials. Variation was noted across trials with respect to what elements of the psychological interventions were included, and there was no standard definition of psychological interventions that would guide the minimal intervention elements that should be included to be called CBT or MI. Future interdisciplinary efforts should specify basic criteria for when an intervention can be classified as CBT and/or MI, such as minimum number of elements to be considered consistent with stand-alone CBT or MI. Future studies are needed comparing combined or integrated interventions to active comparators (e.g., stand-alone CBT or MI) in order to examine the additive effects of the combined or integrated interventions compared to either intervention alone. In addition, future reviews could focus solely on health-related quality of life as an outcome given it was excluded for overlap across ICF domains. In our review of the literature, many investigators posit that combined or integrated interventions improve outcomes because of the psychological intervention targeting barriers to PA or exercise (eg, depression, motivation, confidence, and/or self-care behaviors). To our knowledge, only 1 eligible trial[49] conducted the secondary analysis of whether their combined intervention improved ICF outcomes through changes in exercise self-efficacy.[67] Future studies assessing mechanisms underlying combined or integrated interventions are needed.

Conclusions

Therapeutic exercise with psychological interventions show promise for improving disability outcomes and personal

factors in older adults. Participation and personal outcomes may be particularly favorable when using these interventions, given the psychological and social factors that underlie such outcomes.[18] For future research advancement, we recommend examining mechanisms underlying these interventions, guidance on the selection and pairing of interventions, and assessment of additive benefits through more testing of these interventions against active comparators.

Suppliers

a. Clarivate PLC; 4th Floor, St. Paul's Gate, 22-24 New Street, St. Helier, Jersey, JE14TR.
b. Covidence; Level 10, 446 Collins Street, Melbourne, VIC 3000, Australia, ABN: 41 600 366 274.

Corresponding author

Grace A. Rose, VA Boston Healthcare System, 150 S. Huntington Ave, Jamaica Plain, MA 02130. *E-mail address:* grace.rose@va.gov.

Disclosures

The authors declare no conflicts of interest.

Acknowledgments

We thank Jason G. Smith, MLIS who provided technical expertise and training on Covidence for this review.

References

1. Ansah JP, Chiu CT. Projecting the chronic disease burden among the adult population in the United States using a multi-state population model. Front Public Health 2023;10:1082183.
2. Prince MJ, Wu F, Guo Y, et al. The burden of disease in older people and implications for health policy and practice. Lancet 2015;385:549–62.
3. World Health Organization. International Classification of Functioning, Disability and Health (ICF). 2001. Available at: https://www.who.int/standards/classifications/international-classification-of-functioning-disability-and-health. Accessed November 17, 2022.
4. Jette AM. Toward a common language of disablement. J Gerontol A Biol Sci Med Sci 2009;64A:1165–8.
5. Awick EA, Ehlers DK, Aguiñaga S, Daugherty AM, Kramer AF, McAuley E. Effects of a randomized exercise trial on physical activity, psychological distress and quality of life in older adults. Gen Hosp Psychiatry 2017;49:44–50.
6. Cunningham C, O' Sullivan R, Caserotti P, Tully MA. Consequences of physical inactivity in older adults: a systematic review of reviews and meta-analyses. Scand J Med Sci Sports 2020;30:816–27.
7. Giné-Garriga M, Roqué-Fíguls M, Coll-Planas L, Sitjà-Rabert M, Salvà A. Physical exercise interventions for improving performance-based measures of physical function in community-dwelling, frail older adults: a systematic review and meta-analysis. Arch Phys Med Rehabil 2014;95:753–69. e3.
8. Pasanen T, Tolvanen S, Heinonen A, Kujala UM. Exercise therapy for functional capacity in chronic diseases: an overview of meta-analyses of randomised controlled trials. Br J Sports Med 2017;51:1459–65.
9. Bauman A, Merom D, Bull FC, Buchner DM, Fiatarone Singh MA. Updating the evidence for physical activity: summative reviews of the epidemiological evidence, prevalence, and interventions to promote "active aging". Gerontologist 2016;56(Suppl 2): S268–80.
10. Fragala MS, Cadore EL, Dorgo S, et al. Resistance training for older adults: position statement from the National Strength and Conditioning Association. J Strength Cond Res 2019;33:2019–52.
11. Collado-Mateo D, Lavín-Pérez AM, Peñacoba C, et al. Key factors associated with adherence to physical exercise in patients with chronic diseases and older adults: an umbrella review. Int J Environ Res Public Health 2021;18:2023.
12. Lachman ME, Lipsitz L, Lubben J, Castaneda-Sceppa C, Jette AM. When adults don't exercise: behavioral strategies to increase physical activity in sedentary middle-aged and older adults. Innov Aging 2018;2. igy007.
13. Hughes JM, Brown RT, Fanning J, et al. Achieving and sustaining behavior change for older adults: a research centers collaborative network workshop report. Gerontologist 2022;63:1268–78.
14. Scott AJ, Bisby MA, Heriseanu AI, et al. Cognitive behavioral therapies for depression and anxiety in people with chronic disease: a systematic review and meta-analysis. Clin Psychol Rev 2023;106:102353.
15. Newby JM, McKinnon A, Kuyken W, Gilbody S, Dalgleish T. Systematic review and meta-analysis of transdiagnostic psychological treatments for anxiety and depressive disorders in adulthood. Clin Psychol Rev 2015;40:91–110.
16. Copeland L, McNamara R, Kelson M, Simpson S. Mechanisms of change within motivational interviewing in relation to health behaviors outcomes: a systematic review. Patient Educ Couns 2015;98:401–11.
17. Dimidjian S, Arch JJ, Schneider RL, Desormeau P, Felder JN, Segal ZV. Considering meta-analysis, meaning, and metaphor: a systematic review and critical examination of "third wave" cognitive and behavioral therapies. Behav Ther 2016;47:886–905.
18. Bean JF, Orkaby AR, Driver JA. Geriatric rehabilitation should not be an oxymoron: a path forward. Arch Phys Med Rehabil 2019;100:995–1000.
19. Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71.
20. Michie S, Richardson M, Johnston M, et al. The behavior change technique taxonomy (v1) of 93 hierarchically clustered techniques: building an international consensus for the reporting of behavior change interventions. Ann Behav Med 2013;46(1):81–95.
21. Upsher R, Onabajo D, Stahl D, Ismail K, Winkley K. The effectiveness of behavior change techniques underpinning psychological interventions to improve glycemic levels for adults with type 2 diabetes: a meta-analysis. Front Clin Diabetes Healthc 2021;2:699038.
22. Sterne JAC, Savović J, Page MJ, et al. RoB 2: a revised tool for assessing risk of bias in randomised trials. BMJ 2019;366:l4898.
23. de Vries NM, Staal JB, van der Wees PJ, et al. Patient-centred physical therapy is (cost-) effective in increasing physical activity and reducing frailty in older adults with mobility problems: a randomized controlled trial with 6 months follow-up. J Cachexia Sarcopenia Muscle 2016;7:422–35.
24. Allen KD, Oddone EZ, Coffman CJ, et al. Patient, provider, and combined interventions for managing osteoarthritis in primary care: a cluster randomized trial. Ann Intern Med 2017;166:401.
25. Anderson AS, Craigie AM, Caswell S, et al. The impact of a bodyweight and physical activity intervention (BeWEL) initiated through a national colorectal cancer screening programme: randomised controlled trial. BMJ 2014;348:g1823.
26. Arbillaga-Etxarri A, Gimeno-Santos E, Barberan-Garcia A, et al. Long-term efficacy and effectiveness of a behavioural and

community-based exercise intervention (urban training) to increase physical activity in patients with COPD: a randomised controlled trial. Eur Respir J 2018;52:1800063.
27. Archer K, Haug C, Pennings J. Combining two programs to improve disability, pain, and health among patients who have had back surgery. Patient-Centered Outcome Research Institute (PCORI) 2020;85. https://doi.org/10.25302/04.2020.CER.130601970. Available at: Accessed November 29, 2023.
28. Arkkukangas M, Söderlund A, Eriksson S, Johansson AC. Fall preventive exercise with or without behavior change support for community-dwelling older adults: a randomized controlled trial with short-term follow-up. J Geriatr Phys Ther 2019;42:9–17.
29. Barberan-Garcia A, Ubré M, Roca J, et al. Personalised prehabilitation in high-risk patients undergoing elective major abdominal surgery: a randomized blinded controlled trial. Ann Surg 2018;267:50–6.
30. Blackford K, Jancey J, Lee AH, James A, Howat P, Waddell T. Effects of a home-based intervention on diet and physical activity behaviours for rural adults with or at risk of metabolic syndrome: a randomised controlled trial. Int J Behav Nutr Phys Act 2016;13:13.
31. Blumenthal JA, Sherwood A, Smith PJ, et al. Enhancing cardiac rehabilitation with stress management training: a randomized, clinical efficacy trial. Circulation 2016;133:1341–50.
32. Burtin C, Langer D, van Remoortel H, et al. Physical activity counselling during pulmonary rehabilitation in patients with COPD: a randomised controlled trial. PloS One 2015;10:e0144989.
33. Chair SY, Chan SWC, Thompson DR, Leung KP, Ng SKC, Choi KC. Long-term effect of motivational interviewing on clinical and psychological outcomes and health-related quality of life in cardiac rehabilitation patients with poor motivation in Hong Kong: a randomized controlled trial. Clin Rehabil 2013;27:1107–17.
34. Chan DD, Tsou H, Chang C, et al. Integrated care for geriatric frailty and sarcopenia: a randomized control trial. J Cachexia Sarcopenia Muscle 2017;8:78–88.
35. Cheng ST, Chen PP, Chow YF, et al. An exercise cum cognitive-behavioral intervention for older adults with chronic pain: a cluster-randomized controlled trial. J Consult Clin Psychol 2022;90:221–33.
36. Collins TC, Lu L, Ahluwalia JS, et al. Efficacy of community-based exercise therapy among African American patients with peripheral artery disease: a randomized clinical trial. JAMA Netw Open 2019;2:e187959.
37. Dorresteijn TAC, Zijlstra GAR, Ambergen AW, Delbaere K, Vlaeyen JWS, Kempen GIJM. Effectiveness of a home-based cognitive behavioral program to manage concerns about falls in community-dwelling, frail older people: results of a randomized controlled trial. BMC Geriatr 2016;16:2.
38. Dwinger S, Rezvani F, Kriston L, Herbarth L, Härter M, Dirmaier J. Effects of telephone-based health coaching on patient-reported outcomes and health behavior change: a randomized controlled trial. PLOS One 2020;15:e0236861.
39. Farver-Vestergaard I, O'Toole MS, O'Connor M, et al. Mindfulness-based cognitive therapy in COPD: a cluster randomised controlled trial. Eur Respir J 2018;51:1702082.
40. Friedberg JP, Rodriguez MA, Watsula ME, et al. Effectiveness of a tailored behavioral intervention to improve hypertension control: primary outcomes of a randomized controlled trial. Hypertension 2015;65:440–6.
41. Gilbert AL, Lee J, Ehrlich-Jones L, et al. A randomized trial of a motivational interviewing intervention to increase lifestyle physical activity and improve self-reported function in adults with arthritis. Semin Arthritis Rheum 2018;47:732–40.
42. Hattori S, Yoshida T, Okumura Y, Kondo K. Effects of reablement on the independence of community-dwelling older adults with mild disability: a randomized controlled trial. Int J Environ Res Public Health 2019;16:3954.
43. Hawkes AL, Chambers SK, Pakenham KI, et al. Effects of a telephone-delivered multiple health behavior change intervention (CanChange) on health and behavioral outcomes in survivors of colorectal cancer: a randomized controlled trial. J Clin Oncol 2013;31:2313–21.
44. Hirase T, Kataoka H, Nakano J, Inokuchi S, Sakamoto J, Okita M. Effects of a psychosocial intervention programme combined with exercise in community-dwelling older adults with chronic pain: a randomized controlled trial. Eur J Pain 2018;22:592–600.
45. Jing L, Jin Y, Zhang X, Wang F, Song Y, Xing F. The effect of Baduanjin qigong combined with CBT on physical fitness and psychological health of elderly housebound. Medicine 2018;97:e13654.
46. Knittle K, De Gucht V, Hurkmans E, et al. Targeting motivation and self-regulation to increase physical activity among patients with rheumatoid arthritis: a randomised controlled trial. Clin Rheumatol 2015;34:231–8.
47. Kroesen SH, van Bakel BMA, de Bruin M, et al. A cardiac-rehab behaviour intervention to reduce sedentary time in coronary artery disease patients: the SIT LESS randomized controlled trial. Int J Behav Nutr Phys Act 2024;21:90.
48. Larsen RT, Korfitsen CB, Keller C, et al. The MIPAM trial — motivational interviewing and physical activity monitoring to enhance the daily level of physical activity among older adults — a randomized controlled trial. Eur Rev Aging Phys Act 2021;18:12.
49. Latham NK, Harris BA, Bean JF, et al. Effect of a home-based exercise program on functional recovery following rehabilitation after hip fracture: a randomized clinical trial. JAMA 2014;311:700.
50. Liu X, Ma Z, Zhu X, et al. Cognitive benefit of a multidomain intervention for older adults at risk of cognitive decline: a cluster-randomized controlled trial. Am J Geriatr Psychiatry 2023;31:197–209.
51. Liu YWJ, Tsui CM. A randomized trial comparing Tai Chi with and without cognitive-behavioral intervention (CBI) to reduce fear of falling in community-dwelling elderly people. Arch Gerontol Geriatr 2014;59(2):317–25.
52. Lo YP, Chiang SL, Lin CH, Liu HC, Chiang LC. Effects of individualized aerobic exercise training on physical activity and health-related physical fitness among middle-aged and older adults with multimorbidity: a randomized controlled trial. Int J Environ Res Public Health 2020;18:101.
53. Nicholas MK, Asghari A, Blyth FM, et al. Self-management intervention for chronic pain in older adults: a randomised controlled trial. PAIN 2013;154:824–35.
54. Pfeiffer K, Kampe K, Klenk J, et al. Effects of an intervention to reduce fear of falling and increase physical activity during hip and pelvic fracture rehabilitation. Age Ageing 2020;49:771–8.
55. Phoobangkerdphol C, Limampai P, Dasri S, Kuptniratsaikul V. Walking meditation versus balance training for improving balance abilities among older adults with history of fall: a randomized controlled trial. Clin Rehabil 2022;36:538–49.
56. Salpakoski A, Törmäkangas T, Edgren J, et al. Effects of a multicomponent home-based physical rehabilitation program on mobility recovery after hip fracture: a randomized controlled trial. J Am Med Dir Assoc 2014;15:361–8.
57. Seifert M, Meretz D, Haase-Fielitz A, et al. Impact of physical activity in patients with atrial fibrillation undergoing catheter ablation: The multicenter randomized BE-ACTION trial. Circ Cardiovasc Qual Outcomes 2024;17:e010877.
58. Snoek JA, Prescott EI, van der Velde AE, et al. Effectiveness of home-based mobile guided cardiac rehabilitation as alternative strategy for nonparticipation in clinic-based cardiac rehabilitation among elderly patients in Europe: a randomized clinical trial. JAMA Cardiol 2021;6:463.
59. Spatola CAM, Rapelli G, Giusti EM, et al. Effects of a brief intervention based on Acceptance and Commitment Therapy versus

usual care for cardiac rehabilitation patients with coronary heart disease (ACTonHEART): a randomised controlled trial. BMJ Open 2024;14:e084070.
60. Thompson ED, Pohlig RT, McCartney KM, et al. Increasing activity after stroke: a randomized controlled trial of high-intensity walking and step activity intervention. Stroke 2024;55:5–13.
61. Kennedy MA, Stevens CJ, Pepin R, Lyons KD. Behavioral activation: values-aligned activity engagement as a transdiagnostic intervention for common geriatric conditions. Gerontologist 2024;64. gnad046.
62. Bamonti PM, Rose GA, Park S, Silberbogen AK, Moye J, Moy ML. Emotional distress and physical activity engagement in U.S. veterans with chronic obstructive pulmonary disease: a qualitative study. Ann Behav Med Publ Soc Behav Med 2024;58:539–51.
63. Bamonti PM, Moye J, Harris R, et al. Development of a coaching protocol to enhance self-efficacy within outpatient physical therapy. Arch Rehabil Res Clin Transl 2022;4:100198.
64. Jadotte Y, Buchholz B, Carroll W, Frum-Vassallo D, MacPherson J, Cole S. brief action planning in health and health care: a scoping review. Med Clin North Am 2023;107:1047–96.
65. Cieza A, Stucki G. Content comparison of health-related quality of life (HRQOL) instruments based on the international classification of functioning, disability and health (ICF). Qual Life Res 2005;14:1225–37.
66. Gey S, Cieza A, Kollerits B, Grimby G. Content comparison of health-related quality of life measures used in stroke based on the international classification of functioning, disability and health (ICF): a systematic review. Qual Life Res 2007;16:833–51.
67. Chang FH, Latham NK, Ni P, Jette AM. Does self-efficacy mediate functional change in older adults participating in an exercise program after hip fracture? A randomized controlled trial. Arch Phys Med Rehabil 2015;96:1014–20. e1.