


REVIEW

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Impact of physical activity programs and services for older adults: a rapid review

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Abstract

Background: Knowledge of which physical activity programs are most effective for older adults in different sub-populations and contexts is limited. The objectives of this rapid review were to: 1) Overview evidence evaluating physical activity programs/services for older adults; and 2) Describe impact on physical activity, falls, intrinsic capacity (physical domain), functional ability (physical, social, and cognitive/emotional domains), and quality of life.

Methods: We conducted a rapid review of primary studies from 350 systematic reviews identified in a previous scoping review (March 2021: PEDro, MEDLINE, CINAHL, Cochrane Database). For Objective 1, we included intervention studies investigating physical activity programs/services in adults ≥ 60 years. Of these, we included good quality ($\geq 6/10$ PEDro scale) randomised controlled trials (RCTs) with ≥ 50 participants per group in Objective 2.

Results: Objective 1: Of the 1421 intervention studies identified from 8267 records, 79% were RCTs, 87% were in high income countries and 39% were good quality. Objective 2: We identified 87 large, good quality RCTs (26,861 participants). Overall activity promotion, structured exercise and recreation/sport had positive impacts ($\geq 50\%$ between-group comparisons positive) across all outcome domains. For overall activity promotion (21 intervention groups), greatest impacts were on physical activity (100% positive) and social outcomes (83% positive). Structured exercise (61 intervention groups) had particularly strong impacts on falls (91% positive), intrinsic capacity (67% positive) and physical functioning (77% positive). Recreation/sport (24 intervention groups) had particularly strong impacts on cognitive/emotional functioning (88% positive). Multicomponent exercise (39 intervention groups) had strong impacts across all outcomes, particularly physical activity (95% positive), falls (90% positive) and physical functioning (81% positive). Results for different populations and settings are presented.

Conclusion: Evidence supporting physical activity for older adults is positive. We outline which activity types are most effective in different populations and settings.

Keywords: Physical activity, Older adults, Aged, Exercise, Healthy ageing

Introduction

Globally there are more than 1 billion adults aged over 60 years and this number is forecast to increase to 2 billion by 2050 [1]. The 2020 World Health Organization (WHO) *Guidelines on Physical Activity and Sedentary Behaviour* [2] recommend that older adults should engage in regular aerobic activity, muscle strengthening

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activities as well as multicomponent physical activity that incorporates strength and balance training to improve physical function and prevent falls [2]. However older adults have higher rates of physical inactivity, with 19–25% of adults aged 60–69 years, and 42–59% of adults aged 80 years and older, not meeting physical activity guidelines for aerobic activity [3]

The WHO Global Action Plan on Physical Activity (GAPPA) was launched in 2018 [4]. GAPPA set out four strategic policy objectives (Active Societies, Active Environments, Active People and Active Systems) and 20 recommended policy actions that are applicable to all countries and that aim to address the social, cultural, environmental and individual determinants of physical inactivity. To assist countries to adopt, tailor and implement the 20 policy recommendations of GAPPA into local contexts, WHO is developing ACTIVE [5], a technical toolkit with implementation guidance for key approaches, settings and populations.

To inform the development of ACTIVE, our group undertook a scoping review of systematic reviews investigating physical activity interventions and programs for older adults [6]. This scoping review mapped the existing literature and identified gaps in the evidence. We identified 39 systematic reviews for interventions aimed at increasing overall physical activity in older adults, and 342 reviews investigating specific physical activity programs and services (GAPPA Objective 3, Active People). However, sport and workplace interventions, and physical activity in diverse populations, were under-investigated.

As most of the reviews identified in our scoping review focused on a mixture of settings, populations and interventions [6], it was not possible to make specific recommendations about programs and services to implement for different populations and in different contexts. We concluded that a review of primary studies would be needed to develop more specific recommendations. Therefore, the aim of the present review was to inform the WHO and others on the effectiveness of physical activity programs and services for older adults. Specific objectives included:

Objective 1: To describe the extent and quality of evidence evaluating the effectiveness of physical activity programs and services for older adults.

Objective 2: To describe the impact of different physical activity programs (physical activity promotion, structured exercise, recreation/sport) compared to no intervention, on outcomes of physical activity, falls, intrinsic capacity (physical domain), functional ability (physical, social, cognitive and emotional domains), well-being and quality of life, and also to describe the impact

of interventions undertaken in different populations, locations and settings.

Methods

We conducted a rapid review and followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) [7]. A protocol was prepared in advance and published on the Open Science Framework website [8].

Data sources

Our previous scoping review identified 39 systematic reviews of physical activity interventions and 342 systematic reviews of physical activity programs/services for older adults [6]. Of the 39 reviews of interventions, 31 reviews were also included again as programs/services, resulting in 350 unique reviews. Therefore, for the current rapid review, we screened primary studies included in these 350 systematic reviews. The search for the previous review was conducted from 1 January 2010 to 1 November 2020 on PEDro, MEDLINE, CINAHL, and the Cochrane Database of Systematic Reviews (Appendix 1). For the present review, we updated this search on 18 March 2021 using the same strategy and databases. This identified 25 additional reviews. We also screened four reviews identified via hand searching. The flow chart showing selection of reviews from the updated search is provided in Appendix 2 and a description of the reviews in Appendix 3.

Our previous review [6] identified limited studies investigating sports in older adults. Since the previous search strategy did not include keywords related to “sports”, we developed a new search strategy that included specific keywords related to sports and searched MEDLINE, CINAHL, SPORTDiscus, PEDro. No date limit was applied, and searches were performed on 19 and 20 April 2021. The search strategy and the flow chart describing the selection of sports primary studies is provided in Appendix 4.

Study selection and data extraction

A pool of eight reviewers assessed the eligibility of primary studies based on title and abstract, followed by full text where indicated. All reviewers received training on the eligibility criteria and attended regular meetings to discuss questions regarding the criteria. One reviewer assessed the eligibility of all primary studies, and a second reviewer checked the eligibility assessment of a randomly selected sample of studies (5%). Any disagreements were discussed and resolved.

Screening and data extraction were divided into two objectives:

Objective 1. Primary studies identified in the reviews and searches were screened according to the following eligibility criteria (additional details on eligibility criteria are available in Appendix 5):

- i) Population: adults aged 60 years and older, or studies in which the mean age of participants was ≥ 60 years if age was not specified as an inclusion criterion. We included studies in which all participants had a physical impairment (e.g., mobility limitation) or particular symptoms (e.g., low mood or mild cognitive impairment). We excluded studies in which all participants had experienced a particular health event (e.g., stroke) or had a formal diagnosis (e.g., major mental illness or dementia).
- ii) Intervention: physical activity program or service.
- iii) Comparator: any comparator.
- iv) Outcome: physical activity, falls, intrinsic capacity (physical domain), functional ability (physical, social, and cognitive and emotional domains), and wellbeing and quality of life; and
- v) Study design: interventional studies.

The following information was extracted for all studies included in Objective 1: study design, sample size, country, type of physical activity, comparator, methodological quality for randomised trials using the Physiotherapy Evidence Database (PEDro) scale score [9]. One reviewer from the pool of eight extracted data for studies included in Objective 1 and a second reviewer checked 5% of studies.

Objective 2: Studies identified in Objective 1 were included in Objective 2 analyses if they met the following additional criteria:

- i) Comparison: no active intervention.
- ii) Study design: randomised controlled trial (RCT).
- iii) Sample size: at least 50 participants per group on average.
- iv) Methodological quality: good quality, as determined by a score of at least 6 on the PEDro scale (0 to 10 scale).
- v) Results of between-group statistical comparisons reported for relevant outcomes.

Studies were excluded if they did not include a non-active intervention comparison, if the study design was not an RCT, if there were fewer than 50 participants per group, if the methodological quality was ≤ 5 out of 10 on the PEDro scale, and if no between-group comparisons were reported for relevant outcomes.

Where multiple publications were from the same trial, we only included those that reported different outcomes.

Duplicate publications reporting the same participants and outcomes were excluded.

The sample size of 50 per group was chosen as small studies tend to have greater effects that are not replicated in larger samples [10]. We were also more interested in programs that had been delivered to larger numbers of people as these programs were likely more suitable for scaling up.

The PEDro scale was developed to assess the methodological quality of trials indexed by the Physiotherapy Evidence Database. A score of 6/10 or higher is considered to reflect “good” methodological quality although the validity of these cut-off scores has not been evaluated [11]. Two items are for blinding of those receiving and delivering interventions so the maximum score for trials evaluating physical activity interventions is 8/10. PEDro scores were downloaded from the PEDro database (<https://www.pedro.org.au/>).

We extracted detailed information (Population, Intervention, Comparison, Outcomes) for studies included in Objective 2 using a modified version of the framework our team developed for our previous review. [6]. The framework covers detailed information to describe the study population or sample, characteristics of the intervention and comparison, and outcomes used to evaluate the intervention. Development of the structure and content of the framework was informed by the WHO *Global Action Plan on Physical Activity* (GAPPA) [4], the Consolidated Standards of Reporting Trials (CONSORT) Template for Intervention Description and Replication (TIDieR) framework [12], and the Prevention of Falls Network Europe (ProFaNE) taxonomy [13]. The classification of outcomes was guided by the *World report on ageing and health* [14], the *Decade of healthy ageing: baseline report* [15] and the *International classification of functioning, disability and health (ICF)* [16]. The framework was extensively pilot tested during our previous scoping review of physical activity interventions [6].

The same pool of eight reviewers undertook data extraction for Objective 2. One reviewer performed initial data extraction for included studies and a second reviewer checked the data for most (> 80%) studies.

All relevant outcomes reported by the primary studies were classified as per our framework [6]. Briefly, outcome domains included physical activity, falls, intrinsic capacity (physical domain), functional ability (physical, social, cognitive and emotional domains), and wellbeing and quality of life. Intrinsic capacity refers to the composite of all the mental and physical capacities of an individual, while functional ability comprises the health-related attributes that enable people to be and to do what they have reason to value, encompassing both intrinsic capacity and environmental characteristics. [14]. Further

information regarding these resources is provided in Appendix 6.

Intervention effect for each relevant outcome was extracted and categorised as follows: positive significant, positive non-significant, no/negligible effect, negative non-significant, negative significant. In choosing this approach, we were guided by the Cochrane Collaboration Handbook for systematic reviews chapter describing methods for synthesising data from trials without undertaking meta-analysis [17].

Data synthesis

We summarised descriptive information for all included studies in figures and tables. We also summarised the studies' effects based on recommendations for synthesising and presenting findings of reviews when meta-analysis is not possible or appropriate [18]. For each study we calculated the proportion of effects that were positive as well as positive and statistically significant. We also calculated these proportions across all studies by outcomes and by outcome domains. These results are summarised in tables and plotted in figures.

Results

We identified and screened 8267 primary study records from the systematic reviews included in our previous scoping review and in our hand search. Of these, 1421 records were included in Objective 1 and 107 records reporting 87 unique trials were included in Objective 2. The flow chart for selection of primary studies for Objectives 1 and 2 is shown in Fig. 1.

Objective 1: Studies investigating physical activity programs/services in older adults

Most records (79%) identified in Objective 1 were RCTs investigating the effectiveness of physical activity interventions compared with no intervention (57%) (Table 1). The most common type of physical activity investigated was structured exercise (79%), followed by promotion of overall physical activity (9%). Overall, the records had a relatively small sample size (median = 55 participants). Most RCTs (61%) were of poor/fair methodological quality (median PEDro score 5, 0 to 10 scale).

The included records investigated a total of 178,622 participants, although the actual number of participants included in the studies is smaller as there are multiple publications from the same study, however we did not calculate the actual total number of participants included across individual studies in Objective 1. Most studies were conducted in high income countries (87%). None of the included studies were conducted in low-income countries and only six in lower-middle income countries.

Objective 2: Large, good quality trials investigating physical activity programs/services in older adults compared with no intervention

Description of included studies

We extracted data from 107 records reporting 87 large, good quality ($\geq 6/10$ PEDro scale), RCTs investigating physical activity programs and services for older adults. A total of 106 intervention groups were included as some studies had two intervention groups compared to control. Appendix 7 outlines the Population, Intervention and Outcome data for these 87 trials, classified according to our framework.

Setting

All studies eligible for inclusion in Objective 2 were conducted in high- and upper-middle income countries. No studies were undertaken entirely in vulnerable/underserved populations according to cultural, linguistic, migrant, indigenous or socio-economic status. One study was conducted in a combination of urban and rural/remote areas, with most studies not specifying remoteness ($n=73$ studies) or conducted in urban areas ($n=13$ studies).

Participants

Most studies recruited both males and females ($n=76$ studies). Most participants were aged ≥ 60 years ($n=24$ studies) or ≥ 65 years ($n=32$ studies), with a smaller number investigating older subgroups such as ≥ 80 years ($n=3$ studies) or ≥ 85 years ($n=1$ study). Some studies were entirely undertaken in participants with physical impairments/limitations (mobility: $n=11$ studies, frailty: $n=6$, falls risk: $n=11$), mild cognitive impairment ($n=9$), symptoms of depression ($n=1$) and mixed chronic conditions ($n=3$). We did not include studies entirely undertaken in adults with a particular health condition as per the inclusion criteria. The total number of participants across studies included in Objective 2 was 26,861 (mean 309, standard deviation 259, median 207, range 100 to 1,635).

Type of physical activity

Of the 106 intervention groups included in the 87 trials, overall activity promotion was investigated in 21 (20%) intervention groups [19–38]. Structured exercise was investigated in 61 (57%) intervention groups, including strength/resistance/power exercise (14 intervention groups) [25, 39–50], balance/functional/neuromotor exercise (4 intervention groups) [43, 51–53], walking (1 intervention group) [54], endurance exercise (2 intervention groups) [55, 56], and multicomponent exercise (39 intervention groups) [40, 42, 43, 49, 57–99]. Recreation/

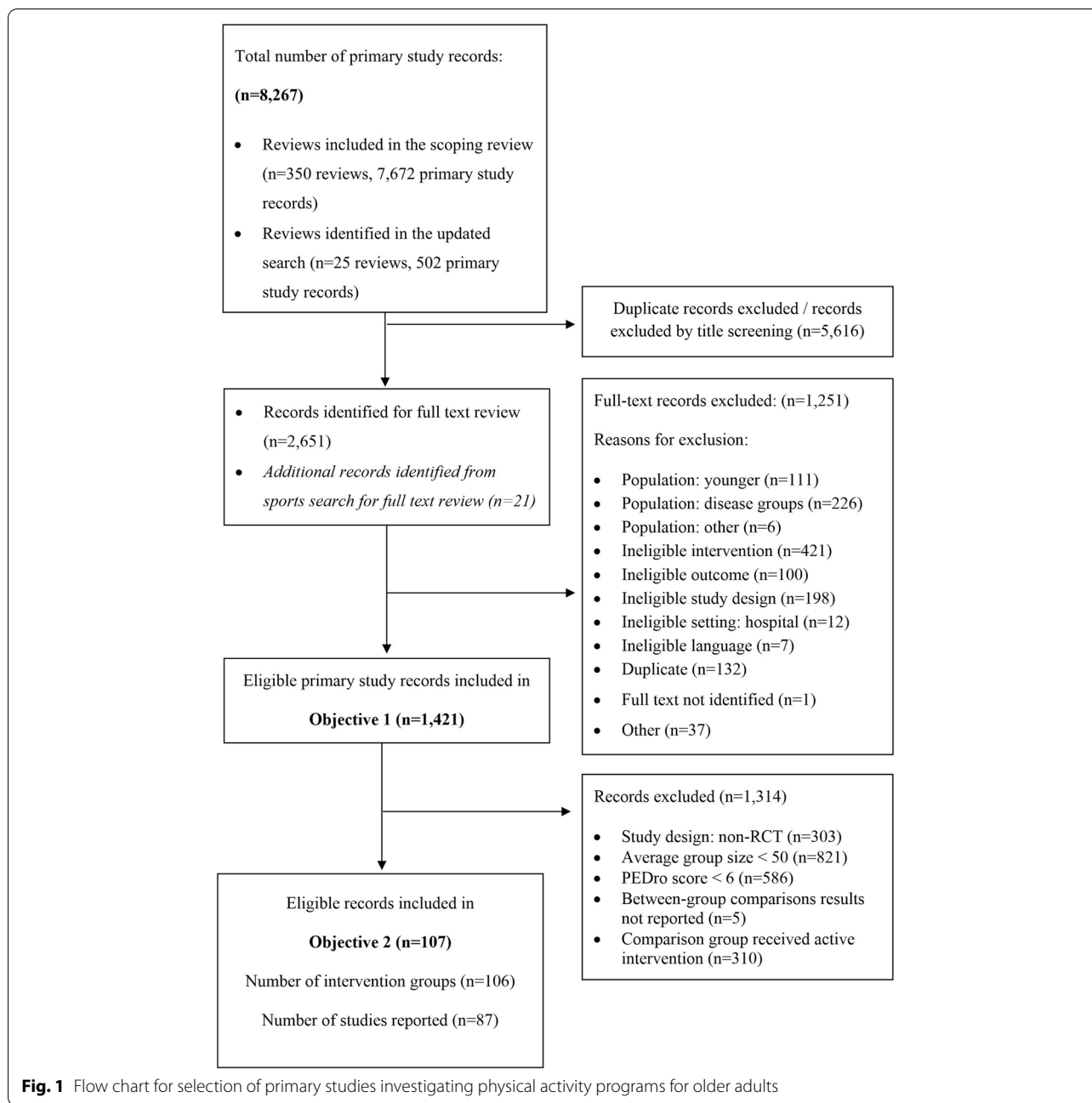


Fig. 1 Flow chart for selection of primary studies investigating physical activity programs for older adults

sport was investigated in 24 (25%) intervention groups, including Tai chi (15 intervention groups), [48, 50, 78, 100–115], yoga and Pilates (3 intervention groups) [116–118], dance (5 intervention groups) [119–124] and competitive sport (1 intervention group) [125].

Location

A description of included studies categorised according to location is provided in Appendix 8. Thirty-eight studies were conducted in community facilities, 22 were

conducted at home, 3 in outpatient health facilities, 8 in residential aged care facilities, 4 in retirement villages and 14 in no set location.

Outcomes investigated

The number of intervention groups investigating each outcome domain is shown in Fig. 2. Outcomes most commonly collected included overall physical activity (n=28 intervention groups), moderate to vigorous physical activity (n=20), rate of falls (n=34), strength (n=35),

Table 1 Characteristics of the 1421 primary studies of physical activity interventions for older adults (Objective 1)

Characteristics	N (%)
<i>Country</i> [n (%)]*	
High income	1240 (87)
Upper-middle income	171 (12)
Lower-middle income	6 (0.4)
Low income	0 (0)
Mixed	1 (0.1)
Not specified	3 (0.2)
<i>Sample size</i> [mean (SD), median, range]	126 (295), 55, 6–5893
<i>Study design</i>	
RCT [n (%)]	1124 (79)
Non-RCT [n (%)]	297 (21)
<i>Type of physical activity</i> [n (%)]	
Promoting overall activity	127 (9)
Structured exercise	1,120 (79)
Recreation	158 (11)
Sport	16 (1)
<i>Comparison</i> [n (%)]**	
No intervention	812 (57)
Higher dose of same activity	21 (2)
Behaviour change support to PA	8 (1)
Different delivery mode of same activity	39 (3)
Different physical activity	199 (14)
Nutrition	6 (0.4)
Education	86 (6)
Combination of interventions	21 (2)
Other	229 (16)
<i>PEDro score</i> /10***	
Poor 0–3 [n (%)]	73 (7)
Fair 4–5 [n (%)]	601 (54)
Good 6–8 [n (%)]	438 (39)
Median score**** [(SD), range]	5 (1.3), 1–8

RCT randomised controlled trial, SD standard deviation

* Income classification strata as per World Bank Country and Lending Groups 2021

** Percentages total > 100 as some studies included more than one intervention group

*** PEDro scores are available only for RCTs ($n = 1124$), PEDro score not available for $n = 12$ trials. The optimal score for trials evaluating physical activity interventions is 8/10

**** The median and average PEDro score was the same among studies that met the inclusion criteria for Objective 1

mobility and balance ($n = 67$), cognitive and emotional functioning ($n = 25$ and 27 respectively, $n = 7$ collected both) and quality of life ($n = 22$).

Physical activity in all populations and locations

The results of the large, good quality RCTs were overall positive. Across all studies combined, positive effects

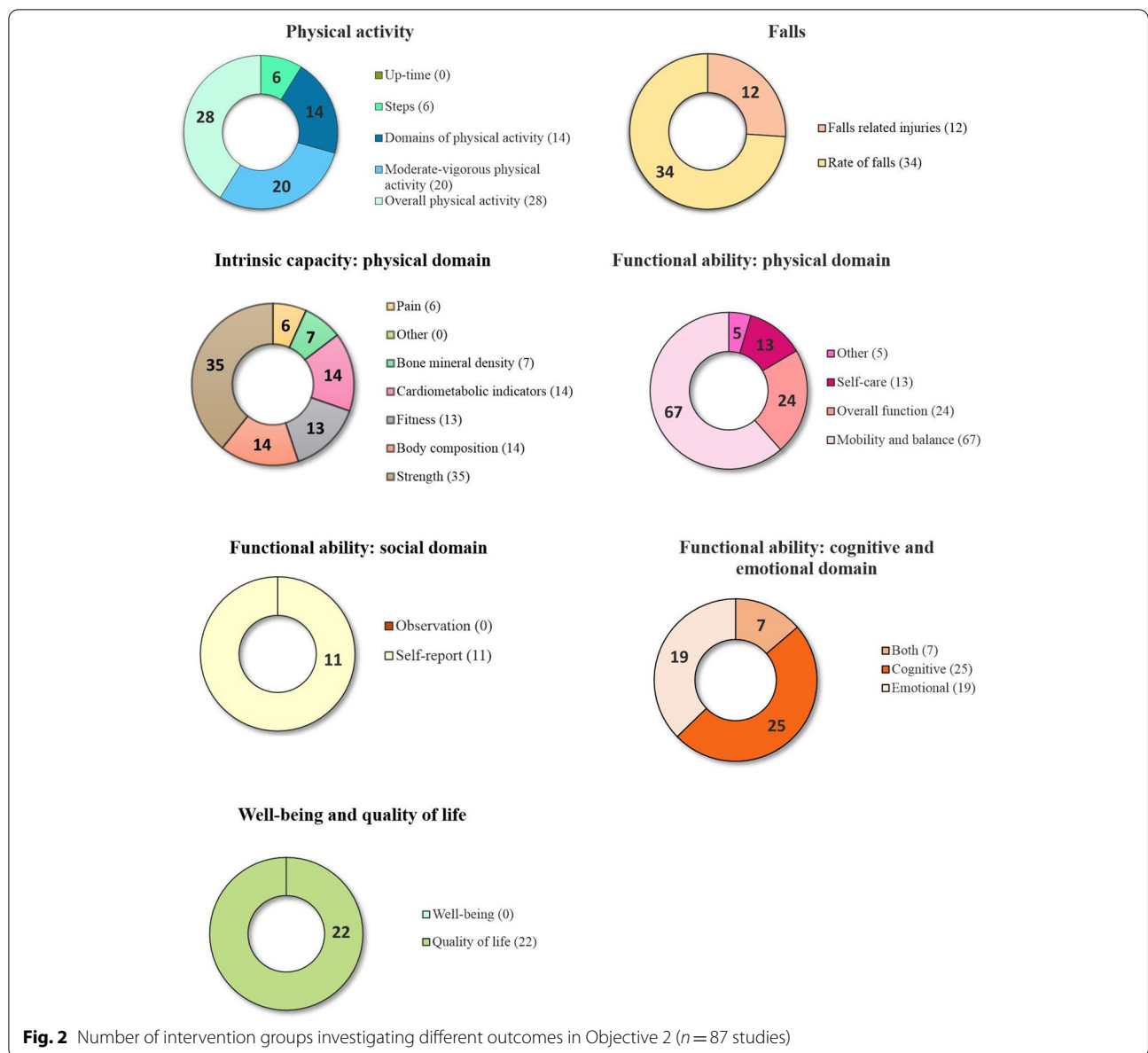
($\geq 50\%$ between-group comparisons positive) were evident for outcomes of physical activity (44 intervention groups, 125 individual outcomes), falls (38 intervention groups, 82 outcomes), intrinsic capacity: physical domain (56 intervention groups, 231 outcomes), functional ability: physical domain (74 intervention groups, 295 outcomes), social domain (11 intervention groups, 22 outcomes), cognitive and emotional domain (50 intervention groups, 190 outcomes), and quality of life (22 intervention groups, 31 outcomes) (Fig. 3, Appendix 9: Table A.9.1). For each individual physical activity type (overall activity promotion, structured exercise, and recreation/sport), positive effects ($\geq 50\%$ outcomes positive) were seen for all outcome domains. For physical activity outcomes, evidence was particularly strong for overall activity promotion (21 intervention groups, 84% outcomes statistically significant). For outcomes of falls and the physical domains of intrinsic capacity and functional ability, the strongest evidence was for structured exercise (24 intervention groups [91% positive], 35 intervention groups [67% positive] and 43 intervention groups [77% positive], respectively). For cognitive and emotional outcomes, the strongest impacts were seen for recreation and sport (14 groups, 88% positive) and structured exercise (30 intervention groups, 56% positive). Overall activity promotion and structured exercise had the strongest impacts on quality of life (6 intervention groups [75% positive] and 13 intervention groups [58% positive], respectively).

Physical activity in adults with physical impairments/limitations

In adults with physical impairments/limitations (32 intervention groups, 349 outcomes in total) there were positive effects of structured exercise on most outcomes except social domain (Appendix 10: Figure A.10, Table A.10). Strong impacts were seen for interventions promoting overall physical activity on outcomes of physical activity (2 intervention groups, 79% positive and statistically significant), and for structured exercise on functional ability: physical domain (23 intervention groups, 50% positive and statistically significant). Recreation/sport had positive impacts on falls (4 intervention groups, 67% positive and statistically significant) and functional ability: physical domain (7 intervention groups, 90% positive) in adults with physical impairments/limitations.

Physical activity in adults with mild cognitive impairment or low mood

In adults with mild cognitive impairment or low mood (11 intervention groups, 79 outcomes in total) structured exercise had positive effects on most outcome domains except social outcomes which were not commonly

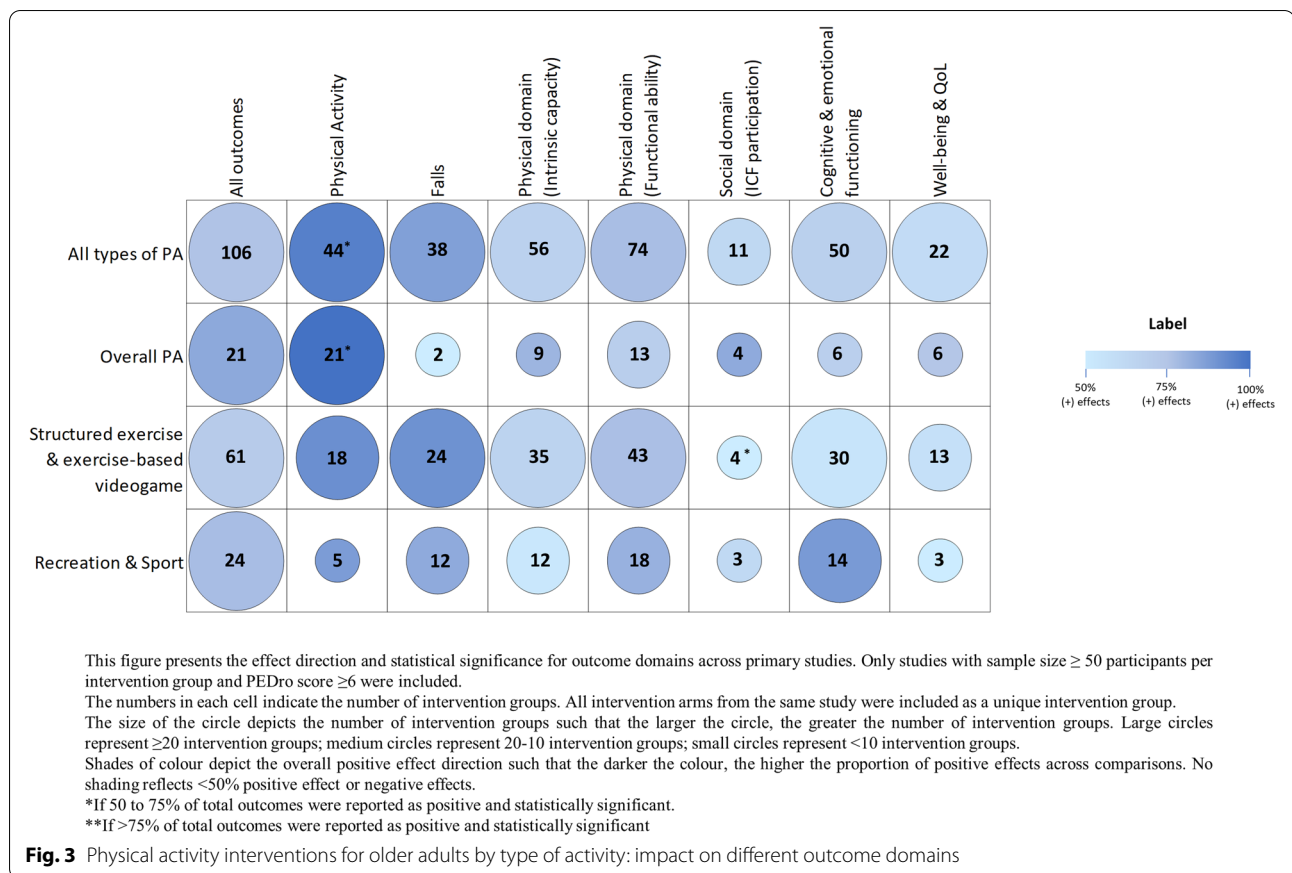


investigated (Appendix 11: Figure A.11, Table A.11). Statistical significance was reached in $\geq 50\%$ of comparisons for the impact of structured exercise on functional ability: physical domain (3 intervention groups), cognitive and emotional outcomes (6 intervention groups) and quality of life (1 intervention group), and for recreation/sport on cognitive and emotional outcomes (3 intervention groups).

Physical activity in different locations

Physical activity interventions undertaken in community facilities (45 intervention groups, 391 outcomes) and people’s own homes (24 intervention groups, 230

outcomes) had positive impacts ($\geq 50\%$ of outcomes positive) across most outcomes except social domain (Appendix 12: Figure A.12, Table A.12). Physical activity delivered in outpatient health facilities was investigated in 4 intervention groups with $\geq 50\%$ outcomes statistically significant in domains of physical activity, functional ability: physical and social domains (1 intervention group each), and cognitive and emotional outcomes (2 intervention groups). Physical activity undertaken in residential aged care facilities had positive impacts on falls (3 intervention groups, 100% positive) and functional ability: physical domain (11 intervention groups, 50% positive). Physical activity undertaken in retirement villages



(4 intervention groups) had moderately positive effects across most outcomes except quality of life.

Types of structured exercise

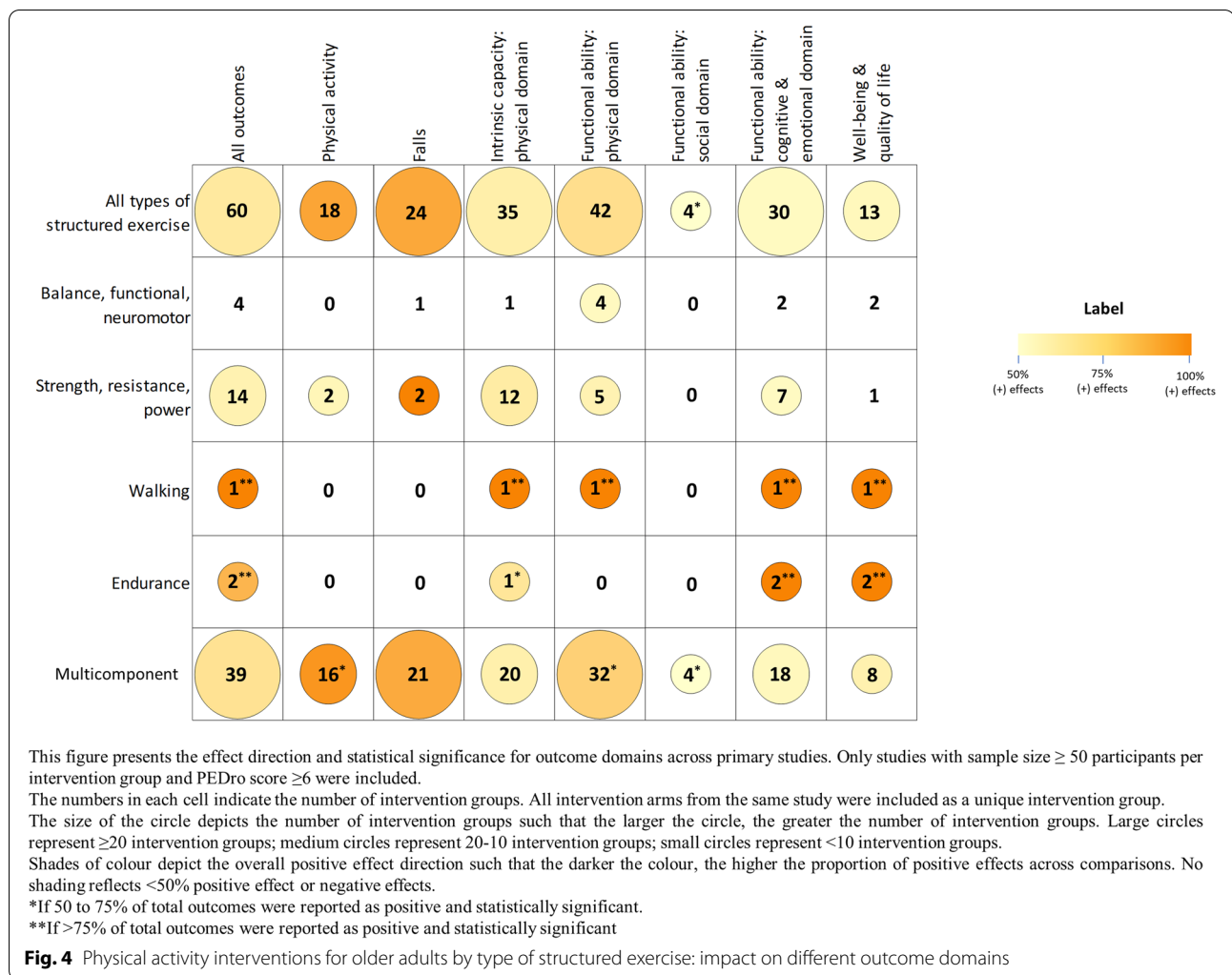
Multicomponent exercise, defined in our framework as structured exercise programs containing more than one type of exercise, was the most investigated type of structured exercise (39 intervention groups, 398 outcomes) (Fig. 4, Appendix 9: Table A.9.2). Positive effects for multicomponent exercise were seen across all outcome domains, with particularly strong impacts on physical activity (16 intervention groups, 50% of outcomes statistically significant), falls (21 intervention groups, 90% positive) and functional ability: physical domain (32 intervention groups, 81% statistically significant). Walking and endurance interventions had strongly positive effects on intrinsic capacity: physical domain, cognitive and emotional functioning, and quality of life ($\geq 50\%$ outcomes statistically significant). No studies investigated interventions for individuals with wheelchair mobility. Strength training as a single form of exercise also showed positive impacts across most outcome domains except

social and quality of life, while balance training alone only had positive impacts on functional ability: physical domain (4 intervention groups, 56% positive). Evidence for structured exercise in community facilities, homes, outpatient health facilities, residential aged care facilities and retirement villages, is presented in Appendix 13: Figures A.13.1- A.13.5, Tables A.13.1 – A.13.5.

When the components of multicomponent exercise interventions were analysed, positive impacts were seen across all outcomes for programs that included strength (38 intervention groups, $\geq 50\%$ positive). Positive effects were also evident for most outcomes from programs that included balance (35 intervention groups), walking (18 intervention groups) and endurance (8 intervention groups) (Fig. 5, Appendix 9: Table A.9.3).

Types of recreation/sport

Tai chi (15 intervention groups) had strong positive impacts across all outcomes, reaching statistical significance in $\geq 50\%$ outcomes for functional ability: physical domain (13 intervention groups) and quality of life (2 intervention groups) (Fig. 6, Appendix 9: Table A.9.4).



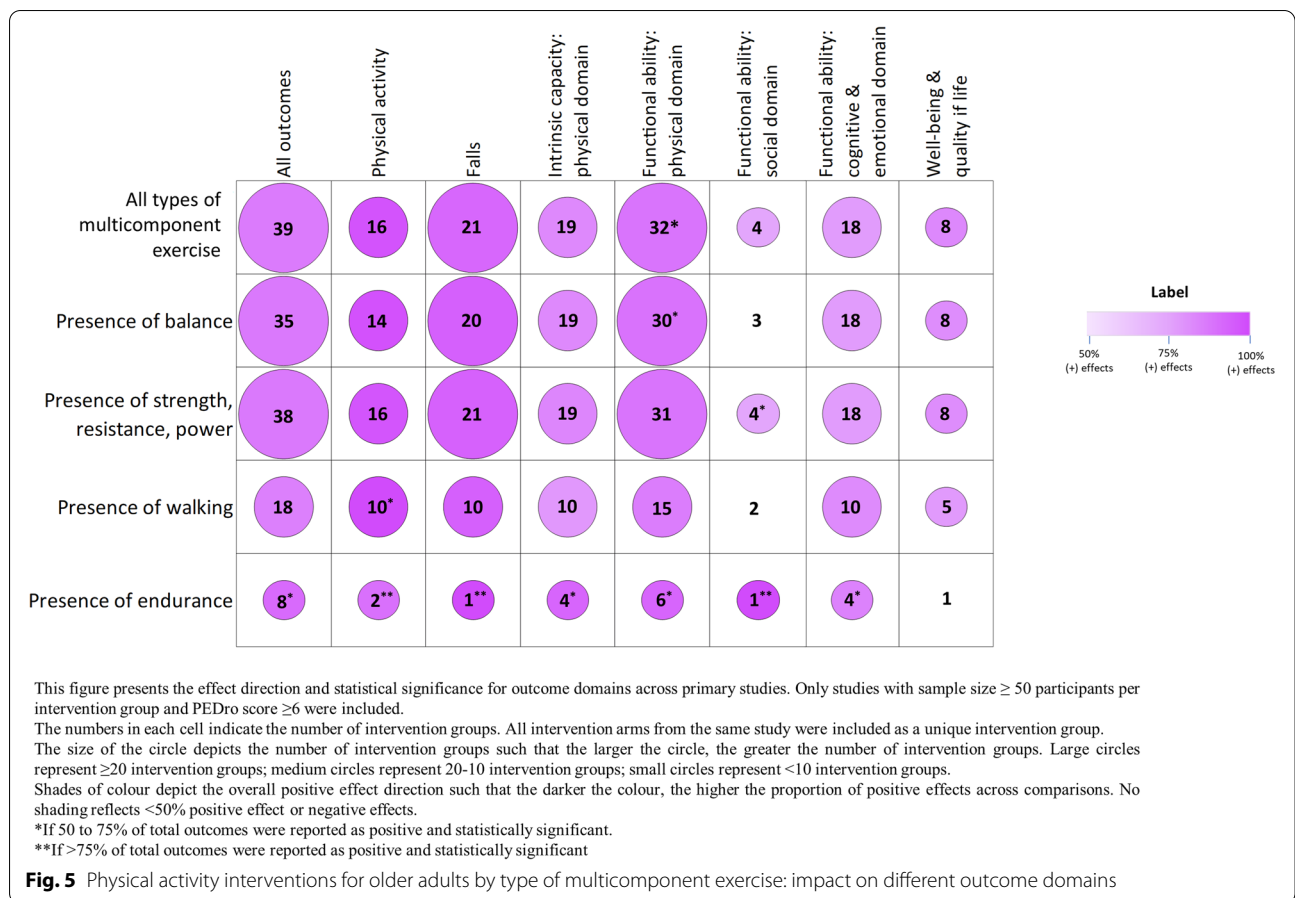
Yoga/Pilates (3 intervention groups) had positive effects on functional ability: physical domain (1 intervention group) and cognitive and emotional outcomes (2 intervention groups, 100% statistically significant). Dance (5 intervention groups) was effective for outcomes of physical activity and falls (2 intervention groups each, $\geq 50\%$ statistically significant), functional ability: physical domain (3 intervention groups, 78% positive) and cognitive and emotional outcomes (4 intervention groups, 56% statistically significant), although no impact was seen for intrinsic capacity: physical domain or quality of life. Competitive sport had positive impacts on cognitive and emotional outcomes (1 intervention group, 91% outcomes positive), although no impact on the physical domains of intrinsic capacity or functional ability. Results for recreation/sport in community facilities, residential aged care facilities and retirement villages are presented in Appendix 14: Figures A.14.1 – A.14.3, Tables A.14.1 – A.14.3).

Discussion

We identified 1421 studies evaluating physical activity programs/services for older adults, although only 87 of these studies were large, good quality RCTs. Overall, the evidence supporting physical activity was positive. Positive effects were seen in $\geq 50\%$ of all outcomes for structured exercise, recreation/sport and interventions promoting overall activity, with multicomponent exercise identified as a particularly effective form of structured exercise. We have presented results for different populations, including older adults with physical impairments and mild cognitive impairments or low mood, as well as different locations. These findings will be valuable for program providers and policymakers when planning and implementing physical activity programs/services.

Implications for practice

While the evidence in this review was positive in favour of physical activity programs and services overall, different

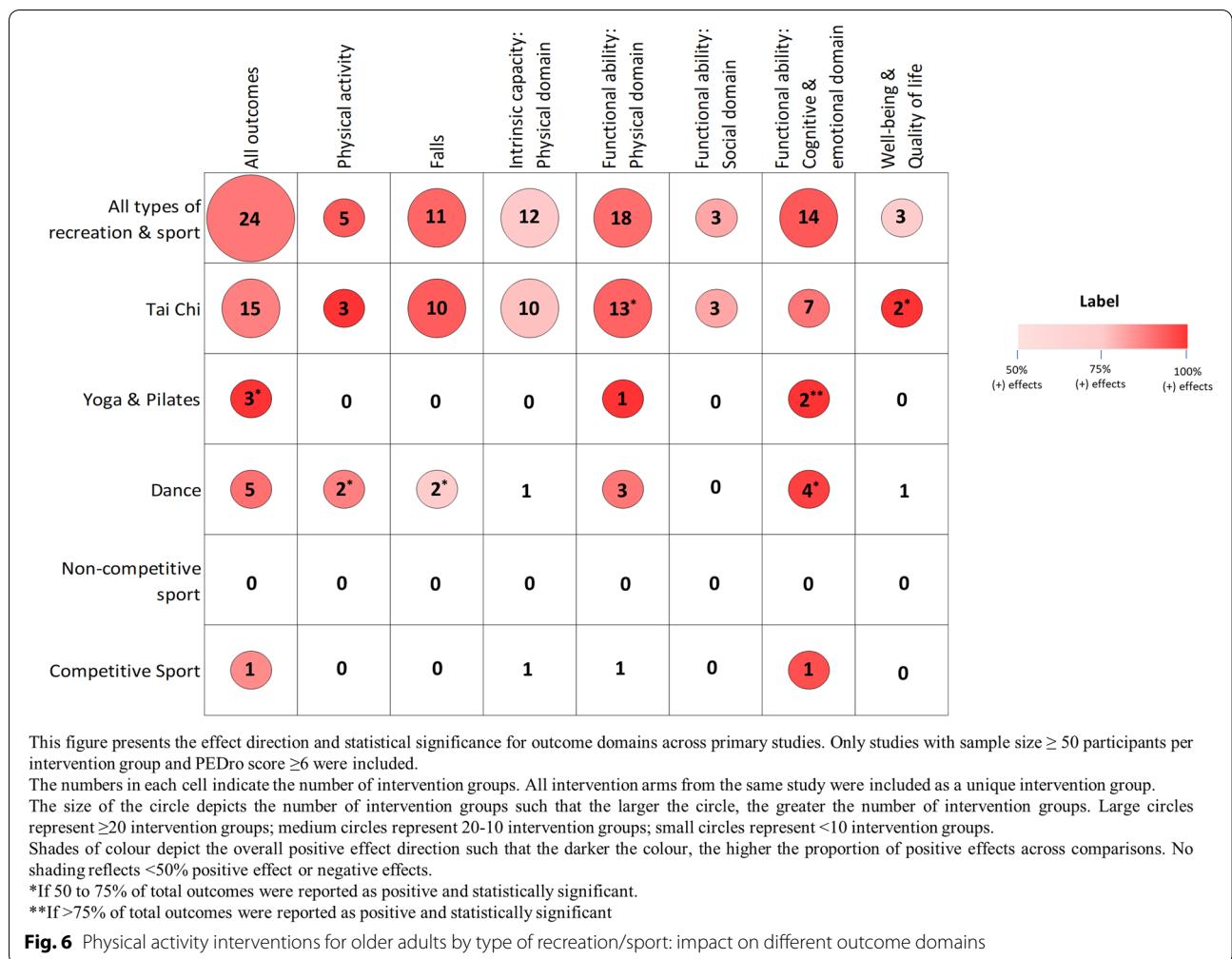


impacts were seen across different physical activity types, populations, and locations. It is therefore important for policymakers and program providers to consider the context and desired outcomes when planning a physical activity program or service. For structured exercise, the strongest impacts were on falls and the physical domains of intrinsic capacity and functional ability. There was strong evidence for multicomponent exercise that included balance or strength exercises across all outcome domains, except social outcomes. For recreation/sport, the strongest impact was on cognitive and emotional functioning. For interventions promoting overall activity, the strongest positive impact was on physical activity and social outcomes. Positive impacts were also seen across all outcome domains for older adults with physical limitations and mild cognitive impairment/low mood, except social outcomes which were not investigated. Physical activity programs/services also had positive impacts across diverse locations, including community facilities, people’s own homes, outpatient health facilities, residential aged care facilities and retirement villages.

Many older adults have chronic health conditions [126]. As we were seeking to inform interventions for

broad groups of older adults rather than people with particular conditions, we did not include studies in which all participants had been diagnosed with particular health conditions (e.g., stroke, heart failure). Many of the participants in the included studies would have had various health conditions so the findings are still relevant for adults with health conditions. We also considered the functional impact of a health condition to be more important than the condition itself.

For the present review we did not differentiate outcome according to measurement tool. Different tools measure different aspects of outcomes (e.g., self-reported versus device-based physical activity) and may have different psychometric properties (such as validity, reliability, responsiveness) and different inherent biases (possibility for blinding of assessors to intervention group allocation, greater risk of loss to follow up from more inconvenient measures). Given the importance of these issues we included measurement tools in our framework but considering the broad scope and aim of this study—to provide information about effectiveness of physical activity programs – we did not extract information regarding measurement tools from individual studies included



in our review. Furthermore, as our aim was, we did not include studies that primarily sought to implement physical activity interventions previously found to be effective rather than establishing the effectiveness of an intervention. A recent review [127] identified 137 studies about implementation of physical activity interventions for older adults and called for implementation research that extends beyond analysis at an individual level.

Perspectives for future research

Our review highlights several gaps in current literature. Further primary studies are required in a number of areas: i) sport interventions (only one high-quality, large clinical trial investigating the impact of sport in people aged ≥ 60 years was identified); ii) social and well-being outcomes (no studies were found investigating the impact of physical activity on wellbeing outcomes in older adults, and no studies investigated social outcomes for older adults with physical impairments, mild cognitive impairment or mood symptoms); iii) low and

lower-middle income countries (no studies investigated structured exercise and overall activity in lower-middle income countries, and no studies were conducted in low income countries); iv) physical activity in underserved/disadvantaged populations (no studies were identified that investigated physical activity in culturally or linguistically diverse populations, migrant or indigenous populations, socio-economically disadvantaged populations or rural/remote settings, or interventions for older adults with wheelchair mobility), and v) the effectiveness of physical activity programs in the oldest age group ≥ 80 years (four out of 87 studies focused on participants aged ≥ 80 years).

Limitations

We endeavoured to provide a rapid, broad but rigorous overview of the evidence to guide physical activity approaches for older adults around the world. There are inherent limitations of this approach compared to detailed systematic reviews that focus on particular

interventions, outcomes, or settings. These limitations apply to the approach we took to searching, classifying, and synthesising evidence. First, we mostly searched for reviews rather than primary studies for this review to be comprehensive in types of activities, settings and outcomes covered. The exception to this was sport, for which we did not identify any reviews, so we did search for primary studies. We are confident we identified the bulk of important studies; however, we could have missed studies. There is also the likelihood of publication bias favouring physical activity benefits within studies we identified. Second, we classified studies using the framework we developed in consultation with experts in the field and WHO. We were only able to classify interventions based on what was reported in the articles, so may have misinterpreted elements, or made incorrect assumptions. We did not classify specific exercise types, such as different strengthening exercises, nor did we classify exercise prescription, intensity, or progression. We also did not classify studies according to measurement tool, which could have affected overall results as different measurement tools have different properties such as the ability to detect change. Future reviews could investigate these components in greater detail. Our definition of multi-component exercise (as exercise containing two or more types of structured exercise) differs to that of a previous Cochrane review of exercise for preventing falls where to be classified as multicomponent a program had to meet the definitions from the ProFaNE taxonomy [13] for more than one type of exercise, and had to equally focus on two or more components [128]. Hence, given that we classified a high number of interventions as ‘multicomponent’ in the current review, it is possible that some of these interventions could be re-classified as another type of structured exercise (e.g. strength/resistance/power or balance/functional/neuromotor) using the definition from the Cochrane review. However, our definition of multicomponent exercise is consistent with the WHO *Guidelines on Physical Activity and Sedentary Behaviour* [2] which emphasise incorporating strength and balance exercises for health benefits. Future reviews could also focus on primary studies reported in languages other than English, as we only included reviews written in English, which could have contributed to the lack of studies from low and lower-middle income countries. Effect sizes for interventions could also be investigated as it is likely that some interventions have bigger effects (i.e., larger improvements compared to control) than others.

Third, we did not undertake meta-analysis. Instead, we used a form of ‘vote-counting’ to report the proportion of outcomes for which comparisons between groups were positive. The Cochrane Collaboration Handbook cautions against traditional vote counting which only

considers the statistical significance of comparisons, as many trials will be underpowered so potentially important effects could be missed [17]. Rather, we estimated the proportion of effects in individual trials that were positive. Our figures show the outcome domains for which $\geq 50\%$ of outcomes in individual studies were positive for a particular combination of population, location and type of intervention. As between-group comparisons in trials are seeking to estimate ‘true’ effects of interventions, if an intervention has a ‘true’ positive effect, more of the effects found in individual trials would be on the positive rather than negative side of the point of no effect (zero between group difference). The approach we have taken is considered an ‘acceptable’ form of vote counting [17]. We acknowledge that as we did not consider effect sizes this approach remains inferior to meta-analysis. This rapid review provides a platform for future meta-analyses. Finally, our findings do not enable program providers to make decisions about weighing up the benefits of programs against program costs and efforts. Nonetheless we consider the breadth of programs, settings and outcomes summarised in our review to illustrate the benefits of the approach we have taken.

Conclusions

We identified 1421 physical activity intervention studies, although studies were generally small and of poor/fair quality. Overall, findings from the 87 good quality large trials were positive. Positive impacts were evident for overall activity, structured exercise, and recreation/sport across the outcomes of physical activity, falls, intrinsic capacity (physical domain), functional ability (physical, social and cognitive and emotional domains) and quality of life. The evidence presented in this review for different populations and settings will provide guidance for developing physical activity programs for different populations, locations and settings globally.

Abbreviations

CONSORT: Consolidated Standards of Reporting Trials; GAPP: Global Action Plan on Physical Activity; ProFaNE: Prevention of Falls Network Europe; TIDieR: Template for Intervention Description and Replication; WHO: World Health Organization.

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12966-022-01318-9>.

Additional file 1: PRISMA-ScR_checklist

Additional file 2: Appendix 1. Eligibility criteria and search strategies used to identify systematic reviews. **Appendix 2.** Flow chart of selection of reviews from the updated search. **Appendix 3.** Systematic reviews identified in the updated search. **Appendix 4.** Search strategies and flow chart of the selection of primary studies investigating sports for older adults. **Appendix 5.** Eligibility criteria for selection of primary

studies. **Appendix 6.** Overview of relevant concepts incategorising outcomes of physical activity interventions for older adults. **Appendix 7.** Overview of primary studies of physical activity programs and services for older adults included in Objective 2 (k=87 studies). **Appendix 8.** Description of studies included in Objective 2 according to intervention location. **Appendix 9.** Databases used to create Figures 2-5 presenting the evidence of physical activity services and programs for older adults. **Appendix 10.** Impact of physical activity types on different outcome domains in adults with physical impairments. **Appendix 11.** Impact of physical activity types on outcome domains in adults with mild cognitive impairment or low mood. **Appendix 12.** Impact of physical activity on different outcome domains by location. **Appendix 13.** Impact of structured exercise in different locations on different outcome domains. **Appendix 14.** Impact of recreation/sport in different locations on different outcome domains.

Additional file 3:

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Not applicable.

Authors' contributions

MBP, JSO, LH, CS and AT developed the concept and protocol. MBP designed the search strategy, screened studies, extracted data, conducted data synthesis and drafted and revised the paper. JSO screened studies, extracted data, conducted data synthesis, developed the figures, and revised the paper. JNB screened studies, extracted data and drafted and revised the paper. MBP, JSO, JNB, LH, CS and AT analysed and interpreted the data. NC, HG, BW, WK, BSA, LRP, APMCC and SS screened studies, extracted data, and revised the paper. SG, AB, FB and JW revised the draft paper. All authors approved the final manuscript.

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Availability of data and materials

Data are available in a searchable Excel database which can be downloaded at <https://crepreventfallsinjuries.org.au/publications/>.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

CS, AT, JSO and LH are authors on clinical trials included in this rapid review. The remaining authors confirm they have no conflicts of interest.

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