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How effective are allied health group interventions for the management of adults with long-term conditions? An umbrella review of systematic reviews and its applicability to the Australian primary health system

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Abstract

Background Group allied health interventions for people with chronic conditions may be a solution to increasing access to allied health in primary care. This umbrella review aimed to determine the effectiveness of allied health group interventions to improve health-related outcomes for adults with chronic conditions and the applicability of the findings to the Australian primary health care context.

Methods An umbrella review of systematic reviews conducted April-July 2022, searching eight databases. Systematic reviews were eligible if they included randomised controlled trials (RCT) or quasi-RCTs, community dwelling adults aged ≥ 18, at least one chronic condition, group intervention in scope for allied health professionals, and published in English after 2000. Studies were excluded if interventions were conducted in hospital or aged care facilities, out of scope for allied health, or unsupervised.

Results Two thousand three hundred eighty-five systematic reviews were identified: after screening and full text review 154 were included and data extracted from 90. The chronic conditions included: cancer ($n=15$), cardiovascular disease ($n=6$), mixed chronic conditions ($n=3$), kidney disease ($n=1$), low back pain ($n=12$), respiratory disease ($n=8$), diabetes ($n=14$), heart failure ($n=9$), risk of falls ($n=5$), hypertension ($n=4$, osteoarthritis ($n=6$) and stroke ($n=8$). Most group interventions included prescribed exercise and were in scope for physiotherapists and exercise physiologists. Overall, allied health group exercise programs for community dwelling adults improved health outcomes for most chronic conditions. Aggregated data from the systematic reviews suggests programs of 45–60 min per session, 2–3 times per week for 12 weeks. Lifestyle education and support for people with type-2 diabetes improved glycaemic control.

Conclusions Prescribed group exercise delivered by allied health professionals, predominantly by exercise physiologists and physiotherapists, significantly improved health outcomes for community dwelling adults with a broad range of chronic conditions.

Keywords Chronic disease, Allied health, Primary care, Group programs

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Introduction

Globally, the prevalence of chronic disease is high. In Australia in 2020–21, 79% of all Australians had a chronic condition with 47% reporting one or more chronic conditions [1]. The burden of disease changes over the life course, increasing in people aged over 45 [2]. The chronic conditions contributing to greatest burden of disease in 2018 were coronary heart disease, back pain and musculoskeletal problems, dementia, and lung cancer [2]. Many of these conditions are amenable to evidence-based allied health interventions, especially musculoskeletal issues and respiratory conditions. There is a higher prevalence and burden, of these chronic diseases in Aboriginal and Torres Strait Islander people compared to other Australians and considerable geographic variation [3].

Most people with chronic conditions are managed by their general practitioner (GP) with approximately 70% of Australian GP encounters primarily associated with the management of chronic conditions [4]. Of those who present with at least one chronic condition, more than two thirds have multimorbidity [5]. Primary care in Australia is healthcare that people seek in the community from a GP, allied health professional, or nurse and it is a fee for service model. The Enhanced Primary Care (EPC) package was introduced in 1999 and extended in 2005 with the introduction of the GP Management Plan (GPMP) and Team Care Arrangement (TCA) to support Australian GPs to better manage people with chronic conditions. These plans aimed to facilitate Medicare subsidised longer appointments and multidisciplinary team care, the TCA provides subsidies for five allied health visits per year with allied health professionals such as physiotherapists, exercise physiologists, occupational therapists, dietitians, or podiatrists. Medicare-subsidised group interventions for people with type-2 diabetes by exercise physiologists, dietitians and diabetes educators were introduced in 2007 to further support multi-disciplinary team care [6].

There has been a steady increase in uptake of the TCA item numbers since their introduction in Australia, with an associated improvement in health outcomes, however care remains poorly co-ordinated with limited information sharing between the service providers and is expensive for the patient [7]. The proportion of people with a GPMP or TCA who claim an allied health item in the subsequent 12-months, has steadily increased from 4% in 2006 to 21% in 2014 [8]. In 2021–2022, 37% of Australians had claimed Medicare subsidised allied health service. Physiotherapy and podiatry [8–10] have had the highest uptake of the TCA item numbers, particularly for those aged 80–84, with diabetes, more severe physical limitations, and from low socioeconomic status background. The Medicare data for allied health group services (only available for exercise physiologists and dietitians) have shown a steady increase since 2007 for exercise physiology, but minimal uptake of the items for diabetes educators and dietitians [11]. In 2016, one in three people with a chronic condition had used a general practice chronic disease management item number, but only one in five had used an associated allied health item number [12]. There is a need to ensure affordable access to allied health to optimise health outcomes and reduce the burden on the health system.

Current evidence suggests that access to allied health interventions in Australian primary care results in a reduction in hospital admissions and emergency department use [10]. Those people with five or more physiotherapy claims in the previous 12-month period had a statistically significant reduction in both potentially preventable hospital admissions of 21% and emergency department use of 17% [10]. Increasing access to evidence-based allied health interventions by expanding the range of group allied health interventions subsidised through Medicare is potentially a cost-effective option to improve health outcomes and reduce demands on hospital services. Therefore, the aim of this umbrella review was to determine the effectiveness of allied health group therapy services to improve the health-related outcomes for community dwelling adults with one or more chronic conditions.

Methods

An umbrella review of systematic reviews provides an overview of systematic reviews and was the chosen methodology because of the large number of systematic reviews on group allied health interventions [13]. The review was commenced prior to the publication of the Preferred Reporting Items for Overviews of Reviews (PRIOR) statement [14] and was informed by the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines [15].

A search of Medline, Embase, Scopus, AMED, JBI Database of Systematic Reviews, Cochrane Database of Systematic Reviews, Database of Abstracts or Reviews and Effects (DARE) and PROSPERO was conducted from 2000 up until July 2022. (Supplementary File 1). The review was registered with PROSPERO (CRD42022324827).

Inclusion criteria

Published systematic reviews synthesising quantitative data with meta-analysis or narrative synthesis were included. The systematic reviews were eligible if they included randomised controlled and/or quasi-randomised controlled trials. Where there was a Cochrane Systematic Review and associated co-publication from

the same Cochrane review, only the Cochrane Systematic Review was included. Only reviews published in English from 2000 to 2022 were included. The choice to only include English language is justified. The evidence shows that inclusion of studies published in other languages rarely changes the result [16].

Population

- Community dwelling adults ≥ 18 years.
- With at least one of the following long-term health conditions (from the eligibility for Medicare subsidised GPMP and TCA) :

1. Chronic respiratory disease (chronic obstructive pulmonary disease (COPD), bronchiectasis, asthma).
2. Cancer.
3. Cardiovascular disease (hypertension, coronary heart disease, heart failure).
4. Diabetes (Type 1 and 2).
5. Chronic kidney disease.
6. Musculoskeletal conditions (osteoarthritis, back pain, high risk of falls).
7. Chronic stroke.

Intervention

Data from systematic reviews were included if:

- An intervention that was or could be delivered by an appropriately credentialed allied health professional and was either delivered as a group program or could be delivered in a group format.
- The intervention were delivered by an allied health professional who was eligible to provide Medicare subsidised services for people with chronic conditions in Australia [15]:

1. Aboriginal health worker / Torres Strait Islander health practitioner.
2. Audiologist.
3. Chiropractor.
4. Diabetes educator.
5. Dietitian.
6. Exercise physiologist.
7. Occupational therapist.
8. Osteopath.
9. Physiotherapist.
10. Podiatrist.
11. Speech pathologist.
12. Genetic Counsellor.

- The group intervention was delivered to > 1 person at a time in a clinic or, community setting or via telehealth. Where the review contained individual and group programs, the review was excluded unless the group program results were presented separately.
- For walking training intervention: data were included if the walking training was prescribed and supervised, i.e., studies of advice about walking were excluded.

Comparator

- Comparator: any comparator, including home programs.

Outcomes

- The review reported any outcomes listed in Table 1. The primary and secondary outcomes from the included reviews were grouped according to the International Classification of Functioning, Disability and Health (ICF) framework [17].

Exclusion criteria

Systematic reviews and meta-analyses were excluded if:

- They were adults living in residential aged care or currently admitted to hospital.
- The intervention was provided in an in-patient setting or was a home-based program.
- The intervention or comparator were provided by psychologists or pharmacists (because these are funded by different schemes in Australia) [18].
- Systematic review protocols were excluded.

Screening and quality assessment

All titles and abstracts were screened by one reviewer (SD) with other authors (JA, WK, GN, KR, AW) screening a sample each using Covidence systematic review software (Veritas Health Innovation, Melbourne, Australia. Available at www.covidence.org). Full-text articles were reviewed by one reviewer (SD), with other authors (JA, WK, GN, KR, AW) screening a sample each. Team discussions addressed cases of uncertainty and disagreements were resolved by two reviewers (WK and SD). Data were extracted by one reviewer (SD) and summary tables checked by all reviewers. Where there were multiple reviews on the same type of group intervention, the list of included studies of the

Table 1 International Classification of Functioning, Disability and Health (ICF) framework

1) Body function	a) Mental functions (e.g. scales to measure depression and anxiety such as HADs, DASS, subscales of quality of life (QoL) scales etc). b) Sensory functions and pain (e.g. visual analogue scale (VAS) for pain). c) Voice and speech functions d) Functions of the cardiovascular, haematological (e.g. V02 max, heart rate). e) Immunological and respiratory systems (e.g. pulmonary function, exacerbation). f) Functions of the digestive, metabolic, endocrine systems (e.g. HbA1c, lipids, BMI). g) Neuromusculoskeletal and movement-related functions (e.g. strength, falls and fall related injuries).
2) Body Structure	a) Structure of the nervous system b) The eye, ear and related structures c) Structures involved in voice and speech (e.g. swallowing) d) Structure of the cardiovascular, immunological and respiratory systems e) Structures related to the digestive, metabolic and endocrine systems f) Structure related to genitourinary and reproductive systems g) Structures related to movement (e.g. sarcopenia) h) Skin and related structure
3) Activities and participation	a) Learning and applying knowledge (e.g. knowledge questionnaires) b) General tasks and demands (e.g., COPM) c) Communication d) Mobility (e.g. 6MWT, physical activity, Timed up and Go (TUG)) e) Self care (e.g. COPM, Activities of Daily Living (ADL) f) Domestic life (e.g. subscales of participation measures) g) Interpersonal interactions and relationships (e.g. sustained social networks) h) Major life areas (Quality of life) i) Community, social and civic life (e.g. measures of social engagement)
4) Environmental Systems	a) Products and technology b) Natural environment and human-made changes to environment c) Support and relationships d) Attitudes e) Services, systems and policies (e.g. Health service utilisation, hospital admission, ED use)
5) Costs	

older systematic reviews were checked against those of the more recent reviews. Data were not extracted from the older reviews if the majority of studies were included in the more recent systematic reviews.

Risk of bias assessment

The included systematic reviews were assessed using the AMSTAR 2 tool [19]. A summary of the risk of bias assessment of included trials reported in the systematic review was also extracted.

Strategy for data synthesis

It was not possible to perform a meta-analysis of the included reviews because of the diverse range of reviews included. The included systematic reviews were grouped according to condition, type of group intervention, and chronologically. The quantitative findings for each included systematic review were presented in a summary format [20]. The outcomes reported in the systematic review were presented using a traffic light system, see Table 2.

Results

A total of 2385 articles (2381 studies) were identified. Once duplicates were removed 2220 studies were screened, 507 full text systematic reviews were screened and a total of 154 systematic reviews were included (see Fig. 1). From these 154 reviews, data were extracted from 90 reviews (see Table 3 for a summary of the included and extracted reviews and Supplementary File 2 for a reference list of reviews not extracted). A summary of the extracted reviews are presented in Supplementary File 3 and the detailed summary of all extracted reviews is available in Supplementary file 4.

Most of the included systematic reviews reported on the outcomes for group exercise programs. A small number ($n=11$) were included that reported on the effectiveness of group lifestyle education and dietary advice.

Cancer

Data were extracted from 15 systematic reviews [21–35]. Group exercise programs consisting of 50 to 60 min, two to four times per week for 9 to 19 weeks were effective in improving body composition, physical function, cardiovascular fitness, sleep quality and fatigue in people

Table 2 Summary of traffic light system

Key:

Clear evidence for effectiveness means that there is a clinically meaningful and statistically significant difference in favour of the group intervention.	
Weak evidence for effectiveness means that there is either not a clinically meaningful difference even though it may be statistically significant or a clinically meaningful difference even though it may not be statistically significant in favour of the group program.	
No evidence for effectiveness means that there is no difference between the outcome of the group program and the comparator.	
Evidence of harm means that there is evidence that the group program causes harm.	

with a range of cancers [21, 22, 24, 27, 28, 30, 32–35]. The design of group programs and prescription of exercise is in scope for exercise physiologists and physiotherapists.

Examples of effective exercise interventions for people living with cancer included prescribed gym-based resistance [21, 23] or aerobic exercise training [22] or both [24, 27–35]; and prescribed walking programs [22].

Cardiovascular disease

Data were extracted from six systematic reviews [36–41]. Group exercise programs consisting of 60 min, two to three times per week for 12 weeks were effective for reducing cardiovascular mortality, hospital admission and improving exercise capacity and some physiological measures [36–41]. Effective exercise interventions were prescribed to ensure the participants were exercising at a moderate intensity ($\geq$ 60% heart rate maximum (HR_{max})). Group centre-based exercise programs had similar outcomes to equivalent home-based programs with regular telephone support. The design of group programs and prescription of exercise is in scope for exercise physiologists and physiotherapists.

Chronic conditions (mixed)

Data were extracted from three systematic reviews which included people with chronic conditions in general [42–44]. There is not clear evidence for the effectiveness of group self-management education delivered by allied health [42], and group upper limb resistance training for the management of general chronic conditions to improve postural tremor [44].

Chronic kidney disease

Data were extracted from one systematic review. There is limited evidence regarding the benefits of dietary interventions that focus on diet quality and are delivered by dietitians in relation to outcomes associated with chronic kidney disease [45].

Chronic low back pain

Data were extracted from 12 systematic reviews [46–57]. Group exercise programs delivered over a period of eight weeks (interquartile range (IQR) 6 to 12) for a median total duration of 12 h (IQR 8 to 20) were effective for reducing pain intensity and functional limitation associated with chronic low back pain. It was unclear whether the addition of self-management (education, booklets) or psychological approaches (Cognitive Behavioural Therapy (CBT), relaxation techniques) conferred additional benefit [48, 53, 54]. The design of group programs and prescription of exercise is in scope for chiropractors, osteopaths and physiotherapists.

Two network analyses [56, 57] identified the most effective exercises for different outcomes in the management of low back pain, but not whether exercises were provided in group format. However, the following could be delivered effectively in a group format:

- Group exercise to reduce functional limitation (physical function, return to work, sick leave) include McKenzie exercises, Pilates, exercise that focuses on restoration exercises, flexibility, resistance and stabilisation, water-based exercise, and yoga.
- Group exercise to improve mental health associated with low back pain (resistance and aerobic training).

Chronic lung disease

Data were extracted from eight systematic reviews [58–65]. A group exercise program consisting of 45 to 60 min, 1 to 3 times per week for 8 to 12 weeks, was effective for improving exercise capacity, quality of life and reducing the number of hospital admissions for people living

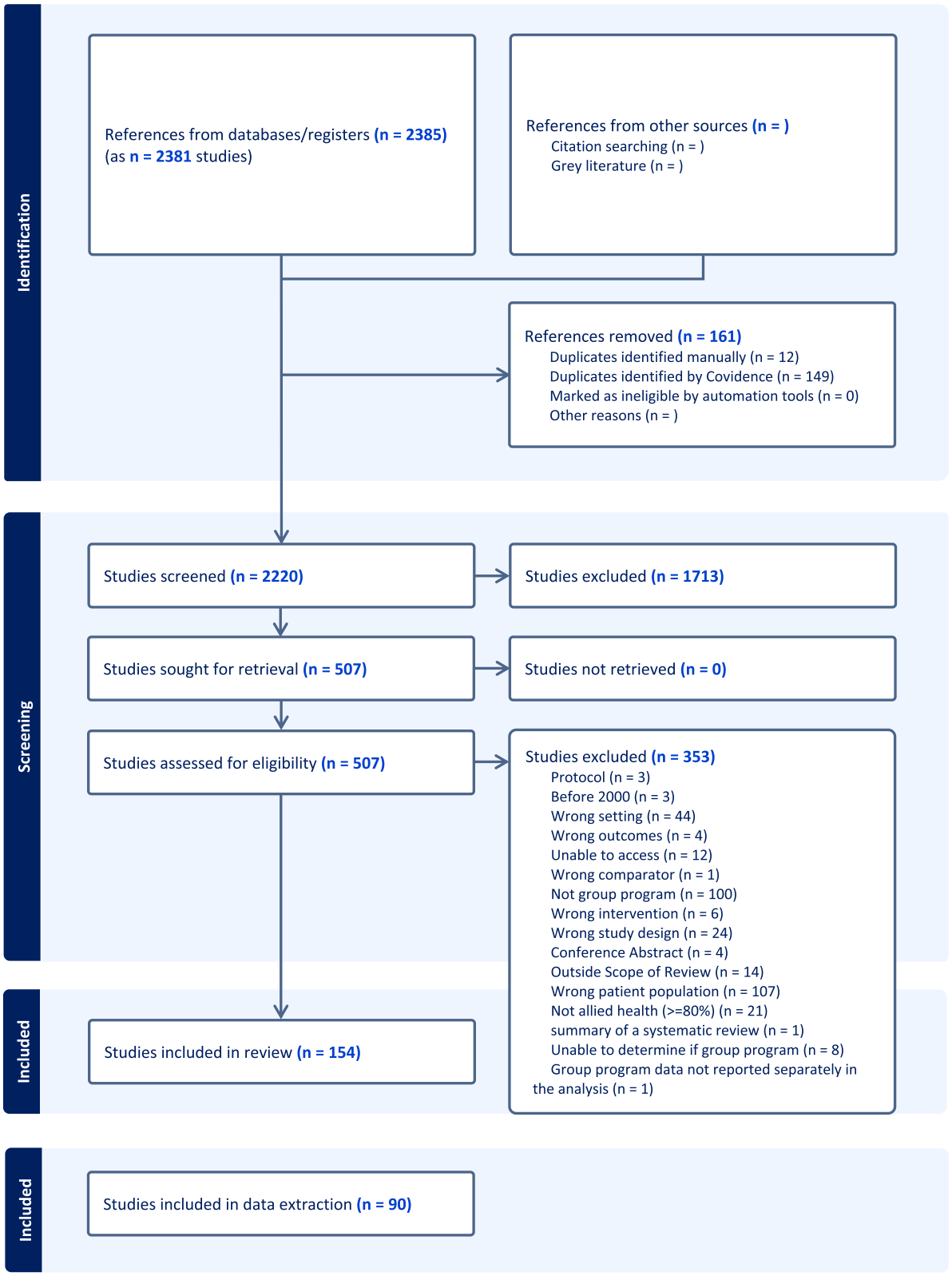

Fig. 1 PRISMA flowchart

Table 3 Summary of the number of systematic reviews identified and extracted for each chronic condition

Chronic condition	Included	Data extracted
Cancer	31	15
Cardiovascular disease	8	6
Chronic conditions (general)	3	3
Chronic kidney disease	1	1
Chronic low back pain	19[a]	12[a]
Chronic respiratory disease	13	8
Diabetes	17	14
Heart Failure	13	9
High risk of falls	19	5
Hypertension	4	4
Osteoarthritis	11[a]	6[a]
Stroke	16	8
Total	155	91

[a] One systematic review is included twice because it reports on data for both OA and chronic low back pain which accounts for the difference in total included in this table (*n*=155) and the total included in the PRISMA flowchart (*n*=154)

with chronic asthma or chronic obstructive pulmonary disease (COPD) [58, 59, 61, 64, 65]. The design of group programs and prescription of exercise is in scope for physiotherapists and exercise physiologists.

An exercise program that combined aerobic exercise and resistance training was the most effective [58, 61, 64, 65] for improving quality of life, exercise capacity and reducing hospital admissions. There was weak evidence for the effectiveness of group programs of resistance training only, compared to control of no exercise training for improving quality of life or exercise capacity [59].

There was no evidence of effectiveness for stand-alone self-management education programs in increasing quality of life or self-efficacy [62]. There was no evidence of effectiveness of relaxation programs delivered by a physiotherapist in reducing anxiety for people living with a chronic lung disease [60].

Diabetes

Data were extracted from 14 systematic reviews [66–79]. A group exercise program consisting of 45 to 60 min, 3 times per week for 12 to 16 weeks, was effective for improving glycaemic control and blood lipids (See supplementary Table 5 for details). Exercise at higher intensity was more effective compared to lower intensity exercise at improving functional outcomes, aerobic fitness and glycaemic control [66, 71–79]. The design of group programs and prescription of exercise is in scope for exercise physiologists and physiotherapists.

Two network analyses comparing different types of exercise ranked the exercise modalities in terms of their effectiveness on glycaemic control [75, 78]. The exercises with the most effect on glycaemic control were supervised combined aerobic and resistance training, followed by supervised aerobic or resistance training separately. For weight loss, supervised aerobic and resistance training, either combined or separately, were effective.

Culturally tailored group education (from 1 to 30 h in total) was effective in improving glycaemic control for people from culturally and linguistically diverse backgrounds [67, 70]. This is in scope for dietitians. There was insufficient evidence regarding whether education tailored to the prevention of foot ulceration was effective [69]. The design of group programs is in scope for podiatrists.

Lifestyle intervention including dietary advice and exercise plus at least one other lifestyle intervention showed some improvement in glycaemic control at the end of the intervention but was not sustained beyond this [68]. The design of group programs is in scope for dietitians, exercise physiologists, and physiotherapists.

Heart failure

Data were extracted from nine systematic reviews [80–88]. A group exercise program consisting of 45 to 60 min, 3 times per week for 10 to 14 weeks was effective for improving aerobic fitness and quality of life, but there was no evidence of impact on mortality [80–86, 88]. The design of group programs and prescription of exercise is in scope for physiotherapists and exercise physiologists.

High risk of falls

Data were extracted from five systematic reviews [89–94]. A group exercise program consisting of 45 to 60 min, 1 to 3 times per week for 12 to 30 weeks was effective in reducing the number of falls and rate of falls in older people who were at a high risk of falls [90–92, 94]. The design of group programs and prescription of exercise is in scope for exercise physiologists, physiotherapists, occupational therapists, and osteopaths. There was evidence that programs delivered by trained health professionals such as physiotherapists and exercise physiologists were more effective than those provided by a non-health professional (e.g. fitness trainer) [91].

A network analysis [93] indicated that a group exercise class should contain exercises that focus on: anticipatory control, dynamic stability, functional stability limits, reactive control and flexibility.

Hypertension

Data were extracted from four systematic reviews [95–98]. A group exercise program consisting of aerobic exercise, 45 min, 3 times per week, improved aerobic fitness and both systolic and diastolic blood pressure in adults with hypertension [95, 96, 98]. The design of group

programs and prescription of exercise is in scope for exercise physiologists and physiotherapists.

Osteoarthritis

Data were extracted from six systematic reviews [49, 99–103]. A group exercise program consisting of 45 to 60 min, 1 to 3 times per week for 12 to 16 weeks was effective in reducing pain and increasing physical function in people with osteoarthritis of the hip or knee.

Examples of effective exercise interventions for osteoarthritis included: prescribed gym-based resistance and aerobic exercise; prescribed walking programs; and conditioning exercises [100–103]. Group physiotherapy programs were comparable in effectiveness to individual physiotherapy programs for pain reduction and increased physical function for people with osteoarthritis [49]. The design of group programs and prescription of exercise is in scope for physiotherapists and exercise physiologists.

Stroke

Data were extracted from eight systematic reviews [104–111]. A group exercise program (or interventions that can be provided in a group setting consisting of 20 to 60 min, 1 to 3 times per week for between 12 weeks up to six months was effective in improving function in people living with chronic stroke. In particular, walking speed and endurance, balance, function, and aerobic fitness improved with a range of exercise modalities [104, 106, 109–111].

Motivational interviewing and counselling, as well as individualised physical activity counselling may increase participation in physical activity longer-term [106]. The design of group programs and prescription of exercise is in scope for physiotherapists and exercise physiologists.

Risk of bias

The quality of the evidence included in the systematic reviews was moderate as determined by the different assessment tools used. The most commonly used assessment tools were the Cochrane Risk of Bias tool and the Physiotherapy Evidence Database (PEDro) scale. The factors that influenced the overall quality scores were lack of blinding of both the participants and the clinicians delivering the intervention, which is unavoidable in randomised controlled trials of human delivered interventions. The quality of the systematic reviews as measured by the AMSTAR score ranged from 3–14 out of 16, with a mean of 9 indicating moderate quality systematic reviews [19]. The main issues identified by the AMSTAR checklist were that some authors did not include a list of excluded studies, reasons for exclusion (usually exclusions only published in Cochrane reviews) and funding sources of the included studies. If authors did not conduct a meta-analysis their review received a lower score because several AMSTAR items relate to the conduct of meta-analysis.

Discussion

The majority of the 90 included systematic reviews addressed group exercise delivered by an allied health professional as an intervention for the management of a range of long-term chronic conditions, and a small number addressed lifestyle education, dietary advice and self-management support. Overall, group exercise programs, with individualised assessment and tailored exercise prescription by a suitably qualified allied health professional were found to be effective in improving health outcomes for community dwelling adults with a broad range of chronic conditions. Lifestyle education and support for people with type-2 diabetes was effective, especially for adults from culturally and linguistically diverse backgrounds.

Overall, the findings presented in Table 1 support group exercise of 45 to 60 min per session, two to three times per week for 12 weeks for community dwelling adults experiencing a range of long-term conditions. These findings support published Australian clinical practice guidelines that recommend prescribed exercise as a key component of management, including the COPD-X guidelines [112], Royal Australian College of General Practitioners guidelines for arthritis [113], Australian Commission on Safety and Quality in Health Care clinical standard for low back pain [114], falls prevention [115] and heart failure [116]. For many chronic conditions this type of intervention has been provided in the hospital outpatient setting, but uptake and attendance is often low [117]. In addition, the high service demands on the secondary care system results in many people referred to a group exercise program being placed on a long waitlist. Options for referral in the primary health care setting have been limited and expensive unless a person has access to private health insurance [118–120].

A key feature of all the group exercise programs was that each patient had a baseline assessment so that the exercise program could be prescribed and progressed according to their symptoms. This requires the input of health professionals who are trained in exercise assessment and prescription, and understand the impact of co-morbidities on the person's ability to exercise safely at the intensity required. This is in contrast to more general group exercise programs delivered in the community which are still beneficial but not targeted specifically to address a person's impairments. Those credentialed to provide exercise programs for people with chronic conditions in primary care are physiotherapists and accredited exercise physiologists. Once a patient has completed the

group program and increased their exercise capacity, in most cases they should be encouraged, and ideally supported, to continue to exercise through suitable community-based options, for example Lungs in Action, Heart Foundation programs, or community falls prevention exercise programs.

Group programs delivering lifestyle education and support for people with type-2 diabetes, especially people from culturally and linguistically diverse backgrounds were found to improve patient outcomes. Whilst not explored in this umbrella review, research has shown that to facilitate patient engagement targeted strategies are an essential component of group programs to develop patient self-efficacy [121]. These strategies include shared decision making with the patient, using techniques such as motivational interviewing and counselling to identify goals and work with patients to overcome barriers to lifestyle modification in addition to the benefits of group settings. Furthermore, those programs developed for people from culturally and linguistically diverse backgrounds are more effective at improving HbA1c if they are culturally appropriate for the community [122]. There is limited evidence to support extension to people with chronic kidney disease [45].

Some of the included reviews evaluated the evidence for other forms of exercise such as Pilates, yoga and traditional Chinese exercises. These interventions can be provided by exercise physiologists and physiotherapists but are often provided by instructors who do not have an allied health qualification. These may be suitable maintenance options for patients once they have completed a prescribed group exercise program.

A strength of this review is that we set out to examine extensive evidence for group programs applicable to delivery by allied health clinicians in the community. However, a limitation is that the included reviews primarily addressed exercise interventions and did not always address the effectiveness of a group allied health intervention in the community and some reviews were excluded as data for inpatient and community programs could not be separated. Despite this, the results of the reviews addressing group exercise interventions are broadly consistent across the diverse range of conditions included. The narrative synthesis approach used does not allow us to explore the effect of potential confounding variables on the outcomes, further complicated by the fact that there was no consistency in the reporting of these variables in the included systematic reviews. This review only focused on interventions for adults with chronic conditions and interventions for people with mental health conditions were excluded because in the Australian system they are funded be different Medicare funding streams. A further limitation is that the database search was conducted in 2022 and there has been a considerable time lapse prior to publication which has reduced the currency of the information. The authors are currently working on an update of the umbrella review. However, the findings of the current review address a gap in the knowledge base concerning the effectiveness of group programs. There were also a number of studies that were included in multiple systematic reviews, where possible reviews were excluded if the majority of studies had been included in a more recent review, but some studies would still have been included in multiple reviews. There were very few systematic reviews included that reported the costs of the interventions, this information is important for policy makes with competing priorities to determine how to allocate scarce resources.

The interventions described in the included systematic reviews are complex interventions. They comprise multiple components such as exercises, education, interventions delivered by different types of health professionals, patient groups and in a range of settings and this context impacts effectiveness. There are frameworks for describing complex interventions including the MRC Complex Intervention Framework [123] and TIdieR checklist [124]. These frameworks are used when reporting the results of randomised controlled trials but less so when reporting the interventions in systematic reviews [125]. A limitation of this umbrella review is that the group allied health interventions summarised could not be described in detail using one of these frameworks without going back to the authors of the original randomised controlled trials. There is a need to better report complex interventions in systematic reviews of complex interventions.

In summary, this systematic review provides a comprehensive summary of group interventions, that could be delivered by allied health for a broad range of chronic conditions commonly managed in primary care. In Australia, group exercise programs, with individualised assessment and tailored exercise prescription by a suitably qualified allied health professional, are currently only supported by an MBS item number for people with, or at risk of, type-2 diabetes provided by exercise physiologists or dietitians. Extending this for people with cancer, cardiovascular disease, chronic low back pain, chronic lung disease, heart failure, high risk of falls, hypertension, osteoarthritis and chronic stroke and to include a wider range of allied health professionals is likely to realise health benefits. A key feature of the group exercise programs is that the person undergoes a suitable baseline assessment, and the exercise is prescribed according to the findings of the assessment and progressed during the program.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12875-024-02570-7.

Supplementary Material 1.

Supplementary Material 2.

Supplementary Material 3.

Supplementary Material 4.

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SD: conceptualisation, methodology, analysis, investigation, writing - original draft. WK: methodology, analysis, investigation, writing - review and editing. JA: conceptualisation, methodology, analysis, investigation, writing - review and editing. LH: conceptualisation, methodology, analysis, investigation, writing - review and editing. GN: conceptualisation, methodology, analysis, investigation, writing - review and editing. KR: conceptualisation, methodology, analysis, investigation, writing - review and editing. CS: conceptualisation, methodology, analysis, writing - review and editing. AW: conceptualisation, methodology, validation, investigation, writing - review and editing.

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Data availability
Data is provided within the manuscript or supplementary information files.

Declarations

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This is a systematic review and Human Research Ethics Approval was not required.

Consent for publication
This is a systematic review and no participants were recruited.

Competing interests
The authors declare no competing interests.

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References

1. Australian Bureau of Statistics. Over three quarters of Australians have a long-term health condition [Media Release]. 2022 [updated 21/03/2022. Available from: https://www.abs.gov.au/media-centre/media-releases/over-three-quarters-australians-have-long-term-health-condition.
2. Australian Institute of Health and Welfare. Australian burden of disease study: impact and causes of illness and death in Australia 2018. Canberra: AIHW; 2021. Contract No.: BOD 29.
3. Australian Commission on Safety and Quality in Health Care and Australian Institute of Health and Welfare. The Fourth Australian Atlas of Healthcare Variation. Sydney: ACSQHC; 2021.
4. Harrison C, Henderson J, Miller G, Britt H. The prevalence of diagnosed chronic conditions and multimorbidity in Australia: a method for estimating population prevalence from general practice patient encounter data. PLoS ONE. 2017;12(3):e0172935.
5. Britt H, Harrison C, Miller G, Knox S. Prevalence and patterns of multimorbidity in Australia. MJA. 2008;189(2):72–7.
6. Australian Government Department of Health. History of key MBS primary care initiatives 1999-2013. 2014. [updated 03 April 2014. Available from: https://www1.health.gov.au/internet/main/publishing.nsf/Content/mbsprimarycare-History.
7. Harris MF, Harris-Roxas B, Knight AW. Care of patients with chronic disease: achievements in Australia over the past decade. Med J Aust. 2018;209(2):55–7.
8. Welberry H, Barr ML, Comino EJ, Harris-Roxas BF, Harris E, Harris MF. Increasing use of general practice management and team care arrangements over time in New South Wales. Australia Aust J Prim Health. 2019;25(2):168–75.
9. Cant RP, Foster MM. Investing in big ideas: utilisation and cost of medicare allied health services in Australia under the chronic disease management initiative in primary care. Aust Health Rev. 2011;35(4):468–74.
10. Barr M, Welberry H, Comino E, Harris-Roxas B, Harris E, Lloyd J, et al. Understanding the use and impact of allied health services for people with chronic health conditions in Central and Eastern Sydney, Australia: a five-year longitudinal analysis. Prim Health Care Res Dev. 2019;20:e141.
11. Australian Government Services Australia. Medicare item reports services Australia - statistics - item reports. 2022. Available from: http://medicarestatistics.humanservices.gov.au/statistics/mbs_item.jsp.
12. Australian Institute of Health and Welfare. Use of Medicare chronic disease management items by patients with long-term health conditions. Canberra: AIHW, Australian Government; 2022.
13. Belbasis L, Bellou V, Ioannidis JPA. Conducting umbrella reviews. BMJ Med. 2022;1:e000071. https://doi.org/10.1136/bmjmed-2021-000071.
14. Gates M, Gates A, Pieper D, Fernandes RM, Tricco AC, Moher D, et al. Reporting guideline for overviews of reviews of healthcare interventions: development of the PRIOR statement. BMJ. 2022;378: e070849.
15. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ. 2021;372:n71. https://doi.org/10.1136/bmj.n71.
16. Nussbaumer-Streit B, Klerings I, Dobrescu AI, Persad E, Stevens A, Garritty C, et al. Excluding non-English publications from evidence-syntheses did not change conclusions: a meta-epidemiological study. J Clin Epidemiol. 2020;118:42–54.
17. Organization WH. International classification of functioning, disability, and health : ICF. Geneva: World Health Organization; 2001.
18. Australian Government Department of Health and Ageing. Better Access initiative: Commonwealth of Austalia; 2023 [updated 1 June 2023. Available from: https://www.health.gov.au/our-work/better-access-initiative?utm_source=health.gov.au&utm_medium=callout-auto-custom&utm_campaign=digital_transformation.
19. Shea BJ, Reeves BC, Wells G, Thuku M, Hamel C, Moran J, et al. AMSTAR 2: a critical appraisal tool for systematic reviews that include randomised or non-randomised studies of healthcare interventions, or both. BMJ. 2017;358: j4008.
20. Aromataris E, Fernandez R, Godfrey CM, Holly C, Khalil H, Tungpunkom P. Summarizing systematic reviews: methodological development, conduct and reporting of an umbrella review approach. JBI Evidence Implement. 2015;13(3):132–40.
21. Lopez P, Taaffe DR, Newton RU, Galvao DA. Resistance exercise dosage in men with prostate cancer: systematic review, meta-analysis, and meta-regression. Med Sci Sports Exerc. 2021;53(3):459–69.
22. Lavin-Perez AM, Collado-Mateo D, Mayo X, Humphreys L, Liguori G, James Copeland R, et al. High-intensity exercise to improve

cardiorespiratory fitness in cancer patients and survivors: a systematic review and meta-analysis. Scand J Med Sci Sports. 2021;31(2):265–94.
23. Clifford B, Koizumi S, Wewege MA, Leake HB, Ha L, Macdonald E, et al. The effect of resistance training on body composition during and after cancer treatment: a systematic review and meta-analysis. Sports Med (Auckland, NZ). 2021;51(12):2527–46.
24. Ma R-C, Yin Y-Y, Liu X, Wang Y-Q, Xie J. Effect of exercise interventions on quality of life in patients with lung cancer: a systematic review of randomized controlled trials. Oncol Nurs Forum. 2020;47(3):E58–72.
25. Liu L, Tan H, Yu S, Yin H, Baxter GD. The effectiveness of tai chi in breast cancer patients: a systematic review and meta-analysis. Complement Ther Clin Pract. 2020;38:101078.
26. Duan L, Xu Y, Li M. Effects of mind-body exercise in cancer survivors: a systematic review and meta-analysis. Evid Based Complement Alternat Med. 2020;2020:7607161.
27. Campbell KL, Zadravec K, Bland KA, Chesley E, Wolf F, Janelsins MC. The effect of exercise on cancer-related cognitive impairment and applications for physical therapy: systematic review of randomized controlled trials. Phys Ther. 2020;100(3):523–42.
28. Fang YY, Hung CT, Chan JC, Huang SM, Lee YH. Meta-analysis: Exercise intervention for sleep problems in cancer patients. Eur J Cancer Care (Engl). 2019;28(5):e13131. https://doi.org/10.1111/ecc.13131. Epub 2019 Jul 28.
29. Sommer MS, Staerkind MEB, Christensen J, Vibe-Petersen J, Larsen KR, Holst Pedersen J, et al. Effect of postsurgical rehabilitation programmes in patients operated for lung cancer: a systematic review and meta-analysis. J Rehabil Med. 2018;50(3):236–45.
30. Singh B, Spence RR, Steele ML, Sandler CX, Peake JM, Hayes SC. A systematic review and meta-analysis of the safety, feasibility, and effect of exercise in women with stage II+ breast cancer. Arch Phys Med Rehabil. 2018;99(12):2621–36.
31. Lahart IM, Metsios GS, Nevill AM, Carmichael AR. Physical activity for women with breast cancer after adjuvant therapy. Cochrane Database Syst Rev. 2018;1(1):CD011292. https://doi.org/10.1002/14651858.CD011292.pub2.
32. Dalla Via J, Daly RM, Fraser SF. The effect of exercise on bone mineral density in adult cancer survivors: a systematic review and meta-analysis. Osteoporosis international : a journal established as result of cooperation between the European Foundation for Osteoporosis and the National Osteoporosis Foundation of the USA. 2018;29(2):287–303.
33. Meneses-Echavez JF, Gonzalez-Jimenez E, Ramirez-Velez R. Effects of supervised multimodal exercise interventions on cancer-related fatigue: systematic review and meta-analysis of randomized controlled trials. Biomed Res Int. 2015;2015: 328636.
34. Grande AJ, Silva V, Sawaris Neto L, Teixeira Basmage JP, Peccin MS, Maddocks M. Exercise for cancer cachexia in adults. Cochrane Database Syst Rev. 2021;3(3):CD010804. https://doi.org/10.1002/14651858.CD010804.pub3.
35. Brown JC, Huedo-Medina TB, Pescatello LS, Ryan SM, Pescatello SM, Moker E, et al. The efficacy of exercise in reducing depressive symptoms among cancer survivors: a meta-analysis. PLoS ONE. 2012;7(1): e30955.
36. Dalal HM, Zawada A, Jolly K, Moxham T, Taylor RS. Home based versus centre based cardiac rehabilitation: cochrane systematic review and meta-analysis. BMJ (Clinical research ed). 2010;340: b5631.
37. Chen Y-C, Tsai J-C, Liou Y-M, Chan P. Effectiveness of endurance exercise training in patients with coronary artery disease: a meta-analysis of randomised controlled trials. Eur Cardiovasc Nurs. 2017;16(5):397–408.
38. Cugusi L, Manca A, Yeo TJ, Bassareo PP, Mercuro G, Kaski JC. Nordic walking for individuals with cardiovascular disease: a systematic review and meta-analysis of randomized controlled trials. Eur J Prev Cardiol. 2017;24(18):1938–55.
39. Pengelly J, Pengelly M, Lin K-Y, Royse C, Karri R, Royse A, et al. Exercise Parameters and outcome measures used in cardiac rehabilitation programs following median sternotomy in the elderly: a systematic review and meta-analysis. Heart Lung Circ. 2019;28(10):1560–70.
40. Lee J, Lee R, Stone AJ. Combined aerobic and resistance training for peak oxygen uptake, muscle strength, and hypertrophy after coronary artery disease: a systematic review and meta-analysis. J Cardiovasc Transl Res. 2020;13(4):601–11.
41. Chair SY, Zou H, Cao X. Effects of exercise therapy for adults with coronary heart disease: a systematic review and meta-analysis of randomized controlled trials. J Cardiovasc Nurs. 2021;36(1):56–77.
42. Quiñones AR, Richardson J, Freeman M, Fu R, O'Neil ME, Motu'apuaka M, et al. Educational group visits for the management of chronic health conditions: a systematic review. Patient Educ Couns. 2014;95(1):3–29.
43. Miranda S, Marques A. Pilates in noncommunicable diseases: a systematic review of its effects. Complement Ther Med. 2018;39:114–30.
44. Keogh JWL, O'Reilly S, O'Brien E, Morrison S, Kavanagh JJ. Can resistance training improve upper limb postural tremor, force steadiness and dexterity in older adults? A systematic review. Sports Med (Auckland, NZ). 2019;49(8):1199–216.
45. Brown TJ, Williams H, Mafrici B, Jackson HS, Johansson L, Willingham F, et al. Dietary interventions with dietitian involvement in adults with chronic kidney disease: a systematic review. J Human Nutr Dietet. 2021;34(4):747–57.
46. Hayden JA, van Tulder MW, Tomlinson G. Systematic review: strategies for using exercise therapy to improve outcomes in chronic low back pain. Ann Intern Med. 2005;142(9):776–85.
47. Choi BK, Verbeek JH, Tam WW, Jiang JY. Exercises for prevention of recurrences of low-back pain. Cochrane Database Syst Rev. 2010;2010(1):CD006555. https://doi.org/10.1002/14651858.CD006555.pub2.
48. Ravenek MJ, Hughes ID, Ivanovich N, Tyrer K, Desrochers C, Klinger L, et al. A systematic review of multidisciplinary outcomes in the management of chronic low back pain. Work. 2010;35(3):349–67.
49. Toomey E, Currie-Murphy L, Matthews J, Hurley D. The effectiveness of physiotherapist-delivered group education and exercise interventions to promote self-management for people with osteoarthritis and chronic low back pain: rapid review Part I. Man Ther. 2015;20(2):265–86.
50. Yamato TP, Maher CG, Saragiotto BT, Hancock MJ, Ostelo WJGR, Cabral MNC, et al. Pilates for low back pain. Spine. 2015;41(12):1013–23.
51. Parreira P, Heymans MW, van Tulder MW, Esmail R, Koes BW, Poquet N, et al. Back Schools for chronic non-specific low back pain. Cochrane Database Syst Rev. 2017;8:CD011674.
52. Wewege MA, Booth J, Parmenter BJ. Aerobic vs. resistance exercise for chronic non-specific low back pain: a systematic review and meta-analysis. J Back Musculosk Rehab. 2018;31(5):889–99.
53. van Erp RMA, Huijnen IPJ, Jakobs MLG, Kleijnen J, Smeets RJEM. Effectiveness of primary care interventions using a biopsychosocial approach in chronic low back pain: a systematic review. Pain Pract. 2019;19(2):224–41.
54. Zhang Q, Jiang S, Young L, Li F. The effectiveness of group-based physiotherapy-led behavioral psychological interventions on adults with chronic low back pain: a systematic review and meta-analysis. Am J Phys Med Rehabil. 2019;98(3):215–25.
55. Domingues de Freitas C, Costa DA, Junior NC, Civile VT. Effects of the pilates method on kinesiophobia associated with chronic non-specific low back pain: Systematic review and meta-analysis. J Bodywork Mov Ther. 2020;24(3):300–6.
56. Owen PJ, Miller CT, Mundell NL, Verswijveren SJ, Tagliaferri SD, Brisby H, et al. Which specific modes of exercise training are most effective for treating low back pain? Network meta-analysis. Br J Sports Med. 2020;54(21):1279.
57. Hayden JA, Ellis J, Ogilvie R, Stewart SA, Bagg MK, Stanojevic S, et al. Some types of exercise are more effective than others in people with chronic low back pain: a network meta-analysis. J Physiother. 2021;67(4):252–62.
58. COPD Working Group. Pulmonary rehabilitation for patients with chronic pulmonary disease (COPD): an evidence-based analysis. Ontario Health Technol Assess Ser. 2012;12(6):1–75.
59. Liao W-H, Chen J-W, Chen X, Lin L, Yan H-Y, Zhou Y-Q, et al. Impact of resistance training in subjects with COPD: a systematic review and meta-analysis. Respir Care. 2015;60(8):1130–45.
60. Volpato E, Banfi P, Rogers SM, Pagnini F, Qidwai W. Relaxation techniques for people with chronic obstructive pulmonary disease: a systematic review and a meta-analysis. Evid Based Complement Alternat Med. 2015;2015: 628365.
61. Jenkins AR, Gowler H, Curtis F, Holden NS, Bridle C, Jones AW. Efficacy of supervised maintenance exercise following pulmonary rehabilitation

on health care use: a systematic review and meta-analysis. Int J Chron Obstruct Pulmon Dis. 2018;13:257–73.
62. Kelly C, Grundy S, Lynes D, Evans JWD, Gudur S, Milan SJ, et al. Self-management for bronchiectasis. Cochrane Databse Syst Rev. 2018;2:1465–858.
63. Li Z, Liu S, Wang L, Smith L. Mind-Body exercise for anxiety and depression in COPD patients: a systematic review and meta-analysis. Int J Environ Res Public Health. 2019;17(1):22.
64. Li N, Li P, Lu Y, Wang Z, Li J, Liu X, et al. Effects of resistance training on exercise capacity in elderly patients with chronic obstructive pulmonary disease: a meta-analysis and systematic review. Aging Clin Exp Res. 2020;32(10):1911–22.
65. Feng Z, Wang J, Xie Y, Li J. Effects of exercise-based pulmonary rehabilitation on adults with asthma: a systematic review and meta-analysis. Respir Res. 2021;22(1):33.
66. Umpierre D, Ribeiro PAB, Kramer CK, Leitao CB, Zucatti ATN, Azevedo MJ, et al. Physical activity advice only or structured exercise training and association with HbA1c levels in type 2 diabetes: a systematic review and meta-analysis. JAMA. 2011;305(17):1790–9.
67. Nam S, Janson SL, Stotts NA, Chesla C, Kroon L. Effect of culturally tailored diabetes education in ethnic minorities with type 2 diabetes: a meta-analysis. J Cardiovasc Nurs. 2012;27(6):505–18.
68. Schellenberg ES, Dryden DM, Vandermeer B, Ha C, Korownyk C. Lifestyle interventions for patients with and at risk for type 2 diabetes: a systematic review and meta-analysis. Ann Intern Med. 2013;159(8):543–51.
69. Dorresteijn JA, Kriegsman DM, Assendelft WJ, Valk GD. Patient education for preventing diabetic foot ulceration. Cochrane Database Syst Rev. 2014;2014(12):CD001488. https://doi.org/10.1002/14651858.CD001488.pub5.
70. Ahmad Sharoni SK, Minhat HS, Mohd Zulkefli NA, Baharom A. Health education programmes to improve foot self-care practices and foot problems among older people with diabetes: a systematic review. Int J Older People Nurs. 2016;11(3):214–39.
71. Zou Z, Cai W, Cai M, Xiao M, Wang Z. Influence of the intervention of exercise on obese type II diabetes mellitus: a meta-analysis. Prim Care Diabetes. 2016;10(3):186–201.
72. Albalawi H, Coulter E, Ghouri N, Paul L. The effectiveness of structured exercise in the south Asian population with type 2 diabetes: a systematic review. Phys Sportsmed. 2017;45(4):408–17.
73. Sabag A, Way KL, Keating SE, Sultana RN, O'Connor HT, Baker MK, et al. Exercise and ectopic fat in type 2 diabetes: a systematic review and meta-analysis. Diabetes Metab. 2017;43(3):195–210.
74. De Nardi AT, Tolves T, Lenzi TL, Signori LU, Silva AMVd. High-intensity interval training versus continuous training on physiological and metabolic variables in prediabetes and type 2 diabetes: a meta-analysis. Diab Res Clin Pract. 2018;137:149–59.
75. Pan B, Ge L, Xun Y-Q, Chen Y-J, Gao C-Y, Han X, et al. Exercise training modalities in patients with type 2 diabetes mellitus: a systematic review and network meta-analysis. Int J Behav Nutr Phys Act. 2018;15(1):72.
76. Sampath Kumar A, Maiya AG, Shastry BA, Vaishali K, Ravishankar N, Hazari A, et al. Exercise and insulin resistance in type 2 diabetes mellitus: a systematic review and meta-analysis. Ann Phys Rehabil Med. 2019;62(2):98–103.
77. Janssen SM, Connelly DM. The effects of exercise interventions on physical function tests and glycemic control in adults with type 2 diabetes: a systematic review. J Bodyw Mov Ther. 2021;28:283–93.
78. Mannucci E, Bonifazi A, Monami M. Comparison between different types of exercise training in patients with type 2 diabetes mellitus: a systematic review and network metanalysis of randomized controlled trials. Nutr Metab Cardiovasc Dis. 2021;31(7):1985–92.
79. Jansson AK, Chan LX, Lubans DR, Duncan MJ, Plotnikoff RC. Effect of resistance training on HbA1c in adults with type 2 diabetes mellitus and the moderating effect of changes in muscular strength: a systematic review and meta-analysis. BMJ Open Diabetes Res Care. 2022;10(2):e002595.
80. Hwang C-L, Chien C-L, Wu Y-T. Resistance training increases 6-minute walk distance in people with chronic heart failure: a systematic review. J Physiother. 2010;56(2):87–96.
81. Chen YM, Li Y. Safety and efficacy of exercise training in elderly heart failure patients: a systematic review and meta-analysis. Int J Clin Pract. 2013;67(11):1192–8.
82. Dieberg G, Ismail H, Giallauria F, Smart NA. Clinical outcomes and cardiovascular responses to exercise training in heart failure patients with preserved ejection fraction: a systematic review and meta-analysis. J Appl Physiol. 2015;119(3):726–33.
83. Palmer K, Bowles K-A, Paton M, Jepson M, Lane R. Chronic heart failure and exercise rehabilitation: a systematic review and meta-analysis. Arch Phys Med Rehabil. 2018;99(12):2570–82.
84. Pattyn N, Beulque R, Cornelissen V. Aerobic interval vs. continuous training in patients with coronary artery disease or heart failure: an updated systematic review and meta-analysis with a focus on secondary outcomes. Sports Med (Auckland, NZ). 2018;48(5):1189–205.
85. Gomes-Neto M, Duraes AR, Conceicao LSR, Roever L, Liu T, Tse G, et al. Effect of aerobic exercise on peak oxygen consumption, VE/VCO2 Slope, and health-related quality of life in patients with heart failure with preserved left ventricular ejection fraction: a systematic review and meta-analysis. Curr Atheroscler Rep. 2019;21(11):45.
86. Bjarnason-Wehrens B, Nebel R, Jensen K, Hackbusch M, Grilli M, Gielen S, et al. Exercise-based cardiac rehabilitation in patients with reduced left ventricular ejection fraction: The Cardiac Rehabilitation Outcome Study in Heart Failure (CROS-HF): a systematic review and meta-analysis. Eur J Prev Cardiol. 2020;27(9):929–52.
87. Liao Y, Wen H, Ge S, Zhong W, Liang Y, Yu L, et al. Effects of traditional Chinese exercise in patients with chronic heart failure: a systematic review and meta-analysis. Eur J Integ Med. 2020;40:101218.
88. Guo R, Wen Y, Xu Y, Jia R, Zou S, Lu S, et al. The impact of exercise training for chronic heart failure patients with cardiac resynchronization therapy: A systematic review and meta-analysis. Medicine. 2021;100(13): e25128.
89. Barker AL, Bird ML, Talevski J. Effect of pilates exercise for improving balance in older adults: a systematic review with meta-analysis. Arch Phys Med Rehabil. 2015;96(4):715–23.
90. Gu Y, Dennis SM. Are falls prevention programs effective at reducing the risk factors for falls in people with type-2 diabetes mellitus and peripheral neuropathy: a systematic review with narrative synthesis. J Diabetes Complications. 2017;31(2):504–16.
91. Sherrington C, Fairhall N, Wallbank G, Tiedemann A, Michaleff ZA, Howard K, et al. Exercise for preventing falls in older people living in the community: an abridged Cochrane systematic review. Br J Sports Med. 2020;54(15):885–91.
92. Sherrington C, Fairhall NJ, Wallbank GK, Tiedemann A, Michaleff ZA, Howard K, Clemson L, Hopewell S, Lamb SE. Exercise for preventing falls in older people living in the community. Cochrane Database Syst Rev. 2019;1(1):CD012424. https://doi.org/10.1002/14651858.CD012424.pub2.
93. Sibley KM, Thomas SM, Veroniki AA, Rodrigues M, Hamid JS, Lachance CC, et al. Comparative effectiveness of exercise interventions for preventing falls in older adults: a secondary analysis of a systematic review with network meta-analysis. Exp Gerontol. 2021;143: 111151.
94. Wang Q, Jiang X, Shen Y, Yao P, Chen J, Zhou Y, et al. Effectiveness of exercise intervention on fall-related fractures in older adults: a systematic review and meta-analysis of randomized controlled trials. BMC Geriatr. 2020;20(1):322.
95. Sardeli AV, Griffth GJ, Dos Santos MVMA, Ito MSR, Chacon-Mikahil MPT. The effects of exercise training on hypertensive older adults: an umbrella meta-analysis. Hypertens Res. 2021;44(11):1434–43.
96. Park S, Kim J, Lee J. Effects of exercise intervention on adults with both hypertension and type 2 diabetes mellitus: a systematic review and meta-analysis. J Cardiovasc Nurs. 2021;36(1):23–33.
97. Pan X, Tian L, Yang F, Sun J, Li X, An N, et al. Tai Chi as a therapy of traditional Chinese medicine on reducing blood pressure: a systematic review of randomized controlled trials. Evid Based Complement Alternat Med. 2021;2021:4094325.
98. Sardeli AV, Griffith GJ, Dos Santos MVMA, Ito MSR, Nadruz W, Chacon-Mikahil MPT. Do baseline blood pressure and type of exercise influence level of reduction induced by training in hypertensive older adults? A meta-analysis of controlled trials. Exp Gerontol. 2020;140: 111052.

99. Zeng ZP, Liu YB, Fang J, Liu Y, Luo J, Yang M. Effects of Baduanjin exercise for knee osteoarthritis: a systematic review and meta-analysis. Complement Ther Med. 2020;48:102279.
100. Fernandopulle S, Perry M, Manlapaz D, Jayakaran P. Effect of land-based generic physical activity interventions on pain, physical function, and physical performance in hip and knee osteoarthritis: a systematic review and meta-analysis. Am J Phys Med Rehabil. 2017;96(11):773–92.
101. Regnaux JP, Lefevre-Colau MM, Trinquart L, Nguyen C, Boutron I, Brosseau L, Ravaud P. High-intensity versus lowintensity physical activity or exercise in people with hip or knee osteoarthritis. Cochrane Database Syst Rev. 2015;2015(10):CD010203. https://doi.org/10.1002/14651858.CD010203.pub2.
102. Fransen M, McConnell S, Harmer AR, Van der Esch M, Simic M, Bennell KL. Exercise for osteoarthritis of the knee. Cochrane Database Syst Rev. 2015(1):CD004376. https://doi.org/10.1002/14651858.CD004376.pub3.
103. Fransen M, McConnell S, Hernandez-Molina G, Reichenbach S. Exercise for osteoarthritis of the hip. Cochrane Database Syst Rev. 2014(4):CD007912. https://doi.org/10.1002/14651858.CD007912.pub2.
104. Mehta S, Pereira S, Viana R, Mays R, McIntyre A, Janzen S, et al. Resistance training for gait speed and total distance walked during the chronic stage of stroke: a meta-analysis. Top Stroke Rehabil. 2012;19(6):471–8.
105. Dorstyn D, Roberts R, Kneebone I, Kennedy P, Lieu C. Systematic review of leisure therapy and its effectiveness in managing functional outcomes in stroke rehabilitation. Top Stroke Rehabil. 2014;21(1):40–51.
106. Morris JH, MacGillivray S, McFarlane S. Interventions to promote long-term participation in physical activity after stroke: a systematic review of the literature. Arch Phys Med Rehabil. 2014;95(5):956–67.
107. English C, Hillier SL, Lynch EA. Circuit class therapy for improving mobility after stroke. Cochrane Database Syst Rev. 2017;6:CD007513.
108. Zou L, Sasaki JE, Zeng N, Wang C, Sun L. A systematic review with meta-analysis of mindful exercises on rehabilitative outcomes among poststroke patients. Arch Phys Med Rehabil. 2018;99(11):2355–64.
109. Church G, Parker J, Powell L, Mawson S. The effectiveness of group exercise for improving activity and participation in adult stroke survivors: a systematic review. Physiotherapy. 2019;105(4):399–411.
110. Pogrebnoy D, Dennett A. Exercise programs delivered according to guidelines improve mobility in people with stroke: a systematic review and meta-analysis. Arch Phys Med Rehabil. 2020;101(1):154–65.
111. Saunders DH, Sanderson M, Hayes S, Johnson L, Kramer S, Carter DD, et al. Physical fitness training for stroke patients. Cochrane Database Syst Rev. 2020;3:CD003316.
112. Dabscheck E, George J, Hermann K, McDonald CF, McDonald VM, McNamara R, et al. COPD-X Australian guidelines for the diagnosis and management of chronic obstructive pulmonary disease: 2022 update. Med J Aust. 2022;217(8):415–23.
113. The Royal Australian College of General Practitioners. Guideline for the management of knee and hip osteoarthritis. East Melbourne, Vic: RACGP; 2018.
114. Australian Commission on Safety and Quality in Health Care, and Australian Institute of Health and Welfare. Low Back Pain Clinical Care Standard. Sydney: ACSQHC; 2022.
115. Australian Commission on Safety and Quality in Health Care. Preventing falls and harm from falls in older people. Canberra: Commonwealth of Australia; 2009.
116. Atherton JJ, Sindone A, De Pasquale CG, Driscoll A, MacDonald PS, Hopper I, et al. National heart foundation of australia and cardiac society of Australia and New Zealand: guidelines for the prevention, detection, and management of heart failure in Australia 2018. Heart Lung Circ. 2018;27(10):1123–208.
117. Early F, Wellwood I, Kuhn I, Deaton C, Fuld J. Interventions to increase referral and uptake to pulmonary rehabilitation in people with COPD: a systematic review. Int J Chron Obstruct Pulmon Dis. 2018;13:3571–86.
118. Brand CA, Harrison C, Tropea J, Hinman RS, Britt H, Bennell K. Management of osteoarthritis in general practice in Australia. Arthritis Care Res. 2014;66(4):551–8.
119. Dennis S, Watts I, Pan Y, Britt H. Who do Australian general practitioners refer to physiotherapy? Aust Fam Physician. 2017;46:421–6.
120. Dennis S, Watts I, Pan Y, Britt H. The likelihood of general practitioners referring patients to physiotherapists is low for some health problems: secondary analysis of the Bettering the Evaluation and Care of Health (BEACH) observational study. J Physiother. 2018;64(3):178–82.
121. Rodriguez HP, Rubio K, Miller-Rosales C, Wood AJ. US practice adoption of patient-engagement strategies and spending for adults with diabetes and cardiovascular disease. Health Aff Sch. 2023;1(1):qxad021.
122. Creamer J, Attridge M, Ramsden M, Cannings-John R, Hawthorne K. Culturally appropriate health education for type 2 diabetes in ethnic minority groups: an updated Cochrane Review of randomized controlled trials. Diabet Med. 2016;33(2):169–83.
123. Skivington K, Matthews L, Simpson SA, Craig P, Baird J, Blazeby JM, et al. A new framework for developing and evaluating complex interventions: update of medical research council guidance. BMJ. 2021;374:n2061.
124. Hoffmann TC, Glasziou PP, Boutron I, Milne R, Perera R, Moher D, et al. Better reporting of interventions: template for intervention description and replication (TIDieR) checklist and guide. BMJ. 2014;348:g1687.
125. Hoffmann TC, Oxman AD, Ioannidis JP, Moher D, Lasserson TJ, Tovey DI, et al. Enhancing the usability of systematic reviews by improving the consideration and description of interventions. BMJ. 2017;358:j2998.

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