Review

Equity in Physical Activity Interventions to Promote Health: A Scoping Review of Trials

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Equity in Physical Activity Interventions to Promote Health: A Scoping Review of Trials

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Abstract

Physical activity (PA) improves health and well-being, and helps prevent long-term conditions. Yet opportunities to be active are not evenly distributed, with social, economic, and environmental disadvantages constraining access to PA among populations who may benefit most. Since the extent to which PA interventions incorporate equity considerations remains insufficiently characterised, risking exacerbation of health inequity, this scoping review aims to synthesise trial evidence on interventions of PA to improve health outcomes in populations at risk of health inequity as defined by the PROGRESS-Plus and CORE20PLUS5 frameworks. PubMed, Web of Science, and Scopus were searched for randomised controlled trials of PA interventions with at-risk populations published between 2020 and 2025. Study characteristics, intervention design, and equity-relevant factors were extracted. Two reviewers independently screened and synthesised findings narratively. Results indicate that of 2,480 articles identified, 23 trials met eligibility criteria. Most reported positive effect of PA on health outcomes amongst at-risk populations, including weight loss, improved motor skills and gait speed, reduced anxiety and PTSD, and fewer fractures or hospital visits. Interventions commonly included strength and balance training, group exercise, stretching, and aerobic fitness. UK-based studies and subgroup analyses by e.g. sex or age were largely absent, and many populations at risk of health inequity were underrepresented. Explicit equity considerations throughout design, implementation, or evaluation were rare across trials and few assessed differential effects between social or economic groups. Integrating equity frameworks and engaging with at-risk populations is recommended in future physical activity interventions to mitigate exacerbation of health inequity.

Keywords: physical activity; exercise; interventions; inequality; equity

Contribution to Health Promotion

- This review identifies populations that are underrepresented in physical activity research to promote health, including ethnic minorities, people with long-term conditions, and low-income individuals. By mapping which populations are assessed and overlooked, it provides an equity-oriented evidence base to inform the design of future interventions.
- The findings inform policy and practice by highlighting that greater attention to intersectionality and co-production is needed in physical activity research to reach populations at risk of health inequity. By emphasising the importance of inclusive and scalable interventions, this review aligns with health promotion principles that support populations to increase control over their health.

Background

Physical activity (PA), defined as "any bodily movement produced by skeletal muscles that requires energy expenditure" (World Health Organisation, 2024), is an established intervention for preventing and managing long-term conditions (LTCs). However, only 69% of the world's

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population meets recommended PA guidelines of 150–300 minutes of moderate or 75–150 minutes of vigorous activity per week (Kohl *et al.,* 2012; Piercy *et al.,* 2018), despite higher dosages being associated with greater health benefits (Celis-Morales *et al.,* 2012; Fukushima *et al.,* 2024; Lee *et al.,* 2022; Lopez *et al.,* 2019). Regular PA is linked with a 30–40% reduction in all-cause mortality, with adoption later in life still associated with a 20–25% reduction (Yu *et al.,* 2025). Benefits extend across cardiovascular disease, type 2 diabetes, some cancers, and mental health (Mahindru *et al.,* 2023; Pearce *et al.,* 2025; Wahid *et al.,* 2016; Yang *et al.,* 2024; Yu *et al.,* 2025).

Physical inactivity contributes to approximately one in six deaths in the UK, over 5 million global premature deaths annually (Lee *et al.,* 2012), and is associated with an estimated annual cost of £7.4 billion including £0.9 billion to the NHS (Government UK, 2023). Yet engagement in PA is not evenly distributed. Inequity by age, sex, socioeconomic position, disability, ethnicity, and geography persists, and these factors intersect to shape access. Individuals experiencing LTCs, socioeconomic disadvantage, or constrained local environments frequently face barriers such as limited facilities, transport challenges, financial pressures, and competing health needs (Avraham *et al.,* 2024; Bantham *et al.,* 2021; Guthold *et al.,* 2016). Consequently, populations who may benefit most from PA interventions often have the least opportunity to participate. Where interventions do not explicitly address equity, differential uptake and outcomes may contribute to "intervention-generated inequality" (Lorenc *et al.,* 2013).

Frameworks have been developed to support systematic assessment of equity within health research. The PROGRESS-Plus framework, endorsed by the Cochrane Methods Equity Group, outlines domains of social stratification including place of residence (P), race/ethnicity/culture/language (R), occupation (O), gender/sex (G), religion (R), education (E), socioeconomic status (S) and social capital (S), with the "Plus" component capturing additional context-specific characteristics such as age, disability, sexual orientation and migration status (Oliver *et al.,* 2008). The CORE20PLUS5 framework established by NHS England similarly identifies the most deprived 20% of the population (CORE20), five clinical priority areas (maternity, early cancer, COPD, severe mental illness, and hypertension), and additional groups at risk of inequity such as people experiencing homelessness, migrants or refugees, individuals with multiple LTCs, ethnic minorities, LGBTQ+ communities, people with experience of substance misuse or the justice system, and individuals living in underserved rural or urban areas (NHS England, 2021).

Although these frameworks provide structured approaches for examining equity, their application within PA interventions has not been systematically characterised. Limited understanding of how contemporary PA trials incorporate equity considerations restricts the ability to evaluate whether at-risk populations are effectively included and supported. This study therefore aims to synthesise trial evidence on interventions of physical activity to improve health outcomes in populations at risk of health inequity, as defined by the PROGRESS-Plus and CORE20PLUS5 frameworks.

Methods

Design

This scoping review followed a standardised methodological framework (Arksey and O'Malley, 2005; Levac *et al.,* 2010), adhering to the Reporting Items for Systematic Reviews and Meta-Analyses extension for scoping reviews (PRISMA-ScR) (Tricco *et al.,* 2018) (App. 1).

Eligibility Criteria

Eligibility criteria were defined a priori.

Inclusion criteria:

- Population – adults and children from marginalised socioeconomic groups or health backgrounds as defined by PROGRESS-Plus and CORE20PLUS5 frameworks.
- Interventions – interventions with a described PA component aimed at promoting health.

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- Comparators – any comparator (usual care, no intervention, or alternative PA intervention).
- Study design – full randomised controlled trials.
- Outcomes – any health outcome.
- Publication characteristics – peer-reviewed journal articles published between January 2020 and October 2025 in English.

Exclusion criteria:

- Population – non-human or populations not listed in equity frameworks (e.g. not income deprived, from an ethnic/religious minority, immigrant, in a rural area, older, disabled, traveller, LGBTQ+, pregnant, a cancer or respiratory/heart disease patient, mentally ill, in the justice system, with a history of substance misuse, or homeless).
- Interventions – interventions not utilising PA aimed at promoting health.
- Comparators – studies not reporting comparators.
- Study design – any design other than full randomised controlled trials.
- Outcomes – studies not reporting health outcomes.
- Publication characteristics – non-peer-reviewed sources, publications in languages other than English, studies carried out before 2020.

Search Strategy

PubMed, Web of Science, and Scopus were searched for articles published between 1 January 2015 and 1 October 2025, later refining the scope to include only full randomised controlled trials from 1 January 2020 to 1 October 2025. The search strategy, developed with input from an information specialist, combined terms across three core concepts:

1. Physical activity (PA) – including exercise, sport, fitness, movement, walking, cycling, and active travel.
2. Populations at risk of health inequity as defined by the PROGRESS-Plus and CORE20PLUS5 frameworks – including disadvantaged, underserved, deprived, low-income, marginalised, minority, migrant, refugee, homeless, learning disabled, and queer.
3. Study design – including randomised controlled trial, clinical trial, and pragmatic trial.

Both controlled vocabulary (e.g., MeSH and Emtree headings) and free-text keywords were used, with strategies adapted for each database's indexing system. Grey literature was also searched. Full search terms are provided in Appendix 2.

Study Selection

Search results were imported into Rayyan for duplicate removal and screening. Titles and abstracts were independently screened by two reviewers, followed by full-text screening, with disagreements resolved through discussion. A PRISMA flow diagram summarises the selection process (Figure 1).

Data Extraction

Data was extracted into a piloted standardised form and verified by a second reviewer. Extraction focused on study characteristics (author, year, population), intervention design, co-production, study duration, comparators, outcome measures, subgroup analysis, key findings, study effects, and study limitations. Which populations at risk of health inequity as defined by the PROGRESS-Plus and CORE20PLUS5 frameworks were included was also assessed.

Data Synthesis

Given the heterogeneity in interventions, populations, and outcome measures, findings were synthesised narratively following the Synthesis Without Meta-analysis (SWiM) guideline (Campbell *et al.*, 2020), focusing on the extent to which recent PA interventions include at-risk populations.

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Results

Our search identified 2,480 articles, of which 23 were eligible and included in this review, with no additional articles identified through grey literature (Figure 1).

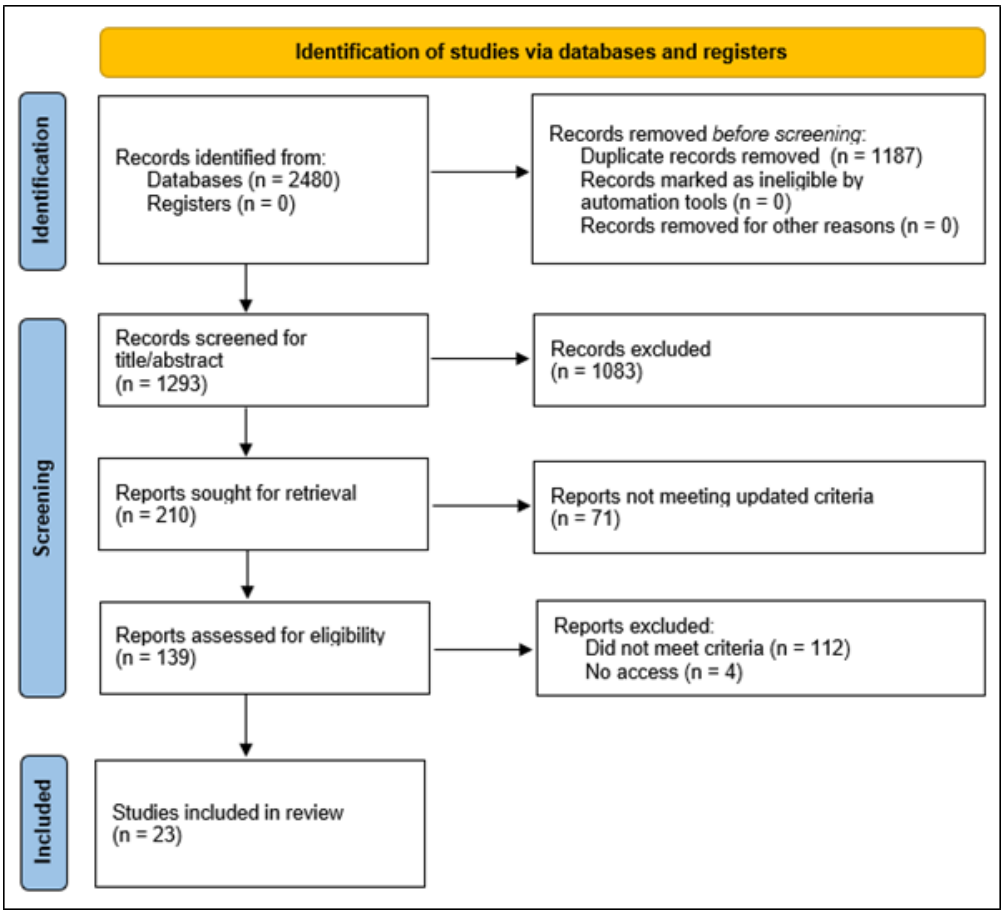

Figure 1. PRISMA flow diagram with number of records identified, screened, excluded, and included for articles with trial evidence on interventions of physical activity to improve health outcomes in populations at risk of health inequity as defined by the PROGRESS-Plus and CORE20PLUS5 frameworks.

Study Characteristics

Sample sizes ranged from 30 to over 30,000 participants, with most (n = 16) enrolling between 30 and 150. Study duration ranged from eight to 113 weeks, with a mean of 29 weeks. Most studies were conducted in high-income countries, predominantly the USA (n = 5), followed by Taiwan (n = 3), South Korea (n = 2), Germany (n = 2), and Greece (n = 2). Spain, Slovenia, and Denmark had one study each. The remainder were from middle-income countries: China (n = 2), Myanmar (n = 1), Iran (n = 1), South Africa (n = 1), and Nigeria (n = 1). No UK-based studies met eligibility criteria (Table 1).

Intervention Content

Most studies examined a PA-only intervention to improve health outcomes (n = 11), followed by a programme combining PA with health education or nutritional support (n = 9), and a combined PA and psychosocial intervention (including counselling, self-efficacy work, or behavioural work) (n = 3). In several, the intervention involved multiple PA components (n = 11). These included predominantly strength or balance training, followed by group exercise classes and stretching or aerobic fitness, martial arts, and then dance, walking, and outdoor activity (Figure 2a, Table 1). Specifics on the exact activities performed alone or in groups were often lacking, but one example of strength and balance training involved weekly sessions with three sets of 15 seated repetitions

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targeting functional muscle groups using different strength resistance bands, following a 10-minute warm-up and followed by a 10-minute cool-down [ID2]. Stretching and aerobic fitness may involve 10-minute sets of moderate intensity jumping, running in place, movement, and side shuffles at 65–85% of maximum heart rate three times a week [ID7]. Lastly, martial arts often involved Tai Chi up to twice a week, a multimodal mind-body exercise combining physical, meditative, cognitive, and social aspects [ID17].

Health Outcomes

Health outcome measures varied across trials, with 11 studies including self-reported outcomes such as quality of life, mental health symptoms, self-efficacy, dietary intake, pain, and disability. Three used standardised surveys or questionnaires with rating scales exclusively (Revised Impact of Event Scale, Patient Health Questionnaire-9, General Anxiety Disorder-5, Perceived Stress Scale-10, WHO Well-being Index-5, Short Form-12, Healthy Eating Index-2015, Rapid Eating Assessment for Participants-S, and Hausa Pain and Belief Scales) [ID5,8,13], while remaining studies incorporated at least one physiological measure. Most assessed physical function (n = 8) and body composition (n = 6), with other outcomes including acute care utilisation, physical performance or skill, muscle mass, and risk factors for cardiovascular disease or brain function. These were generally measured via supervised mobility tests (n = 11, e.g. Short Physical Performance Battery or Timed 10-Meter Walk Test), wearable devices (n = 5, e.g. pedometer or smart watch), and weight scales (n = 4), with other tools including spectroscopy, magnetic resonance imaging, dual-energy x-ray absorptiometry, bioelectrical impedance analysis, stadiometers, dynamometers, saliva swabs, ergometers, ultrasound, stress tests, cognitive tests, and skinfold thickness tests. All studies reported a positive impact of PA on health, except one which reported no effect of mixed PA on PTSD in refugees [ID14]. Increased PA led to weight loss, improved motor skills and gait speed, reduced anxiety and PTSD, and fewer fractures or hospital visits across remaining studies. Some of the greatest effect sizes in Cohen's d (reported in n = 14) were seen using aerobics for autistic children with anxiety (1.32 [ID7]) and resistance training for older adults with sarcopenia (2.45 [ID9]) (Table 1).

Populations at Risk of Health Inequity

All individuals participating in the included trials belonged to at least one population at risk of health inequity as defined by the PROGRESS-Plus and CORE20PLUS5 frameworks, as this was required for eligibility. Six studies included two populations at risk of health inequity [ID9,10,14,16,17,19], mostly a demographic characteristic combined with a condition. Five studies performed subgroup analysis [ID2,3,6,9,16], whereby the sample is divided and compared, mostly between sex or age groups. Of these, two included both multiple at-risk populations and subgroup analysis [ID9,16], while the remainder included neither (n = 14). Age (not in [ID20]) and sex/gender (not in [ID12]) were recorded in the majority of articles. However, education, ethnicity, income, and employment of participants or their parents were inconsistently reported (Figure 2b). Co-production of interventions utilising PA to improve health outcomes with the populations they intended to serve was not mentioned in any study (Table 1).

The "Core 20%" (income deprived) was considered in three studies. Three of the five clinical priority areas were absent, COPD, maternity, and early cancer, while mental illness and hypertension were underrepresented. Rural populations were examined most, followed by refugees or migrants and individuals aged ≥65. The remainder focused on individuals with learning disabilities or neurodivergence, with one study exclusively including an ethnic minority (Korean-Chinese [ID10]). No studies addressed multiple LTCs, homelessness, travelling communities, LGBTQ+ populations, substance misuse, or people with experience of the justice system. Mention of religion or social capital was also absent in all included trials (Figure 2c, Table 1).

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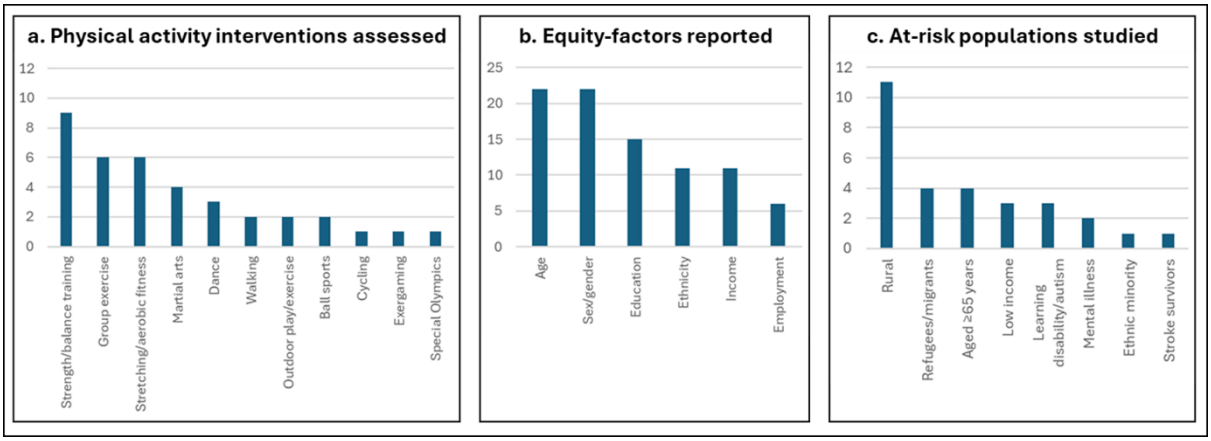

Figure 2. Physical activity interventions assessed (a), equity-relevant factors reported (b), and populations at risk of health inequity studied (c) across articles with trial evidence on interventions of physical activity to improve health outcomes in populations at risk of health inequity as defined by the PROGRESS-Plus and CORE20PLUS5 frameworks.

Table 1. Study characteristics, populations, outcomes, findings, and limitations for articles with trial evidence of interventions of physical activity to improve health outcomes which include populations at risk of health inequity as defined by the PROGRESS-Plus and CORE20PLUS5 frameworks.

Author, year [ID]	Population	Intervention design	Co-production with at risk population	Duration	Comparator
Cai *et al.*, 2022 [1]	Rural 60+ year-olds in China (n = 72)	Group exercise classes and at home walking via app	No	3 months	Intervention vs control
Chang *et al.*, 2025 [2]	Rural 50+ year-olds in Taiwan (n = 528)	Stretching and resistance training, nutritional support	No	12 months	Intervention vs osteoporosis care vs control
Deng *et al.*, 2024 [3]	Rural 60+ year-olds in China (n = 508)	Tai Chi and stretching exercises, counselling	No	26 months	Intervention vs control
Errisuriz *et al.*, 2023 [4]	Low-income Latino 3-year-olds in the United States (n = 310)	Home-based recommendations for children and parents on PA and nutrition (HBI), centre-based structured outdoor play sessions and healthy meals (CBI)	No	8 months	HBI and CBI or CBI vs control
Filippou *et al.*, 2025 [5]	Forcibly displaced individuals from Asia and Africa at refugee camps in Greece (n = 98)	Football, volleyball, basketball, martial arts, fitness, aerobics, and dancing	No	10 weeks	Intervention vs control

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Fulkerson *et al.*, 2022 [6]	Rural 7 to 10-year-olds with parent/guardian in the United States (n = 114)	Goal-setting calls on PA and nutrition, monthly sessions including family exercise	No	7 months	Intervention vs control
Gehricke *et al.*, 2022 [7]	Latino or rural 6 to 12-year-olds with ASD in the United States (n = 148)	Aerobic exercise and muscle strength activities	No	16 weeks	Intervention vs sedentary gaming group
Ibrahim *et al.*, 2023 [8]	Rural community-dwelling adults in Nigeria (n = 120)	Aerobic exercise, stretching, motor control exercise (MCE) or patient education (PE)	No	20 weeks	MCE and PE vs MCE vs PE
Ji *et al.*, 2025 [9]	Rural community-dwelling 65+ year-olds in South Korea (n = 41)	Nutritional support and group exercise with stretching, resistance, aerobic activity	No	12 weeks	Intervention vs control
Kim *et al.*, 2022 [10]	Female Korean-Chinese migrant workers with low PA in South Korea (n = 46)	Regular walking via app (ST), regular walking with self-efficacy and social support (ET)	No	24 weeks	ET vs ST
Knappe *et al.*, 2024 [11]	Forcibly displaced individuals from Southwest Asia and Sub-Saharan Africa at refugee camps in Greece (n = 142)	Fitness training, martial arts, ball sports, dance	No	10 weeks	Intervention vs control
Kovačič *et al.*, 2020 [12]	Inactive adults with Down syndrome, cerebral palsy, ASD, ADHD, Prader-Willi syndrome in Slovenia (n = 150)	Balance exercise, wellness, Special Olympics athletic training (SO)	No	16 weeks	Balance and SO vs wellness and SO vs SO
MacMillan Uribe *et al.*, 2023 [13]	Rural women in the United States (n = 87)	Group exercise, PA and nutrition education	No	24 weeks	Intervention vs control
Nordbrandt *et al.*, 2020 [14]	Refugees with PTSD in Denmark (n = 318)	Body awareness therapy or mixed physical activity with strength, endurance,	No	20 weeks	Awareness vs mixed vs control

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		balance, coordination exercise			
Nqweniso *et al.*, 2021 [15]	8 to 11-year-olds from low socioeconomic groups in South Africa (n = 898)	Physical education, dance, play, health and hygiene education, nutritional support	No	10 weeks	PA vs PA and education vs PA and education and nutrition vs education and nutrition
Peng *et al.*, 2025 [16]	Urban and rural community-dwelling 65+ year-olds in Taiwan (n = 88)	Strength and balance exercise, nutritional support, cognitive training	No	12 months	Intervention vs control
Perloff *et al.*, 2021 [17]	Low-income 65+ year-olds in the United States (n = 142)	Group and video-directed at home Tai Chi exercise	No	12 months	Intervention vs control
Prats-Arimon *et al.*, 2024 [18]	Rural adults in Spain (n = 42)	Group exercise, personalised at home activity, nutritional support	No	9 months	Intervention vs control
Rapp *et al.*, 2022 [19]	Rural community-dwelling 70 to 85-year-olds in Germany (n = 36,726)	Group and at home mobility and fall prevention exercise classes	No	12 months	Intervention vs control
Shariat *et al.*, 2021 [20]	Stroke patients in Iran (n = 30)	Cycling, functional electrical stimulation	No	8 weeks	Interval vs linear
Thein Tun *et al.*, 2025 [21]	Children with Down syndrome in Myanmar (n = 30)	Exercise focused on stability, object control skills, and locomotor skills	No	12 weeks	Intervention vs control
Tuan *et al.*, 2024 [22]	Rural 60+ year-olds in Taiwan (n = 55)	Exergame-based functional movement and progressive resistance training	No	12 weeks	Intervention vs control
Wolf *et al.*, 2024 [23]	Patients with depression, insomnia, PTSD, panic disorder, agoraphobia in Germany (n = 400)	Supervised evidence-based outdoor exercise, behavioural techniques	No	12 months	Intervention vs control

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Table 1. (continued). Study characteristics, populations, outcomes, findings, and limitations for articles with trial evidence of interventions of physical activity to improve health outcomes which include populations at risk of health inequity as defined by the PROGRESS-Plus and CORE20PLUS5 frameworks.

Author, year [ID]	**PROGRESS-Plus/CORE20PLUS 5 characteristics**	**Equity-relevant subgroup analysis**	**Intervention outcome measures**	**Key findings**	**Study limitations**
Cai *et al.*, 2022 [1]	Rural, predominantly 65+ years	No	Physical activity by pedometer, physical function by tests, body composition by spectroscopy, physical activity self-efficacy, quality of life by survey	PA interventions increased grip strength and gait speed	PA intensity not specified, challenges in adherence, changes in daily energy expenditure unknown, short duration, diet not recorded
Chang *et al.*, 2025 [2]	Rural, predominantly 65+ years	Yes, by sex, age, education, income	Osteoporosis diagnosis, self-reported quality of life and depression, institutionalisation, intrinsic and cognitive capacity including locomotion and audiovisual characteristics	PA interventions resulted in better intrinsic capacity and a lower reduction in quality of life	Controls may experience integrated care, recall bias, no cost-effectiveness analysis
Deng *et al.*, 2024 [3]	Rural, predominantly 65+ years	Yes, by sex, age, education, income	Weight, BMI, body fat, waist circumference, hip circumference, waist-to-hip ratio, waist-to-height ratio	PA interventions resulted in weight loss	Short duration, diet not recorded
Errisuriz *et al.*, 2023 [4]	Low income, predominantly ethnic minority (87%)	No	General motor quotient, locomotive skills, ball skills	PA interventions increased children's motor skills	Multiple components so unsure of cause, tests carried out by single observer, tests

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					do not reflect natural play, quality of implementation not assessed
Filippou *et al.*, 2025 [5]	Asylum seekers	No	PTSD, depression, anxiety, stress, well-being symptoms	PA interventions reduced PTSD if attended over twice a week	High attrition, poor literacy
Fulkerson *et al.*, 2022 [6]	Rural	Yes, by sex	BMI, BMIz, body fat, fidelity	PA interventions reduced obesity in boys not girls	Selection bias, low contact hours
Gehricke *et al.*, 2022 [7]	Intellectual disabilities and autism, predominantly rural or ethnic minority	No	Parent- and self-reported anxiety, sleep, physical activity, heart rate by smart watch, stress by salivary cortisol	PA interventions improved anxiety and sleep	No non-activity control, medication effect not considered
Ibrahim *et al.*, 2023 [8]	Rural	No	Self-reported pain intensity, disability, quality of life, global perceived recovery, fear-avoidance beliefs, pain catastrophising, back pain consequences belief, pain medication use	PA interventions reduced back pain, especially with combined MCE and PE	High attrition, short duration, no non-activity control
Ji *et al.*, 2025 [9]	Rural, 65+ years	Yes, by sex, age	Gait speed, physical performance, grip strength, muscle mass, fatigue, disability, frailty, mental illness, quality of life	PA interventions improved gait speed, physical performance, grip strength, disability, frailty, quality of life	Limited generalisability, short duration, small sample size
Kim *et al.*, 2022 [10]	Ethnic minority, immigrant status	No	Step adherence by smart watch, risk of cardiovascular disease, lipid	PA interventions reduced risk of cardiovascular disease	Multiple components so unsure of

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			profiles, fasting blood sugar		cause, poor recruitment
Knappe *et al.*, 2024 [11]	Asylum seekers	No	Cognitive function, cognitive reaction time, pain, cardiorespiratory fitness	PA interventions improved cognitive reaction and cardiorespiratory fitness	High attrition, variability in sports type and amount, short duration, effect of age and PTSD not considered
Kovačič *et al.*, 2020 [12]	Intellectual disabilities and autism	No	Static balance, dynamic balance, fall frequency	PA interventions increased balance, especially in balance-specific exercise group	Diet not recorded, short duration, no cost-effectiveness analysis
MacMillan Uribe *et al.*, 2023 [13]	Rural	No	Self-reported dietary intake, dietary behaviour, diet-related psychosocial measures	PA interventions improved dietary patterns and diet-related psychosocial wellbeing	Multiple components so unsure of cause, mostly white participants, high attrition
Nordbrandt *et al.*, 2020 [14]	Refugees, mental illness, predominantly multimorbid and chronic	No	PTSD severity	PA interventions did not affect PTSD symptoms	Personalised low-intensity PA
Nqweniso *et al.*, 2021 [15]	Low income	No	BMI, body fat	PA interventions mitigated weight gain	Short duration, cofounders
Peng *et al.*, 2025 [16]	Urban/rural, 65+ years	Yes, by residence	Brain structure by MRI, handgrip strength, walking speed, chair rise, cognitive function, body composition	PA interventions improved brain matter volume reduction, chair rise, cognitive function, body composition	Limited comparability, low sample size, possible cognitive impairment
Perloff *et al.*, 2021 [17]	65+ years, low income, predominantly multimorbid and chronic	No	Acute care utilisation, adjusted estimated cost of utilisation	PA interventions reduced emergency department visits	Recall bias, underreporting in controls

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Prats-Arimon *et al.*, 2024 [18]	Rural	No	Physical activity by smart watch, metabolic and body composition, self-reported diet adherence	PA interventions reduced fat and cholesterol	No metabolic markers controls, short duration, low sample size
Rapp *et al.*, 2022 [19]	65+ years, rural	No	Fragility fracture incidence by DXA	PA interventions reduced risk of femoral fractures	Only fractures requiring hospitalisation captured
Shariat *et al.*, 2021 [20]	Hypertension	No	Walk test, functional ambulation, spasticity, active range of motion, functional mobility, balance	PA interventions improved walking, functional ambulation, functional mobility, balance in both, spasticity in interval	Small sample size, short duration, no non-activity control
Thein Tun *et al.*, 2025 [21]	Intellectual disability	No	Functional strength, static balance, motor skills	PA interventions improved functional strength, static balance, motor skills	Small sample size, short duration
Tuan *et al.*, 2024 [22]	Rural, predominantly 65+ years	No	Frailty, sarcopenia, functional performance, muscle condition, daily living activities, health-related quality of life, cognitive function	PA interventions improved muscle function, brain function, living conditions	Small sample size, short duration, personalised PA
Wolf *et al.*, 2024 [23]	Mental illness	No	Symptom severity	PA interventions reduced mental illness symptoms	Attrition bias, cofounders, ethnicity not recorded, no patient involvement

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Discussion

This scoping review examined trial evidence on physical activity interventions aimed at improving health outcomes in populations at risk of health inequity, as defined by the PROGRESS-Plus and CORE20PLUS5 frameworks. Across 23 eligible full randomised controlled trials, PA interventions were generally associated with positive health outcomes, with reported improvements in physical and cognitive function, cardiovascular outcomes, weight, frailty, fractures, hospital utilisation, mental health, and quality of life, predominantly among older adults in rural settings. However, equity considerations were rarely integrated: only two studies included multiple at-risk populations and subgroup analysis, leaving intersectionality largely unexamined. Reporting of equity-relevant factors such as education, ethnicity, income, and employment was inconsistent, limiting cross-study comparability and generalisability. Consequently, several populations at risk of health inequity, particularly ethnic minority groups and individuals with multiple long-term conditions, were underrepresented in the evidence base.

Comparison to Existing Literature

The heterogeneity observed across trials in this review aligns with findings from other systematic reviews of interventions utilising PA to improve health outcomes, which consistently highlight variability in intervention design, duration, and outcomes (Mahon *et al.*, 2025). These also confirm that only a small proportion of PA trials conducts subgroup analysis whereby populations are compared (Montoye *et al.*, 2016). Similarly, while community-based interventions are found to increase PA overall, equity-specific effects are rarely examined and most trials are not designed to test differences between groups defined by socioeconomic status, sex/gender, ethnicity, or disability as observed here (Skender *et al.*, 2016). Mental illness, for example, is disproportionately common among adolescents (Ruiz-Ranz and Asín-Izquierdo, 2025), yet this group was largely absent from the studies included in our review. Such omission reflects a wider tendency to exclude younger populations from equity-focused analyses, despite activity in early adolescence being an established predictor of activity in adulthood (Telama *et al.*, 2005). Other reviews have also reported omission of literacy, sexual orientation, and immigration status as demographic details, as identified in this work too (Band *et al.*, 2025; Welch *et al.*, 202). Overrepresentation of older individuals may then be due to easier recruitment as a result of established community-based programmes and infrastructure, making trials relatively practical and cost-effective (Jackman, 2025). These gaps constrain understanding of who benefits from interventions and under what conditions, ultimately reducing the translational value of the evidence base.

Consistent with our findings, previous studies show that research on health inequity typically addresses a single dimension rather than examining multiple factors (Popay *et al.*, 2023). These approaches are found to perpetuate a mismatch between research frameworks and lived experience, as individuals simultaneously embody intersecting identities (Holman and Walker, 2021). The narrow focus has important implications for PA research, as interventions may fail to capture complex contextual mechanisms shaping behaviour when intersectionality is overlooked. As a result, programmes that appear effective within controlled trial environments may have limited scalability in real-world settings (Holt *et al.*, 2025). Addressing these structural and contextual determinants, for example through cultural adaptation within trials by tailoring to linguistic and religious practices (El Masri *et al.*, 2020; Mendoza-Vasconez *et al.*, 2016), is therefore critical in designing PA interventions that produce equitable and enduring health benefits.

Strengths and Limitations

To our knowledge, this is the first review utilising PROGRESS-Plus and CORE20PLUS5 frameworks to systematically capture representation of populations at risk of health inequity in PA trials. Strengths include the application of a predefined protocol with adherence to PRISMA-ScR and SWiM guidance, the use of independent reviewers, and the structured classification of equity

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integration, which supports reproducibility and comparability. However, limitations include possible selection or extraction bias from observers, as well as restriction to English and peer-reviewed publications which may exclude relevant evidence. By only focusing on full randomised controlled trials published in the last five years, observational or qualitative evidence providing contextual insights into barriers and facilitators of equitable interventions utilising PA to improve health outcomes could have been overlooked. Lastly, heterogeneity in intervention types and outcome measures limited opportunities for quantitative synthesis, and equity-relevant factors were inconsistently reported, which restricts cross-study analysis.

Implications for Practice and Policy

This scoping review shows that physical activity interventions are generally associated with positive health outcomes, however consideration of health equity was limited and inconsistently reported across the included trials. Most studies focused on a single at-risk population, most commonly rural or older adults, with few explicitly including or comparing multiple populations at risk of health inequity. Equity-relevant factors were infrequently reported and subgroup analyses were rare, resulting in limited examination of intersectionality and underrepresentation of several at-risk populations. Deliberate integration of equity frameworks and meaningful engagement with populations at risk of health inequity is recommended in the design and delivery of PA interventions to support inclusive and effective practice and policy, thereby mitigating exacerbation of health inequity.

Supplementary Materials: The following supporting information can be downloaded at the website of this paper posted on Preprints.org.

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Appendix A

Appendix A1. PRISMA Checklist for the Presented Review of Trial Evidence on Interventions of Physical Activity to Improve Health Outcomes in Populations at Risk of Health Inequity as Defined by the PROGRESS-Plus and CORE20PLUS5 Frameworks

Appendix A2. Search Terms to Systematically Identify Trial Evidence on Interventions of Physical Activity to Improve Health Outcomes in Populations at Risk of Health Inequity as Defined by the PROGRESS-Plus and CORE20PLUS5 Frameworks Before Scope Refinement

MeSH and Free Text Search Terms	Filters/Refined by	Databases

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("physical activity" OR "physical activities" OR "exercise" OR "exercising" OR "workout" OR "working out" OR "fitness" OR "sport" OR "walking" OR "cycling" OR "movement" OR "active travel") AND ("intervention") AND ("underserved" OR "under-served" OR "minoritised" OR "minoritized" OR "minority" OR "marginalised" OR "marginalized" OR "disadvantaged" OR "underprivileged" OR "under-privileged" OR "deprived" OR "underrepresented" OR "under-represented" OR "neglected" OR "poverty" OR "impoverished" O"underresourced" OR "under-resourced" OR "low-income" OR "lower-income" OR "migrant" OR "immigrant" OR "migrants" OR "immigrants" OR "refugee" OR "refugees" OR "asylum seeking" OR "asylum seekers" OR "disabled" OR "queer" OR "LGBTQI+" OR "LGBT" OR "homeless" OR "homelessness" OR "non-White" OR "non-white" OR "rural") AND ("randomised controlled trial" OR "randomized controlled trial" OR "clinical trial" OR "pragmatic trial" OR "adaptive trial" OR "cluster trial" OR "evaluation study" OR "quasi-experimental study" OR "experimental study")	Restricted to the English language, randomised controlled trials using PA as intervention with results, populations at risk of health inequity only	PubMed (n = 674 before screening) Web of Science (n = 845 before screening) Scopus (n = 750 before screening)

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