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Effects of sport and physical recreation on health-related outcomes among children and young people with physical disability: systematic review with meta-analysis

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ABSTRACT

Objectives To describe quantitative studies of sport or physical recreation for children and young people with physical disability and evaluate effects on health-related outcomes.

Design Systematic review with meta-analysis of randomised controlled trials.

Data sources Six databases searched from inception to December 2023.

Eligibility criteria Quantitative studies evaluating sports or physical recreation among children and young people≤18 years with physical disability.

Results 77 studies (n=2584) were included in the review, with 11 randomised controlled trials included in meta-analyses. Pre–post measurement design, health condition cerebral palsy and intervention of dance were most common. Meta-analysis could not be performed for participation outcomes because there were only two eligible trials. Sport and physical recreation had a small positive impact on activity limitations (nine trials, n=271, standardised mean difference (SMD) 0.30, 95% CI 0.02 to 0.57, p=0.018, low certainty evidence) and a medium positive impact on physical impairment (seven trials, n=216, SMD 0.63, 95% CI 0.08 to 1.18, p=0.025, very low certainty evidence) compared with control. No effect was found on quality of life (three trials, n=133, SMD −0.02, 95% CI −0.42 to 0.38, p=0.917, moderate certainty evidence) or cognitive or behavioural impairment (four trials, n=124, SMD 0.54, 95% CI −0.29 to 1.36, p=0.202, very low certainty evidence). A small number of mild adverse events were reported.

Conclusion Sport and physical recreation likely improve activity and physical impairment outcomes for children and young people with physical disability. More research assessing participation outcomes and evaluation of existing sport and recreation programmes in the community is indicated.

PROSPERO Registration Number CRD42020159283

WHAT IS ALREADY KNOWN

⇒ Children and young people with physical disability are less active than those without disability, but most could benefit from meeting the WHO physical activity guidelines for children and young people with disability.

⇒ Current evidence suggests beneficial effects of physical activity for children and young people with varying types of disability, but there has not been a synthesis of evidence examining the effects of sport and physical recreation for children and young people with physical disability.

WHAT ARE THE NEW FINDINGS

⇒ Sport and physical recreation may provide small to medium effects on activity limitation and physical impairment for children and young people living with physical disability. The certainty of the evidence was moderate to very low.

⇒ Engaging in sports and physical recreation is safe for children and young people with physical disability and will likely result in positive health outcomes.

⇒ There is a need for research with a more rigorous design methodology using a common set of outcomes to enhance a meaningful synthesis.

⇒ Gaps in the evidence include participation-related outcomes and investigation of community sport and physical recreation programmes already being delivered in the community.

INTRODUCTION

Physical inactivity is higher among people with disability compared with their non-disabled peers.[1–4] In 2020, the WHO included people with disability in their physical activity guidelines for the first time.[5] These guidelines recommend that adults and children and young people with disability should aim to participate in similar volumes of physical

activity to their non-disabled peers. Children and young people are recommended to do an average of 60 min per day of moderate-intensity to vigorous-intensity physical activity, and also include vigorous-intensity aerobic activities and muscle strengthening exercises at least three times per week.[6] These guidelines have been widely welcomed as a move towards promoting inclusion and encouraging greater participation in physical activity among people with disability. However, due to a lack of evidence about the benefits of physical activity for people with disability, the WHO guidelines have been developed based on studies of a limited number of health conditions (predominantly affecting adults), and using indirect evidence from people without disability.[6] Applying indirect evidence to develop guidelines is problematic as it may miss possible harms from physical activity in particular groups and also underestimate benefits, which potentially could be utilised to encourage individuals to participate.[7]

More evidence on the benefits of physical activity specifically for people with disability is needed. In the two decades from 1999 to 2019, less than 5% of all articles published in the five highest impact medical journals focused on people with disability, and less than 7% of these addressed physical activity or health.[8] Evidence for the role of physical activity among children and young people with physical disability is particularly limited. Currently, systematic reviews evaluating the effects of physical activity interventions in children and young people with physical disability have shown only modest benefits.[9–13] Generalisability of these findings is limited due to the narrow range of health conditions included in these studies (predominantly cerebral palsy). Furthermore, most reviews have grouped all physical activity interventions (including those used in therapeutic settings, structured exercise training and sporting and physical recreation activities) together, making it challenging to understand the effectiveness and safety of different modes of physical activity.

A number of factors have been identified to facilitate participation in physical activity of children and young people with physical disabilities. These include social connection with peers, having fun, acceptance within a group and gaining a sense of challenge and achievement.[14–17] While these facilitators could be present in any form of physical activity, sport and physical recreation are particularly obvious settings which can enable all of these facilitators. However, the evidence of any health benefits of sport and physical recreation participation among children and young people with physical disability remains limited. In comparison, studies in adults with physical or intellectual disability have shown multiple health benefits from sport and physical recreation participation.[18 19] Therefore, it seems likely that children and young people could experience similar health benefits. The present review seeks to fill this evidence gap.

The aims of this systematic review of sport and physical recreation for children and young people 18 years and younger with a physical disability are to:

1. Summarise the types of studies, physical disability, sport and physical recreation interventions and health-related outcomes that have been investigated in quantitative studies.
2. Use meta-analysis to determine the effectiveness of sport and physical recreation on health-related outcomes.

METHODS

Design

This systematic review with meta-analysis followed the methods described in the Preferred Reporting Items for Systematic Reviews and Meta- Analyses (PRISMA) guidelines and Cochrane Handbook for Systematic Reviews of Interventions.[20 21] The protocol was registered with the PROSPERO database prior to commencement (CRD42020159283).

Search strategy

We conducted sensitive searches of six electronic databases for relevant literature published from inception to December 2023: MEDLINE (Ovid); Embase (Ovid); PsycINFO (Ovid); CINAHL (EBSCO); SPORTDiscus (EBSCO); and, Physiotherapy Evidence Database (PEDro). We used a combination of Medical Subject Heading terms and text words related to 'sport', 'physical recreation', 'children' and 'disability' to create our search strategy (online supplemental appendix 1). In addition, reference lists of included studies and relevant reviews were hand searched.

Selection criteria

Study type

We considered studies for inclusion if they reported at least one quantitative health outcome. We only included full-text articles in peer-reviewed journals. Conference proceedings and academic theses were excluded. We included papers in any language that could be translated within the resources of the review. Only randomised controlled trials were eligible for inclusion in the meta-analysis.

Population

Studies were included if participants were children and young people aged 18 years or younger. Studies were also included if some participants were over 18, but the sample had a mean or median age of 18 years or younger. We included studies where at least 50% of participants were children and young people with a physical disability.

Intervention

We included studies evaluating leisure-time physical activity defined as sports or physical recreation. Sport was defined as 'an activity involving physical exertion, skill and/or hand-eye coordination as the primary focus of

the activity, with elements of competition where rules and patterns of behaviour governing the activity exist formally through organisations'.[22] Physical recreation was defined as 'an activity or experience that involves varying levels of physical exertion, prowess and/or skill, which may not be the main focus of the activity, and is voluntarily engaged in by an individual in leisure time for the purpose of mental and/or physical satisfaction'.[22]

Eligible activities included whole body movement, or as much body movement as possible in the case of participants with impaired body movement (eg, spinal cord injury). Physical activities which may be forms of physical recreation but where the majority of the activity was a structured exercise or training programme were excluded (eg, therapeutic horse riding or running skills training). Passive strategies to improve function (eg, electrical stimulation) and isolated muscle activity (eg, isometric strengthening) were also excluded.

Comparator

Studies with or without any comparator were included if they met other eligibility criteria. For randomised controlled trials to be eligible for meta-analysis, trials had to compare one group that participated in sport or physical recreation with a non-active comparison group such as usual care, waitlist or a control group. We did not include trials in the meta-analysis that compared sport with another physical activity intervention.

Outcomes

We used the International Classification of Functioning, Disability and Health – Children and Youth Version (ICF-CY)[23] as a basis to categorise outcomes of included studies. Quality of life and adverse events were also used. As this review focused on the health outcomes for children and young people with disability, we did not extract outcomes related to intervention implementation or fidelity, parent or carer outcomes, or outcomes related to the personnel delivering the intervention.

Primary outcomes

1. Participation: defined using the ICF-CY definition as 'involvement in life situations' (p.9) which for children and young people show a developmental progression such as increasingly complex social relationships away from the home, progression in education and engagement in community activities.[23] This could be measured by attendance and/or engagement in school and community and with any multicomponent tools assessing participation.[23]
2. Activity limitation: defined under the ICF-CY as 'the execution of a task or action' (p.9) and measured by self-reported or performance tests of self-care or mobility tasks.[23]
3. Quality of life: defined as 'optimum levels of mental, physical, role and social functioning, including relationships, and perceptions of health, fitness, life satisfaction and well-being' as measured with multi-attribute generic or disease-specific instruments.[24]

Secondary outcomes

1. Impairment: defined under the ICF-CY as problems with body function or structure such as a significant deviation or loss.[23] We further divided impairment outcomes into physical impairment and cognitive or behavioural impairment outcomes.
2. Adverse events: such as injuries sustained while participating in the sport or physical recreation.

Study selection, data collection and extraction

Search results were collated in EndNote and duplicates were removed. Due to the large number of studies, one reviewer (KW) conducted automatic culling with keywords in EndNote to eliminate ineligible conditions, irrelevant study designs, conference proceedings and review articles. Articles were downloaded into Covidence[25] for management of the subsequent review stages. Each title and abstract was independently screened by two out of five reviewers (KW, JSO, GJR, MG, ABD). Conflicts were resolved via discussion between reviewers. Full text review was then conducted with two out of six reviewers (KW, JSO, GJR, MG, ABD, CS). Conflicts were resolved by discussion between two reviewers (KW, CS). Data extraction was conducted by one reviewer (KW), and data were checked for consistency by a second reviewer (CS) using standardised data extraction forms. We extracted the following data from each included study: author, published year, country, research design, sample characteristics (sample size, age, sex and type of disability of participants), intervention description (type of sport or physical recreation, frequency, session duration, length of intervention, setting/location of intervention), comparison intervention, outcomes and quantitative data for the meta-analysis. Where eligible papers did not provide data in a format for meta-analysis, we emailed authors to request data.

For the meta-analysis, trials were grouped according to the outcomes of quality of life, participation, activity limitation and impairment as described above. Meta-analysis was conducted for categories where data was available from three or more studies. Where data was reported for multiple follow-up time points, only the data from the first follow-up was used. Where multiple outcome variables were reported within a category, we prioritised measures that considered the broadest aspects of performance, followed by measures most closely related to the type of sport or physical recreation, and these were determined a priori by consensus between three of the researchers (KW, CS, LH).

Risk of bias assessment and certainty of the evidence

Methodological quality was assessed for randomised controlled trials only, using the PEDro scale.[26] This rates trials on a 10-point scale, although for sport and physical recreation interventions it is only possible to score a

total of eight as blinding of participants and intervention deliverers is not possible. We used the Grading of Recommendations Assessment, Development and Evaluation system to assess the overall certainty of evidence for each outcome included in the meta-analysis.[27] We assessed statistical heterogeneity by visual inspection of the forest plots and with consideration of the I^2 test, with substantial heterogeneity as I^2>60%. We investigated small study effects by using Egger's test, with p<0.1 as evidence of publication bias.[28]

Data analysis

We narratively synthesised information about the study type, populations and interventions of all included studies. For each meta-analysis, we used the random-effects model to pool estimates obtained using Comprehensive Meta-analysis, V.2.2.064 (Biostat, Englewood, New Jersey, USA). Standardised mean difference (SMD) (Hedges' g) and 95% CI were calculated. We standardised the mean difference by postscore SD and calculated it using the pre mean and post mean and SD or, when this was unavailable, the mean change score. Effect sizes were categorised as small (0.1–0.4), medium (0.5–0.7) or large (0.8 or greater).[29]

Equity, diversity and inclusion statement

This review focuses on children and young people with disability who are a marginalised group. The research team includes people with lived experience of childhood disability, sport participation with a disability, caring for children with disability, diverse cultural and language backgrounds, and is predominantly female.

RESULTS

Flow of studies through the review

Searches found 30 950 records (figure 1). After identifying duplicates and removing ineligible records via keyword search in EndNote, 14 010 papers progressed to title and abstract screening, with 462 being assessed by full-text screening. We included 86 publications from 77 discrete studies in our review. Of these, 11 studies were included in the meta-analysis.

Characteristics of included studies

A total of 77 studies were included in this review, published from 1976 to 2023 (median, 2016). Most were conducted in high-income countries (63/77, 82%). The largest number of studies were conducted in the USA (19 studies, 25%) and Canada (11 studies, 14%). Eleven studies were conducted in high-middle-income countries and 3 in lower-middle-income countries. No studies were from low-income countries.

Study design varied, with a small proportion of randomised controlled trials. A total of 17 (22%) studies were randomised controlled trials, with 11 of these trials using an inactive control and 6 comparing two different interventions. There were 11 (14%) non-randomised controlled studies, 35 (45%) studies with single group pre–post measurement design, 6 (8%) cross-sectional studies and 5 (6%) single case reports. The three remaining studies were single studies with observational longitudinal, retrospective cohort and multi-factorial designs. The 11 studies included in the meta-analysis are presented in table 1. All studies are presented in the online supplemental appendix 2 and referenced in the online supplemental appendix 3.

Participants

There were 2584 participants with a disability in total across the 77 studies, with a range from 1 to 458 participants. The mean age was 12 years 4 months (data available from 68 studies) with a range of 3 to 29 years. Only one study focused on children less than 5 years of age.[30] The most common health condition studied was cerebral palsy (40 studies, 52%) followed by mixed physical disabilities (11 studies, 14%), developmental coordination disorder (8 studies, 10%) and mixed physical and other disabilities (8 studies, 10%). There were three studies for each of spina bifida and muscular dystrophy. Single studies covered Charcot-Marie-Tooth disease, developmental cerebellar anomalies, premature birth with motor impairment and upper limb amputees. Sex was reported in 66 studies with 60% of participants being male.

Among the 11 studies included in the meta-analyses, there were a total of 340 participants. Mean age of participants was 9 years (range 5–17 years). Diagnoses included cerebral palsy (eight studies: n=237, 70%), developmental coordination disorder (one study: n=44, 13%), spina bifida (one study: n=13, 4%) and mixed physical and other disabilities (one study: n=46, 14%). All studies described the gender balance with 64% (n=217) of participants being male. All studies included a mix of male and female participants, with all but one having more males than females.

Interventions

The variety of sport and physical recreation categories by number of studies, participants and disability type is shown in figure 2. The most common type of sport or physical recreation was dance (18 studies) followed by aquatic activities (11 studies) and mixed sport programmes (11 studies). Three studies specifically investigated wheelchair sport or physical recreation (basketball, tennis and dance). The average duration of intervention programmes was 15 weeks with two sessions per week lasting 61 min (range 2–52 weeks; 0.4–14 sessions per week; 30–150 min duration). The specific dose was not well reported with 8 studies not reporting duration (weeks), 9 studies not reporting sessions per week and 20 studies not reporting session length (min). Location of the activities included community (32 studies), university/research centre (9 studies), health or rehabilitation (8 studies), school (11 studies) and home (3 studies) settings. Six studies took place in more than one location, and the setting was not stated in 19 studies.

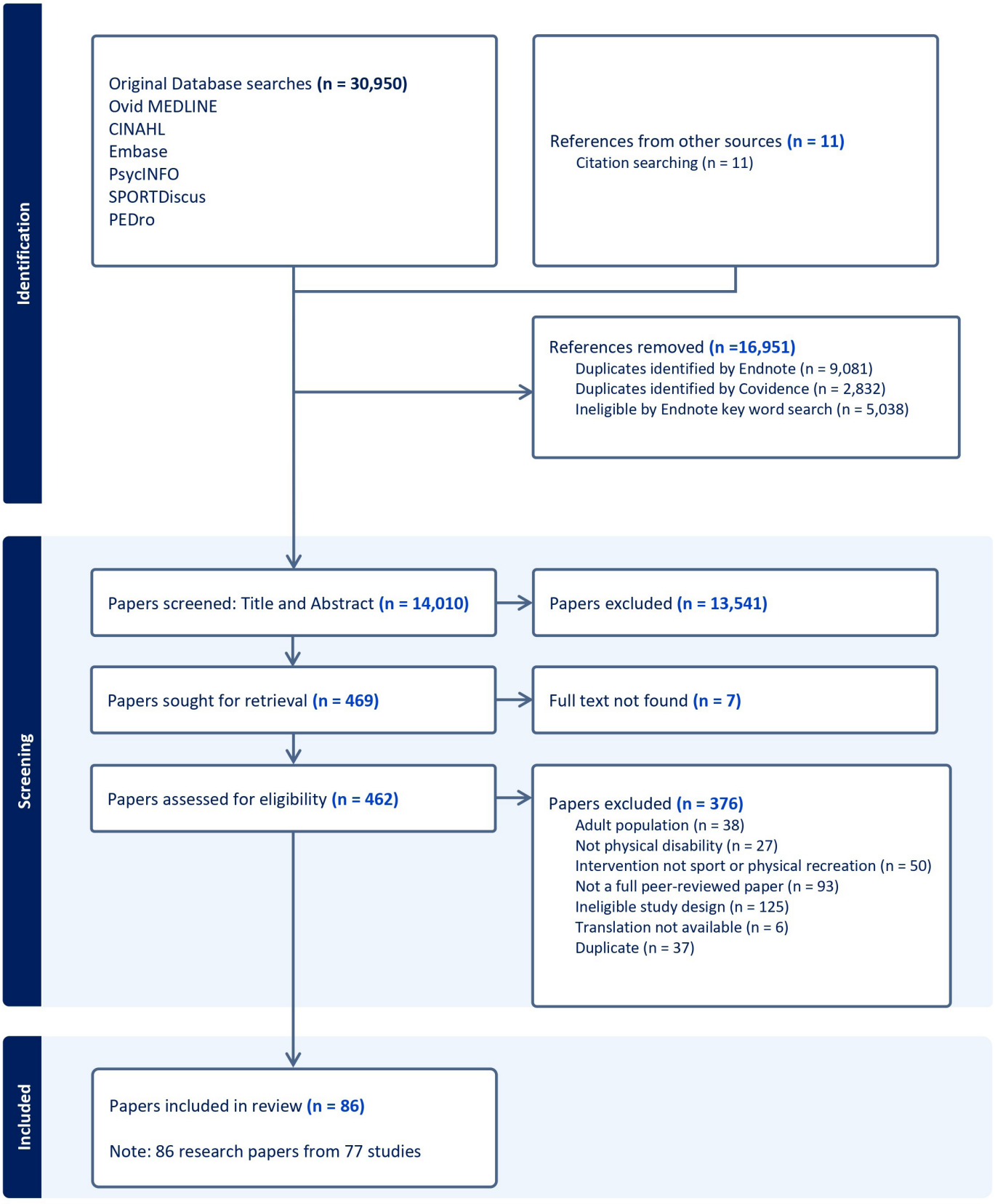


Figure 1 Flow diagram of papers through the review.

Among studies included in the meta-analyses, interventions included three swimming/aquatic programmes, four mixed sports/games programmes and one each of Tae Kwon Do, indoor climbing, cycling and yoga. The average duration of intervention programmes was 14 weeks with two sessions per week, lasting 62 min

Table 1 Country, participant, intervention and outcome characteristics along with the total PEDro score for the randomised controlled trials included in the meta-analysis

Study ID	Country	Participants	N - total (int/con)	Intervention	Outcomes							PEDro
					Particip	Activ	QoL	Phys	Cog/Beh	Other	Adverse	
Andrade *et al* (1991)[47]	Canada	*Health condition:* SB *Mean age (range):* NR (8–13) *Sex (M:F):* 7:6	13 (8/5)	*Type:* Mixed sports+other *Setting:* NR *Dose:* 10 wks, 1 sess/wk, 60 mins/sess	No	Yes	No	Yes	Yes	No	No	4
Clutterbuck *et al* (2022)[32]	Australia	*Health condition:* CP *Mean age (range):* 9 (6–12) *Sex (M:F):* 34:20	54 (29/25)	*Type:* Mixed sports *Setting:* Community *Dose:* 8 wks, 1 sess/wk, 60 mins/sess	Yes	Yes	Yes	Yes	No	No	Yes	6
Declerck *et al* (2016)[41]	UK	*Health condition:* CP *Mean age (range):* 10 (7–17) *Sex (M:F):* 8:6	14 (7/7)	*Type:* Swimming *Setting:* Community pool *Dose:* 10 wks, 2 sess/wk, 45 mins/sess	Yes	Yes	No	Yes	No	No	Yes	5
Dimitrijević *et al* (2012)[48]	Serbia	*Health condition:* CP *Mean age (range):* 10 (5–14) *Sex (M:F):* 17:10	27 (14/13)	*Type:* Swimming *Setting:* Community sports centre *Dose:* 6 wks, 2 sess/wk, 55 mins/sess	No	Yes	No	No	No	No	No	4
Fong *et al* (2012, 2013)[49 50]	Hong Kong	*Health condition:* DCD *Mean age (range):* 8 (6–12) *Sex (M:F):* 35:9	44 (23/21)	*Type:* Tae Kwon Do *Setting:* University *Dose:* 12 wks, 1 sess/wk, 60 mins/sess	No	Yes	No	Yes	No	No	Yes	6
Mak *et al* (2018, 2019, 2022)[51–53]	Australia	*Health condition:* CP *Mean age (range):* 9 (6–16) *Sex (M:F):* 24:18	42 (21/21)	*Type:* Yoga *Setting:* University, research centre *Dose:* 6 wks, 1 sess/wk, 90 mins/sess	No	Yes	Yes	Yes	Yes	Yes	No	7
Mazzoni *et al* (2009)[54]	Canada	*Health condition:* Mixed physical and other (DCD, ASD, SB, DD, CP, learning disability, fine motor difficulty, sensory, other) *Mean age (range):* 8 (6–12) *Sex (M:F):* 37:9	46 (23/23)	*Type:* Indoor climbing *Setting:* Community indoor climbing facility *Dose:* 6 wks, 1 sess/wk, 60 mins/sess	No	Yes	No	No	Yes	Yes	No	5
Mohanty *et al* (2015)[55 56]	India	*Health condition:* CP *Mean age (range):* 7 (4–10) *Sex (M:F):* 11:9	20 (10/10)	*Type:* Cycling *Setting:* Rehabilitation centre *Dose:* 6 wks, 5 sess/wk, 60 mins/sess	No	Yes	No	Yes	No	No	No	3
Ozer *et al* (2007)[57]	Turkey	*Health condition:* CP *Mean age (range):* 9 (5–10) *Sex (M:F):* 15:8	23 (13/10)	*Type:* Swimming *Setting:* NR *Dose:* 14 wks, 3 sess/wk, 30 mins/sess	No	No	No	Yes	Yes	No	No	4

Continued

Table 1 Continued

Study ID	Country	Participants	N - total (int/con)	Intervention	Outcomes							PEDro
Reedman *et al* (2019)[33]	Australia	*Health condition:* CP *Mean age (range):* 10 (8–12) *Sex (M:F):* 18:19	37 (18/19)	*Type:* Mixed sports+other *Setting:* Research centre *Dose:* 8 wks, 1 sess/wk, 60 mins/sess	Yes	Yes	Yes	No	No	No	Yes	7
Van den Berg-Emons *et al* (1998)[58]	Netherlands	*Health condition:* CP *Mean age (range):* 9 (7–13) *Sex (M:F):* 11:9	20 (10/10)	*Type:* Mixed sports *Setting:* School *Dose:* 39 wks, 3 sess/wk, 45 mins/sess	No	Yes	No	Yes	No	No	No	5

Activ, activity limitation; Adverse, adverse events; ASD, autism spectrum disorder; con, control group; Cog/Beh, cognitive or behavioural impairment; CP, cerebral palsy; DCD, developmental coordination disorder; DD, developmental disability; F, female; int, intervention group; M, male; mins, minutes; NR, not reported; Particip, participation; Phys, physical impairment; QoL, quality of life; SB, spina bifida; sess, sessions; wk, week

(range 6–39 weeks; 1–5 sessions per week; 30–90 min duration). Interventions were conducted in various settings including community settings (four studies), university and research centres (three studies), health or rehabilitation centres (one study) and schools (one study). The intervention setting was not stated in two studies.

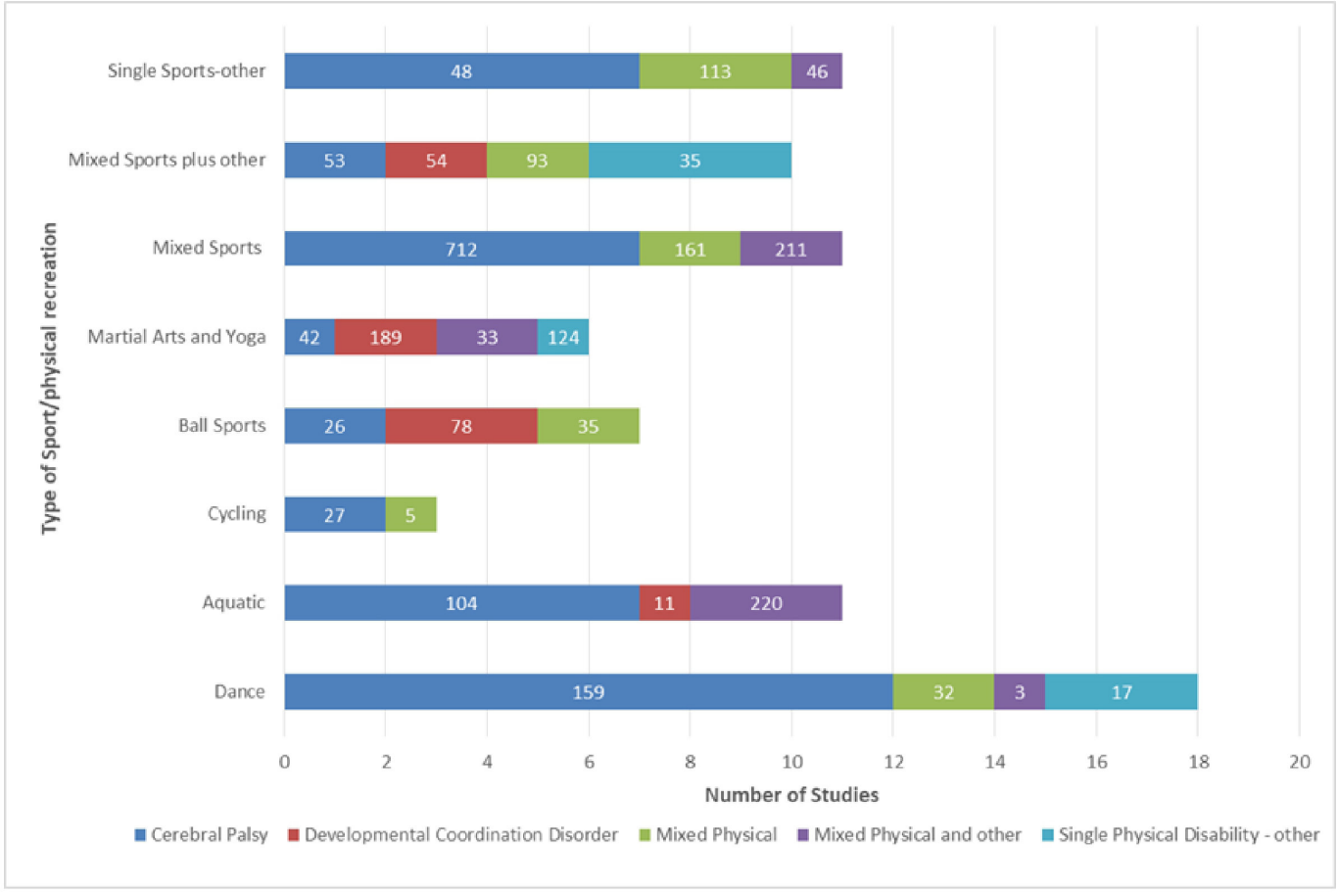


Figure 2 Health condition or disability of participants (coloured bars), number of studies (horizontal axis), number of participants (numbers in the coloured bars) for each category of sport or physical recreation (vertical axis) for all studies included in this review. Note: mixed sports plus other refers to interventions with multiple sports with additional non-sport components; single sports—other are single sport interventions not included in aggregated categories, for example, indoor climbing, sailing.

Comparators

For studies included in the meta-analysis, the comparison groups were usual care (three studies), wait list with delayed intervention (five studies), no intervention (two studies) and a prescribed exercise programme (one study, exercise programme performed by both groups).

Outcomes

Outcomes were reported across all the levels of the ICF-CY and for quality of life. Activity limitation level outcomes were most common (57 studies; 74%). Next most common was impairment of body, structure and function level outcomes (52 studies; 68%), with physical impairment alone measured in 30 studies (39%), cognitive or behavioural impairment alone in 10 (42%) and both constructs in 12 (16%). Less common were participation (26; 34%) and quality of life (16; 21%) outcomes. A large number of different variables were utilised for each level of outcome, with 83 variables used to quantify physical impairment (coordination and strength variables were the most common), 27 variables quantified cognitive or behavioural impairment, 83 variables for activity limitation and 23 variables for participation (5 were attendance or adherence type measures and 18 were scales or checklists).

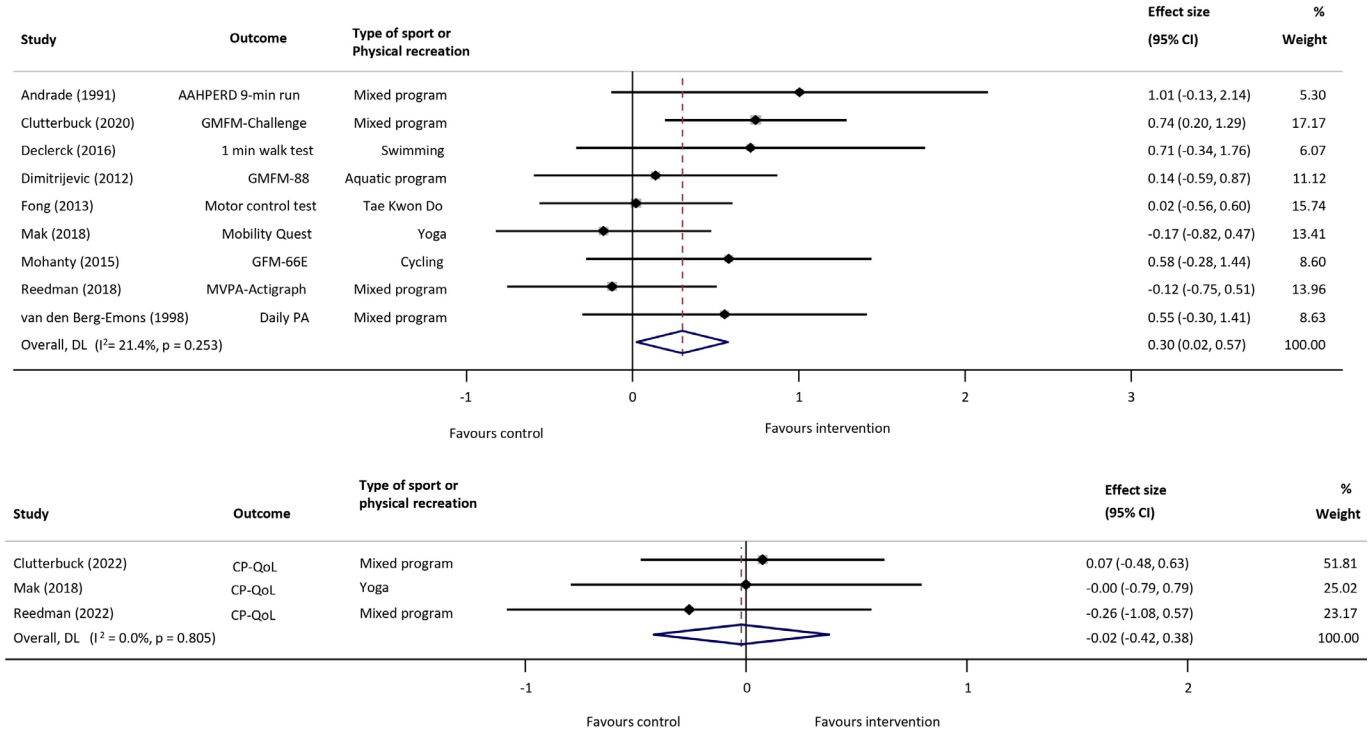
Among the 11 studies included in the meta-analyses, 3 studies reported participation outcomes, with only 2 using standardised multicomponent assessment tools. Activity limitation-related outcomes were reported in 10 studies (with data from 9 studies included in the meta-analysis). Quality of life outcomes were measured in three studies. Physical impairment outcomes were included in eight studies (with seven used in the meta-analysis). Cognitive or behavioural outcomes were measured in four studies.

Adverse events

Adverse events were reported to be collected in 19/77 (28%) studies. Of these, 12 studies reported no adverse events, 3 reported non-injurious falls and 3 reported minor injuries including a wrist sprain, skin abrasions and possible fatigue. One study reported a 12-month detailed surveillance of injuries and illnesses in children and young people with physical disability or chronic illnesses.[31] This study found that participants in sport and physical recreation were not more likely to sustain injuries than non-participants and that the reported injuries were mostly minor (joint contusions and muscle strains) with minimal time lost from normal activities.

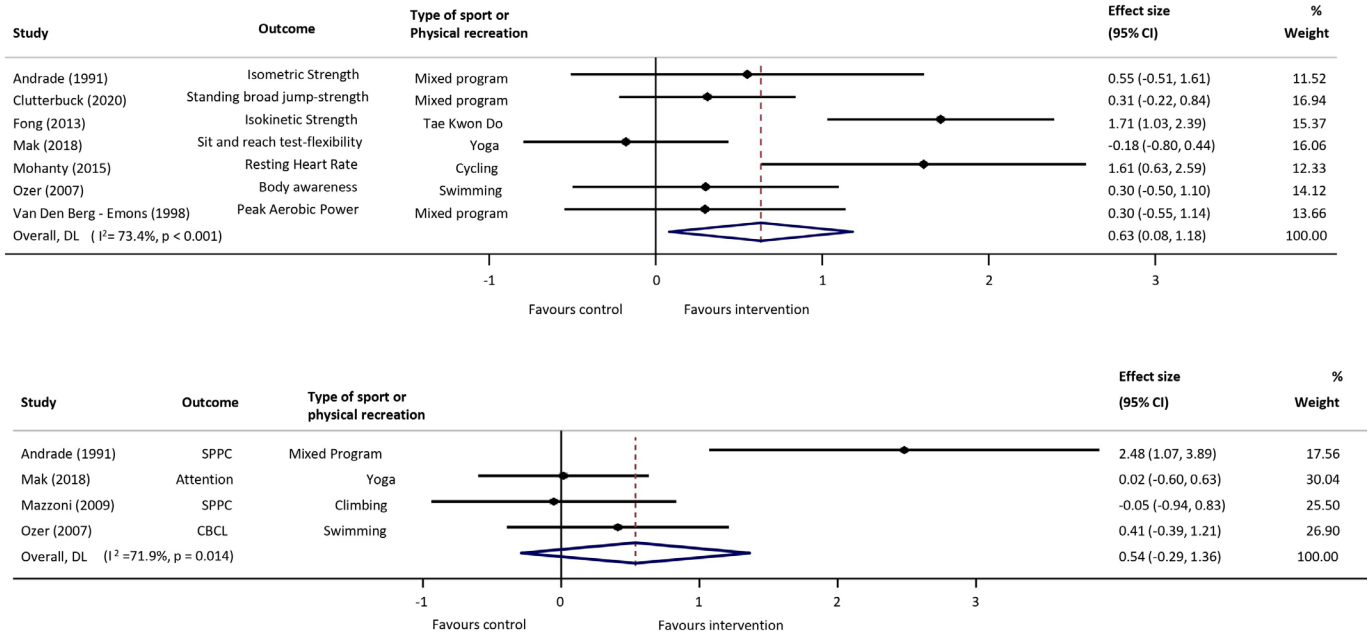
Meta-analysis of the effects of sport and physical recreation versus control

Meta-analyses for the included outcomes are presented in figures 3 and 4. The quality of the randomised controlled trials using the PEDro scale ranged from 3 to 7, with a mean of 5.1. The certainty of evidence summary is presented in online supplemental file appendix 4.



*AAHPERD 9-min run : American Alliance for Health, Physical Education, Recreation and Dance 9-minute run test. GMFM: Gross Motor Function Measure. MVPA: Moderate-to-vigorous physical activity. CP-QoL: The Cerebral Palsy Quality of Life Questionnaire (Participation and physical impairment domain)

Figure 3 Standardised mean difference (Hedges' g) and 95% CI of sport versus control on activity limitation (top panel) and quality of life (bottom panel) using random effect meta-analysis.



SPPC: Self-Perception Profile for Children. CBCL: Child Behaviour Checklist.

Figure 4 Standardised mean difference (Hedges' g) and 95% CI of sport versus control on physical impairment (top panel) and cognitive or behavioural impairment (bottom panel) using random effect meta-analysis.

Effect of sport and physical recreation on participation level outcomes

Meta-analysis for participation level outcomes was not undertaken as only two studies that reported participation outcomes using standardised multicomponent assessment scales to quantify participation (specifically as related to participation in life situations) were identified.[32 33] Both these studies showed significant effects of intervention on self-selected participation goals using the Canadian Occupational Performance Measure.

Effect of sport and physical recreation on activity level outcomes

There was a small positive effect of sport and physical recreation on activity limitations of children and young people with physical disability compared with controls (nine studies, 271 participants, SMD 0.30, 95% CI 0.02 to 0.57, p=0.018, low certainty evidence). Seven studies included children and young people with physical disability from cerebral palsy, one study included children and young people with spina bifida and one included children and young people with developmental coordination disorder (figure 3 top panel).

Effect of sport and physical recreation on quality of life outcomes

There was no effect found for quality of life outcomes (three studies, 133 participants, SMD −0.02, 95% CI −0.42 to 0.38, p=0.917, moderate certainty of evidence). All three studies included participants with cerebral palsy only (figure 3 bottom panel).

Effect of sport and physical recreation on impairment level outcomes

Physical impairment

There was a medium positive effect of sport and physical recreation on physical impairment of children and young people with physical disability (seven studies, 216 participants, SMD 0.63, 95% CI 0.08 to 1.18, p=0.025, very low certainty of evidence). Health conditions included cerebral palsy (five studies) and spina bifida and developmental coordination disorder in one trial each (figure 4 top panel).

Cognitive or behavioural impairment

There was no significant effect found for cognitive or behavioural impairment outcomes (four studies, 124 participants, SMD 0.54, 95% CI −0.29 to 1.36, p=0.202, very low certainty of evidence). Health conditions included cerebral palsy (two studies), spina bifida (one study) and mixed physical and other disabilities (one study, figure 4 bottom panel).

RESULTS OF RANDOMISED CONTROLLED TRIALS COMPARING TWO INTERVENTIONS

The additional six randomised controlled trials that compared sport and recreation to another active intervention were not included in the meta-analysis. These trials used widely varying comparators of uncertain effectiveness making formal statistical synthesis challenging. A summary of the author's conclusions of the results of these trials is presented in online supplemental file appendix 5.

DISCUSSION

Summary of findings

This systematic review identified 77 studies investigating sport and physical recreation activities for children and young people with physical disability. The most common study design was single group pre–post measurement design (35 studies, 45%). There were only 17 randomised controlled trials, 11 of which had a non-active comparator group and were included in meta-analyses. The most common health condition studied was cerebral palsy and the most common sport or physical recreation intervention was dance. Results from our meta-analyses found support favouring sport and physical recreation interventions for improving activity limitation and physical impairment outcomes but no significant effect for cognitive or behavioural impairments or quality of life outcomes. The certainty of the evidence ranged from moderate to very low. Participation level outcomes were measured in 26 studies overall; however, we were unable to conduct a meta-analysis due to insufficient usable data.

Our findings demonstrate that sport and physical recreation interventions may improve activity limitation and physical impairment outcomes and are largely in keeping with previous studies. A previous systematic review found that group exercise programmes, treadmill training and therapeutic riding led to improvements in aerobic capacity, gross motor function and participant/parent satisfaction among youth with disability.[34] Similarly, another review found support for active exercise interventions (including modified sport) improving gross motor performance in children with cerebral palsy.[35] Among adults with physical or intellectual disability, a meta-analysis of 60 studies found small to large improvements in the effect of physical recreation on activity limitation outcomes (ie, mobility), and physical impairment outcomes (ie, fatigue).[18] Results of our review taken together with other current evidence supports the likely benefits of participation in sport and physical recreation programmes for children and young people with physical disability.

We found no evidence of the effect of sport or physical recreation on quality of life or cognitive or behavioural impairment outcomes, although these results were based on a small number of studies. Another possible reason for the lack of detected effects may also be that the programmes evaluated lasted 6–14 weeks. It may be that longer duration programmes are required for significant differences in these outcomes among children and young people. A previous meta-analysis found small to large improvements for the effect of physical recreation on quality of life and psychological outcomes (ie, depression and anxiety) among adults with physical or intellectual disability,[18] suggesting that these benefits may also be achievable for children and young people.

We were also unable to draw conclusions regarding the effect of sport or physical recreation interventions on participation due to the small number of studies measuring this outcome and an even smaller number using standardised assessment tools. Similarly, a systematic review investigating interventions to improve participation among children with physical disability found that only three studies included participation as a primary focus.[36] Among adults with disability, participation was reported in 40 out of 74 included studies, although participation was generally recorded as attendance at the activity rather than involvement in broader life activities.[18] The two randomised controlled trials using standardised tools in this review both showed positive results, which is encouraging and taken together with these other results suggests that improved participation in other life situations may result from participation in sport and physical recreation. Given that enhancing participation is often described as the main goal of rehabilitation and the ultimate health outcome,[37] quantifying participation, as well as quality of life and cognitive or behavioural impairment outcomes, in future clinical trials is warranted.

In addition to reporting the results from our meta-analyses, we have also presented the extent of the current literature investigating sport and recreation for children and young people with physical disabilities. The wide range of activities and disability types studied establishes the feasibility and safety of these activities and a platform from which to expand with higher quality research including more randomised controlled trials. As can be seen in figure 2 dance was the most common activity studied; however, none of these studies were represented in the meta-analysis. Two previous reviews specifically investigating dance for individuals with cerebral palsy also highlighted a lack of high-quality trials and found preliminary evidence suggesting beneficial effects.[38 39] Commonly studied health conditions included cerebral palsy, developmental coordination disorder and neuromuscular conditions. This most likely reflects the incidence rates of various disorders; however, for rarer conditions, the use of multicentre trial designs could facilitate a broader range of childhood disabilities being included.

Strengths and limitations

This is the first systematic review to summarise the impact of sport and physical recreation interventions on health outcomes among children and young people with any physical disability. In conducting this review, we followed the PRISMA recommendations and Cochrane Handbook guidelines, and we registered our protocol on PROSPERO. A strength of this study was the inclusion of a diverse sample covering many different types of physical disability, supported by previous research demonstrating that the severity of a disorder is more strongly related to participation outcomes than the diagnosis.[40] We also identified a diverse range of sport and physical recreation activities including swimming, dance, Tae Kwon Do, yoga, climbing and mixed sports activities. This improves the generalisability of our findings across different sport and physical recreation programmes.

There are several limitations to consider when interpreting the results from our review. Most studies investigated programmes developed specifically for the research study, with few investigating existing sport and physical recreation opportunities in the community. This may limit the generalisability of our findings. Additionally, we identified a range of outcome variables across studies which present challenges for meaningful comparison and synthesis, and we were unable to conduct a meta-analysis on participation as we only identified two studies reporting outcomes at this level. The majority of studies were from high-income countries which may limit generalisability to lower income countries. Our review has some minor deviations from that described at registration, which are outlined in online supplemental file appendix 6. Finally, given the small number of studies included in this review, our results provide preliminary findings. Further investigation of sport and physical recreation programmes—particularly existing community programmes—is suggested.

Implications for clinicians and policymakers

The knowledge that participation in sport and physical recreation can have direct health benefits should guide clinicians to adopt promotion of participation in these opportunities as an important part of the therapeutic toolkit. A number of studies in the review showed encouraging results for programmes which include sports skills training and individual goal setting related to sports and recreation participation.[32 33 41] Similarly, a pilot ICF-based intervention incorporating goal setting, addressing environmental barriers and building activity performance skills has shown early promise in improving leisure participation among adolescents with physical disability.[42] Increased adoption of similar programmes in the community setting has the potential to facilitate participation more broadly.

The range of different outcome variables identified in our review highlights the challenge of synthesising evidence in this field. In addition, it is challenging to categorise measures when they are often measuring multiple aspects of performance and could be argued to fall on a continuum not easily placed in a single ICF construct. The Core Outcome Measures in Effectiveness Trials Initiative,[43] and the WHO initiative to establish ICF core sets for specific conditions,[44] both seek to provide solutions to this challenge. Development of a core outcome set for children and young people with physical disability would promote standardisation and comparability across studies as well as facilitate evaluation of health services at a system level. A previous systematic review identified 36 paediatric core outcome sets covering 22 outcome clusters mapped to the ICF.[45] A core set for children and young people with neurodisability that assesses communication, emotional well-being, pain, sleep, mobility, self-care, independence, social activities, mental health, behaviour, toileting and safety has been developed, although this set only includes patient-reported outcome measures with a view towards use in large datasets.[46] Development of a core outcome set for use in clinical and research settings that includes objective functional measures (such as the Gross Motor Function Measure) as well as patient-reported outcome measures would help overcome the challenges of synthesising evidence. Involving children and young people and their parents/carers in the development of a core outcome set would be critical to ensure relevant outcomes are included.[45]

Unanswered questions and future research

We identified only two studies that measured participation using standardised multicomponent assessment tools. This suggests there is a greater focus on the therapeutic or impairment model rather than a recreational or participation focus. We suggest future studies shift focus towards investigating the effect of interventions on participation level outcomes in natural environments and community settings. This would ensure that research is aligning with the broader goals of enhancing inclusion and well-being for children and young people with physical disability. We also call for greater collaboration among researchers, such as multicentre research initiatives, to overcome the limitations of single-centre studies, particularly in terms of small sample sizes.

CONCLUSION

This systematic review with meta-analysis provides evidence to support the role of sport and physical recreation in improving health outcomes for children and young people with physical disability. Across all studies, the health condition cerebral palsy, the intervention dance and study design of single group pre–post measurement were most common. We found positive effects for activity limitation and physical impairment outcomes. There was no significant effect on quality of life and cognitive or behavioural outcomes, although these were based on a small number of studies, and we were unable to conduct a meta-analysis on participation outcomes. A shift towards more high-quality studies assessing participation level outcomes, and evaluation of existing sport and physical recreation programmes in the community, is indicated. The range of outcome variables identified presents challenges for evidence synthesis and supports our call for the development of a core outcome set for children and young people with physical disability.

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