

BMJ Open Physical activity among young children with disabilities: a systematic review protocol

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ABSTRACT

Introduction Physical activity in the early years is necessary for setting the foundation for healthy growth and development in later childhood and adolescence. While most published evidence to date focuses on typically developing children, prevalence rates of physical activity among children with disabilities have been less studied. This protocol paper documents the plan of a systematic review, which aims to synthesise the evidence regarding physical activity levels among young children with disabilities.

Methods and analysis Searches are anticipated to commence in May 2022. Empirical quantitative studies will be considered for inclusion if they present intervention or observational data on non-therapeutic (ie, leisure time) physical activity among children <5.99 years with physical, mental, intellectual or sensory impairments. Data sources will be retrieved via electronic database searches (Cumulative Index to Nursing and Allied Health Literature (CINAHL), EBSCO Sports Medicine Database (SPORTDiscus), Medical Literature Analysis and Retrieval System Online (MEDLINE), Elsevier Bibliographic Database (Scopus), Psychological Abstracts (PsycINFO), Education Resources Information Centre (ERIC) and Excerpta Medica Database (EMBASE)). Additional strategies to identify relevant studies will include manual searching and citation tracking of included articles. Titles and abstracts of identified studies will be screened for inclusion, followed by full-text reviews. Three independent reviewers will conduct quality appraisal using the Downs and Black checklist. A summary of included studies will describe the study designs, participant and activity characteristics, and outcomes.

Ethics and dissemination This systematic review involves a secondary analysis of previously published data; therefore, this review does not require ethical approval. The proposed paper will summarise the current evidence base on physical activity levels among young children with a diagnosed disability. The findings from this systematic review will identify gaps to be explored by future research studies and inform future investigations among the paediatric disability population.

PROSPERO registration number CRD42021266585.

INTRODUCTION

Physical activity in the early years is necessary for setting the foundation of healthy growth

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ This protocol paper documents the plan of a systematic review, which aims to synthesise the evidence regarding physical activity levels among young children with disabilities—a current gap in the field of paediatric exercise science.
- ⇒ Our search of the literature draws on a wide variety of databases.
- ⇒ A foreseeable challenge of this review is disentangling therapy studies from the studies that focus on non-therapeutic physical activity among young children with disabilities.
- ⇒ Restricting included papers published from 2000 onward could potentially omit key papers related to the overarching objectives of the review.
- ⇒ Eligible studies will be limited to those published in French and English, which may limit the global applicability of these findings.

and development in later childhood and adolescence. Various international guidelines stipulate that young children (0–4 years) should engage in a variety of physical activities totalling 180 min per day,^{1–3} eventually striving for 60 min daily of moderate-to-vigorous physical activity by the age of 5 years.⁴ Increased time spent participating in physical activity in childhood is linked with several health benefits.^{5,6} This includes lower adiposity, improved motor and cognitive development, and improved psychosocial, cardiometabolic and skeletal health.^{5,7} While physical activity has been positively associated with health indicators in children with disabilities,⁸ limited evidence suggests these children are less likely to be physically active compared with their peers without disabilities.⁹ While most published evidence to date focuses on typically developing children,^{10–14} prevalence rates of physical activity among children with disabilities have been less studied. Due to physical and social environment barriers, physical activity participation among children with disabilities can be

challenging, and social inclusion is often limited^{15–17} For example, barriers include inaccessible facilities, financial constraints, lack of accessible equipment and lack of access to professionals who are prepared or trained to promote physical activity among this population.^{17–19} Such realisations are concerning, given there are many additional benefits of physical activity to children with disabilities, including improved social integration^{15 16 20–22} opportunities for enhanced interaction and communication skills,^{23 24} improved daily functions, health-related outcomes and quality of life.²⁵ With close to 240 million children worldwide living with a disability,²⁶ the investigation of physical activity as means of improved physical and social health and well-being among children with disabilities is warranted and needs to be prioritised. In order to synthesise the existing knowledge, identify research gaps and establish research priorities, and ultimately to elevate the importance of physical activity among children with disabilities, a thorough review of the evidence is required.

AIMS AND OBJECTIVES

The aim of this paper is to describe a protocol for conducting a systematic review synthesising the physical activity levels of young children (<5.99 years) with disabilities. The overarching objectives of this review are to: (1) synthesise the existing literature regarding the amount (ie, percentage of day) of physical activity—at various intensities—in which young children with disabilities are participating, (2) explore differences in these outcomes between children with various disability types and (3) identify the gaps in the existing peer-reviewed literature.

For the purpose of this review, disability will be defined as ‘physical, mental, intellectual or sensory impairments which in interaction with various barriers may hinder full and effective participation in society on an equal basis with others’.²⁷ Restrictions will not be placed on the type of disability (ie, physical, intellectual, sensory and neurodevelopmental).

METHODS AND ANALYSIS

Design

The reporting of this systematic review protocol will adhere to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocol (PRISMA-P) checklist.²⁸ The conduct of this systematic review will be guided by the PRISMA.²⁹ This review has been registered with PROSPERO (International prospective register of systematic reviews).

Data sources

Preliminary scans of the available literature suggest that restriction of the review to randomised controlled trials would not be informative. Specifically, there are too few randomised controlled trials published from which to draw meaningful information. Rather, empirical research studies using quantitative and qualitative methods,

intervention (baseline data only) or observational design will be included. The types of quantitative study designs to be included will be randomised and non-randomised controlled trials. Review articles (eg, literature reviews, systematic reviews and meta-analyses) will be excluded, but they will be used to identify additional eligible articles.

Search strategy

Our search strategy was developed with the assistance of a consulting health sciences librarian. The search strategy included key search terms that were pertinent to the review’s primary objectives, namely, physical activity among young children with disabilities. Relevant keywords and medical subject headings terms were combined using Boolean operators (table 1) and adapted based on the databases searched. The following databases will be electronically searched: Cumulative Index to Nursing and Allied Health Literature (CINAHL), EBSCO Sports Medicine Database (SPORTDiscus), Medical Literature Analysis and Retrieval System Online (MEDLINE), Elsevier Bibliographic Database (Scopus), Psychological Abstracts (PsycINFO), Excerpta Medica Database (EMBASE) and Education Resources Information Centre (ERIC). Published theses were searched via ProQuest Dissertations and Theses Global (PQDT). Additional studies meeting inclusion criteria will be identified via hand searching and citation tracking of the included articles’ reference lists.

Searches will be limited to work published from 2000 to present given the increased attention on the movement behaviours of this young demographic in recent decades. Database searches will be run over the course of 7 days to ensure all sources are retrieved during the same period. Search results will be exported to COVidence software and duplications reviewed.³⁰ A log of all searches will be kept to record the initial search strategy and modifications.

Eligibility criteria

Study abstracts identified through the search strategy, citation tracking and hand searching will be screened according to the five eligibility criteria. These criteria include:

1. The study must be written in English or French.
2. The study must focus on young children with a disability. Restrictions will not be placed on the type of disability (ie, physical, mental, intellectual or sensory impairment).
3. The study must focus on young children with a mean age of ≤ 5.99 years. In studies that examine a mixed population of individuals with disabilities, only those studies wherein data are presented separately for young children will be included. Where feasible, study authors will be contacted when participant eligibility is uncertain.
4. The study must include a measure on physical activity. Physical activity will be defined as any bodily movement produced by the skeletal muscles that results in

Table 1 Search strategy and search terms developed in consultation with the health sciences research librarian for online databases

(A) MEDLINE
1 Infant/ or infant*.tw.
2 Child, Preschool/ or preschool*.tw.
3 pre-school*.tw.
4 child*.tw.
5 kindergarten*.tw.
6 toddler*.tw.
7 early child*.tw.
8 early years.tw.
9 young child*.tw.
10 disab*.tw. or Intellectual Disability/
11 physical disabilit*.tw. or Disabled Persons/
12 intellectual disabilit*.tw.
13 cerebral palsy.tw. or Cerebral Palsy/
14 spina bifida.tw. or Spinal Dysraphism/
15 Spinal Dysraphism.tw.
16 Autis*.tw. or exp Autistic Disorder/
17 ASD.tw.
18 ADHD.tw.
19 attention deficit hyperactivity disorder.tw.
20 developmental coordination disorder.tw. or Motor Skills Disorders/
21 Psychomotor Disorders/ or Developmental co-ordination disorder.tw. or Attention Deficit Disorder with Hyperactivity/
22 down syndrome.tw. or Down Syndrome/
23 acquired brain injur*.tw.
24 fetal alcohol syndrome.tw. or Fetal Alcohol Spectrum Disorders/
25 drug related syndrome*.tw.
26 Neurocognitive Disorders/ or neurocognitive disabilit*.tw. or Cognition Disorders/
27 Physical activit*.tw. or Exercise/
28 exp Sports/ or sport*.tw.
29 gymnastics.tw. or Gymnastics/
30 soccer.tw. or Soccer/
31 t-ball.tw.
32 Swimming/ or swim*.tw.
33 danc*.tw. or Dancing/
34 hockey.tw. or Hockey/
35 structured physical activit*.tw.
36 organised physical activit*.tw. or Physical Fitness/
37 gross motor play.tw.
38 aquatic*.tw.
39 active play*.tw.
40 energetic play*.tw.

Continued

Table 1 Continued

(A) MEDLINE
41 exercise*.tw.
42 physical education.tw. or 'Physical Education and Training'/
43 extracurricular.tw.
44 recreational sport*.tw.
45 cancer.tw. or exp Neoplasms/
46 Post-Concussion Syndrome/ or Brain Concussion/ or concussion*.tw.
47 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9
48 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26
49 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44
50 47 and 48 and 49
51 limit 50 to years='2000–2022'
52 51 not (45 or 46)
(B) CINAHL
S48 S46 NOT S44
S47 S46 NOT S44
S46 S9 AND S25 AND S45
S45 S26 OR S27 OR S28 OR S29 OR S30 OR S31 OR S32 OR S33 OR S34 OR S35 OR S36 OR S37 OR S38 OR S39 OR S40 OR S41 OR S42
S44 (MH 'Brain Concussion+') OR 'concussion'
S43 (MH 'Neoplasms+') OR 'cancer'
S42 'recreational sport**'
S41 'extracurricular'
S40 'energetic play'
S39 'active play'
S38 (MH 'Aquatic Sports') OR (MH 'Aquatic Exercises') OR 'aquatic**'
S37 'gross motor play'
S36 (MH 'Physical Fitness') OR 'Physical Fitness'
S35 'organised physical activit**'
S34 'structured physical activit**'
S33 (MH 'Hockey') OR 'hockey'
S32 (MH 'Dancing') OR 'danc**'
S31 (MH 'Swimming') OR 'swimming'
S30 t-ball
S29 (MH 'Soccer') OR 'soccer'
S28 (MH 'Gymnastics') OR 'gymnastics'
S27 (MH 'Sports+') OR 'sport**'
S26 (MH 'Physical Activity') OR 'Physical activit**'
S25 S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19 OR S20 OR S21 OR S22 OR S23 OR S24
S24 'neurocognitive disabilit**'

Continued

Table 1 Continued

(B) CINAHL	
S23	'drug related syndrome'
S22	(MH 'Fetal Alcohol Syndrome') OR 'fetal alcohol syndrome'
S21	'acquired brain injur**'
S20	(MH 'Down Syndrome') OR 'Down Syndrome'
S19	(MH 'Psychomotor Disorders')
S18	(MH 'Psychomotor Disorders') OR 'Psychomotor Disorder**'
S17	(MH 'Motor Skills Disorders') OR 'developmental coordination disorders'
S16	(MH 'Attention Deficit Hyperactivity Disorder') OR 'ADHD'
S15	(MH 'Autistic Disorder') OR 'Autis**' OR (MH 'Asperger Syndrome')
S14	'Spinal Dysraphism'
S13	(MH 'Spina Bifida') OR 'spina bifida'
S12	(MH 'Cerebral Palsy') OR 'Cerebral Palsy'
S11	(MH 'Intellectual Disability') OR 'intellectual disabilit**'
S10	(MH 'Child, Disabled') OR (MH 'Disabled') OR 'physical disabilit**'
S9	S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8
S8	'young child**'
S7	'early years'
S6	'early child**'
S5	'toddler**'
S4	'kindergarten**'
S3	pre-school*
S2	(MH 'Child, Preschool') OR 'preschool**' OR (MH 'Child')
S1	(MH 'Infant') OR 'infant**'
(C) SPORTDiscus, Scopus, PsycINFO and ERIC	
1	infant* OR preschool* OR child* OR kindergarten* OR toddler* OR 'early child**' OR 'early years' OR 'young child'
2	AND disab* OR 'Intellectual Disabilit**' OR 'physical disabilit**' OR 'Cerebral Palsy' OR 'spina bifida' OR 'Spinal Dysraphism' OR Aust* OR ADHD OR ASD OR 'attention deficit hyperactivity disorder' OR 'developmental coordination disorder**' OR 'Motor Skills Disorder**' OR 'Psychomotor Disorder**' OR 'Developmental co-ordination disorder**' OR 'Attention Deficit Disorder with Hyperactivity' OR 'down syndrome' OR 'acquired brain injur**' OR 'fetal alcohol syndrome' OR 'Fetal Alcohol Spectrum Disorder**' OR 'drug related syndrome*' OR 'Neurocognitive Disorder**' OR 'Cognition Disorder**' OR 'neurocognitive disabilit**'
3	AND 'Physical activit**' OR exercise* OR sport* OR gymnastics OR soccer OR t-ball OR swim* OR danc* OR hockey OR 'structured physical activit**' OR 'organised physical activit**' OR 'Physical Fitness' OR 'gross motor play' OR aquatic* OR 'active play**' OR 'energetic play**' OR 'physical education' OR extracurricular OR 'recreational sport**'

Continued

Table 1 Continued

(D) EMBASE	
1	(infant* or preschool* or child* or kindergarten* or toddler* or 'early child**' or 'early years' or 'young child').tw.
2	('Intellectual Disabilit**' or 'physical disabilit**' or 'Cerebral Palsy' or 'spina bifida' or 'Spinal Dysraphism' or autism or autistic or 'attention deficit hyperactivity disorder' or 'developmental coordination disorder**' or 'Motor Skills Disorder**' or 'Psychomotor Disorder**' or 'Developmental co-ordination disorder**' or 'Attention Deficit Disorder with Hyperactivity' or 'down syndrome' or 'acquired brain injur**' or 'fetal alcohol syndrome' or 'Fetal Alcohol Spectrum Disorder**' or 'drug related syndrome*' or 'Neurocognitive Disorder**' or 'Cognition Disorder**' or 'neurocognitive disabilit**').tw
3	('Physical activit**' or sport* or gymnastics or soccer or t-ball or swim* or dance or hockey or 'structured physical activit**' or 'organised physical activit**' or 'Physical Fitness' or 'gross motor play' or aquatic* or 'active play**' or 'energetic play**' or 'physical education' or extracurricular or 'recreational sport**').tw.
4	(cancer or neoplasm* or concussion*).tw.
5	1 and 2 and 3
6	5 not 4
7	limit 6 to years='2000–2022'
CINAHL, Cumulative Index to Nursing and Allied Health Literature; EMBASE, Excerpta Medica Database; ERIC, Education Resources Information Center; MEDLINE, Medical Literature Analysis and Retrieval System Online; PsycINFO, Psychological Abstracts; SPORTDiscus, EBSCO Sports Medicine Database.	

a substantial increase in energy expenditure over resting levels.³¹ Prospective studies will only be included if they provide details on the amount (ie, duration in percentage of day) and/or intensity level of physical activity participation. For the purpose of this systematic review, 'activities of daily living' (eg, bathing, dressing and position transfers) and therapies (ie, non-leisure time physical activity) will not be included in this definition of physical activity. Studies will be excluded if the primary focus is on children's physical activity preferences or correlates.

5. The study must be study peer reviewed.

Selection of studies

Title and abstract screening will be conducted by three researchers using the outlined eligibility criteria. Included articles will be imported into COVIDENCE for full-text screening by the same three review authors. Any discrepancies will be discussed as a group until consensus is achieved. The results of the study inclusion process will be documented on a PRISMA flow chart for systematic reviews (figure 1).

Data extraction

For each included study, data will be extracted and presented in a standardised form (table 2). The extracted

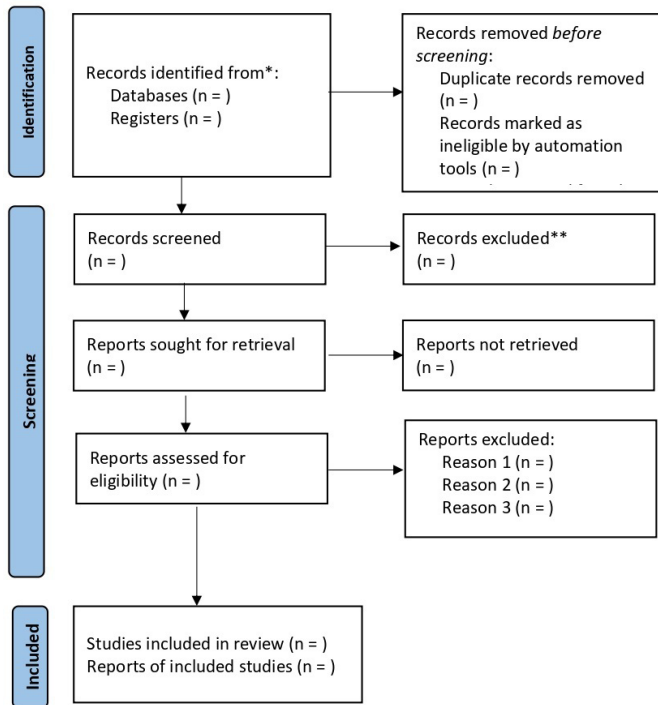


Figure 1 PRISMA flow chart detailing the study selection process. PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

data will include the following: (1) study details: title, authors, source, country, design and year of publication (2) population characteristics: number of participants, age, gender and type of disability and (3) physical activity measure: type, self-reported outcomes, objective outcomes and intensity. Study authors of included articles will be contacted, where possible, for missing or incomplete data. Three authors will perform data extraction in COVIDENCE.

Quality assessment

Three independent reviewers will conduct the quality appraisal of each of the included articles. Differences in quality assessment will be resolved by discussion between all authors.

Each article will be independently assessed using the Downs and Black checklist.³² For randomised controlled trials, the full checklist (27 questions) will be used and a modified version of the checklist (10 questions) will be used for all other study types, which is in-line with previous studies.^{33 34} The quality score of each article will be included in the extraction table.

Data synthesis

Narrative syntheses of extracted data will follow Popay and colleagues' framework.³⁵ Data from studies will be grouped according to study characteristics and findings collated in tabular or text form (where appropriate). Using narrative analysis, a comprehensive descriptive account of study quality, strengths and limitations will be described. Extracted physical activity data will be

Table 2 Standardised extraction form

Author and year	Sample (age, gender and ethnicity)	Study design	Disability type	Type of activity (recess, sport, play and outdoor play)	PA levels and intensity	Assessment: accelerometry (wear time, cut points, # days and device model)	Assessment: observation (include additional details)	Assessment: parent report (include additional details)	Quality assessment score
PA, physical activity.									



summarised (or ranges derived) based on frequency, duration and by intensity. Research gaps and study recommendation for future research veins will also be reported. All authors will be involved in this process.

Patient and public involvement

This research did not involve patient or public involvement.

ETHICS AND DISSEMINATION

All data used in this systematic review have been published and are publicly available. As such, this review does not require ethical approval. The findings from this systematic review will be disseminated via scientific peer-reviewed publication and conference presentations.

DISCUSSION

The aim of this review is to explore the literature on physical activity levels among young children (<5.99 years) with disabilities; it is anticipated that the results of this review will provide important insight into the existing knowledge and identify gaps in the literature. By highlighting specific trends in activity behaviours and approaches to measurement most commonly investigated, the findings of this work may help direct future research efforts as well as programme and service needs to support physical activity for young children with disabilities. Given the growing attention and investments in issues related to equity, diversity and inclusion, there is an identified need to understand the current physical activity behaviours of young children with disabilities and to identify potential avenues for intervention espoused to support healthy growth and development.

Strengths and Limitations of the Review

This systematic review will describe existing evidence regarding physical activity levels among young children with disabilities as well as highlight any gaps in the literature. This review is committed to transparently adhering to validated methods and best practices for systematically searching, identifying, appraising and extracting current literature. A robust search strategy has been developed (drawing on a variety of databases), clear inclusion criteria have been delineated and multiple independent screeners will be employed to review the selected evidence. A foreseeable challenge of this review is disentangling therapy studies from the studies that focus on non-therapeutic physical activity (eg, leisure activity, sport, play and active transportation) among young children with disabilities as well as interpreting behaviours within different disability groups. Eligible studies will be limited to those published from 2000 onward and in French and English only. As such, some relevant articles may be excluded based on year or language of publication.

IMPLICATIONS FOR RESEARCH

This systematic review will provide a comprehensive and rigorous evidence base on which areas of improvement and future research directions for physical activity among young children with disabilities can be proposed. Such work may lead to the development of physical activity interventions and inform public health recommendations regarding physical activity for this population.

REVIEW STATUS

This is an ongoing review. We estimate that the draft manuscript to be completed and submitted for peer review by June 2022 or July 2022.

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Contributors LV conceived and designed this study protocol, developed the literature search strategy and drafted this manuscript for publication. MS contributed to the search strategy development, arranged for the search strategy, conducted all the electronic database searches and read and provided comments for the final manuscript. LV, LT and JY carried out all screening and extraction activities. LV, LT, JY, PT, MS and RB-G assisted with data synthesis as well as revised and approved the final manuscript.

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Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval Not applicable.

Provenance and peer review Not commissioned; externally peer reviewed.

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REFERENCES

- 1 Tremblay MS, Chaput J-P, Adamo KB, *et al*. Canadian 24-Hour Movement Guidelines for the Early Years (0-4 years): An Integration of Physical Activity, Sedentary Behaviour, and Sleep. *BMC Public Health* 2017;17:874.
- 2 World Health Organization. WHO guidelines on physical activity. In: *Sedentary behaviour and sleep for children under 5 years of age*, 2019.
- 3 New Zealand Ministry of Health. Sit less, move more, sleep well: active play guidelines for Under-Fives, 2017. Available: <https://www.health.govt.nz/publication/sit-less-move-more-sleep-well-active-play-guidelines-under-fives>
- 4 Tremblay MS, Carson V, Chaput J-P, *et al*. Canadian 24-hour movement guidelines for children and youth: an integration of physical activity, sedentary behaviour, and sleep. *Appl Physiol Nutr Metab* 2016;41:S311-27.
- 5 Kuzik N, Poitras VJ, Tremblay MS, *et al*. Systematic review of the relationships between combinations of movement behaviours and health indicators in the early years (0-4 years). *BMC Public Health* 2017;17:109-22.
- 6 Poitras VJ, Gray CE, Borghese MM, *et al*. Systematic review of the relationships between objectively measured physical activity and

- health indicators in school-aged children and youth. *Appl Physiol Nutr Metab* 2016;41:S197–239.
- 7 Timmons BW, Leblanc AG, Carson V, *et al.* Systematic review of physical activity and health in the early years (aged 0–4 years). *Appl Physiol Nutr Metab* 2012;37:773–92.
 - 8 Cerrillo-Urbina AJ, Garcia-Hermoso A, Sánchez-López M, *et al.* The effects of physical exercise in children with attention deficit hyperactivity disorder: a systematic review and meta-analysis of randomized control trials. *Child Care Health Dev* 2015;41:779–88.
 - 9 Hinckson EA, Curtis A. Measuring physical activity in children and youth living with intellectual disabilities: a systematic review. *Res Dev Disabil* 2013;34:72–86.
 - 10 Biddle SJH, Asare M. Physical activity and mental health in children and adolescents: a review of reviews. *Br J Sports Med* 2011;45:886–95.
 - 11 Pontifex MB, Fine JG, da Cruz K, *et al.* Vi. The role of physical activity in reducing barriers to learning in children with developmental disorders. *Monogr Soc Res Child Dev* 2014;79:93–118.
 - 12 Pontifex MB, Scudder MR, Drollette ES, *et al.* Fit and vigilant: the relationship between poorer aerobic fitness and failures in sustained attention during preadolescence. *Neuropsychology* 2012;26:407–13.
 - 13 Reddon H, Meyre D, Cairney J. Physical activity and global Self-worth in a longitudinal study of children. *Med Sci Sport Exerc* 2017;49:1606–13.
 - 14 Lubans D, Richards J, Hillman C, *et al.* Physical activity for cognitive and mental health in youth: a systematic review of mechanisms. *Pediatrics* 2016;138. doi:10.1542/peds.2016-1642. [Epub ahead of print: 19 Aug 2016].
 - 15 Majnemer A, Shevell M, Law M, *et al.* Participation and enjoyment of leisure activities in school-aged children with cerebral palsy. *Dev Med Child Neurol* 2008;50:751–8.
 - 16 Kang L-J, Palisano RJ, King GA, *et al.* A multidimensional model of optimal participation of children with physical disabilities. *Disabil Rehabil* 2014;36:1735–41.
 - 17 Martin Ginis KA, Ma JK, Latimer-Cheung AE, *et al.* A systematic review of review articles addressing factors related to physical activity participation among children and adults with physical disabilities. *Health Psychol Rev* 2016;10:478–94.
 - 18 DeFazio V, Porter HR. Barriers and facilitators to physical activity for youth with cerebral palsy. *Ther Recreation J* 2016;50:327–34.
 - 19 Bassett-Gunter RL, Ruscitti RJ, Latimer-Cheung AE, *et al.* Targeted physical activity messages for parents of children with disabilities: a qualitative investigation of parents' informational needs and preferences. *Res Dev Disabil* 2017;64:37–46.
 - 20 Pan C-Y, Chu C-H, Tsai C-L, *et al.* A racket-sport intervention improves behavioral and cognitive performance in children with attention-deficit/hyperactivity disorder. *Res Dev Disabil* 2016;57:1–10.
 - 21 Sun J. How object, situation and personality shape human attitude in learning: an activity perspective and a multilevel modeling approach. *Learn Individ Differ* 2009;19:314–9.
 - 22 Hutzler Y, Chacham-Guber A, Reiter S. Psychosocial effects of reverse-integrated basketball activity compared to separate and no physical activity in young people with physical disability. *Res Dev Disabil* 2013;34:579–87.
 - 23 Kang KD, Choi JW, Kang SG, *et al.* Sports therapy for attention, cognitions and sociality. *Int J Sports Med* 2011;32:953–9.
 - 24 Steiner H, Kertesz Z. Effects of therapeutic horse riding on gait cycle parameters and some aspects of behavior of children with autism. *Acta Physiol Hung* 2015;102:324–35.
 - 25 Korkmaz B. Theory of mind and neurodevelopmental disorders of childhood. *Pediatr Res* 2011;69:101R–8.
 - 26 UNICEF. *Seen, counted, included: using data to shed light on the well-being of children with disabilities*, 2021.
 - 27 United Nations. Convention on the rights of persons with disabilities (CRPD), 2006 <https://www.un.org/development/desa/disabilities/convention-on-the-rights-of-persons-with-disabilities.html> [Accessed 21 Sep 2021].
 - 28 Moher D, Shamseer L, Clarke M, *et al.* Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Syst Rev* 2015;4.
 - 29 Liberati A, Altman DG, Tetzlaff J, *et al.* The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate healthcare interventions: explanation and elaboration. *BMJ* 2009;339:b2700
 - 30 Veritas Health Innovation. Covidence systematic review software, 2017. Available: www.covidence.org
 - 31 Caspersen CJ, Powell KE, Christenson GM. Physical activity, exercise, and physical fitness: definitions and distinctions for health-related research. *Public Health Rep* 1985;100:126–31.
 - 32 Downs SH, Black N. The feasibility of creating a checklist for the assessment of the methodological quality both of randomised and non-randomised studies of health care interventions. *J Epidemiol Community Health* 1998;52:377–84.
 - 33 Vanderloo LM. Screen-viewing among preschoolers in childcare: a systematic review. *BMC Pediatr* 2014;14:205.
 - 34 Duch H, Fisher EM, Ensari I, *et al.* Screen time use in children under 3 years old: a systematic review of correlates. *Int J Behav Nutr Phys Act* 2013;10:102.
 - 35 Popay J, Roberts H, Sowden A. *Guidance on the conduct of narrative synthesis in systematic reviews*. A Product from the ESRC Methods Programme, 2016.