

# INPLASY PROTOCOL

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None declared.

## Evidence-based practice interventions for children and young people with Developmental Coordination Disorder - A scoping review

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**Review question / Objective:** The aim of this review was to identify, qualify, evaluate and synthesise interventions used for children and young people with Developmental Coordination Disorder. The PCC was used to develop the review question: Population – children and young people with disorders of motor coordination aged to 25 years, not due to neurological disease or disorder eg. Cerebral Palsy. Concept - any method aimed to improve/treat/intervene in areas of motor learning, motor control, motor coordination or motor skill. Context - information on methods of delivery of interventions to consider context and cultural factors influencing delivery as well as details of intervention timing and outcomes. Primary Question: What interventions are being used for children and young people with DCD? Secondary Questions: How are these interventions being implemented? What outcomes are evident?

**INPLASY registration number:** This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 07 February 2023 and was last updated on 07 February 2023 (registration number INPLASY202320028).

### INTRODUCTION

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**Background:** Children with Developmental Coordination Disorder (DCD) experience challenges with everyday life tasks. This affects 5-10% of all children (Henderson & Henderson, 2002; DSM5; American Psychiatric Association, 2013). Intervention for these children at an early stage of development is important since the processes of development in the brain at a young age are rapidly changing. While it is not known whether processes such as neural myelination, responsible for fast neural activity and communication, can be altered by stimulating motor learning at a young age for children with DCD, it is known that sensory and motor areas are myelinated around the preschool period, while regions responsible for higher cognitive abilities (f.e. prefrontal cortex) continue to develop during adolescence (Nelson, de Haan, & Thomas, 2006; Nelson & Jeste, 2008).

Motor learning and skill acquisition are the goals of intervention offered to children with DCD. The exploration of movements and finding solutions for movement challenges depend on efficient sensorimotor feedback to develop adequate internal models of motor tasks (Assaiante & Amblard, 1995). So far, activity-oriented interventions are the most supported for evidence-based practice for increasing skill performance in children with DCD (Blank et al., 2019). Activity and some body-function oriented interventions (e.g. strength, fitness) showed positive changes in motor function although longer term maintenance is not known (Blank et al., 2019). However, intervention studies are relatively scarce across age groups and extremely varied in the approach used, types and contexts of delivery and dose and duration provided

It is important to understand the potential of differing methods for developing movement skills which involve differing tasks and/or variable environmental constraints. The aim of this scoping review is to explore several questions and issues about intervention methods being used for children and young people with DCD including: what approach, how (and by whom) and where delivered, at what stage of development and at what intensity and duration. We will assess the extent of the available evidence and categorise treatment methods into groups, consider the utility and efficacy of approaches, and highlight the alleged gaps. Based on the results, evidence-based practice recommendations will be formulated and areas for further research and development outlined.

**Rationale:** Since early childhood the acquisition and execution of motor skills are below the expectancy for children with DCD in comparison to their peers (DSM5; American Psychiatric Association, 2013). Slower movements, lack of predictive motor control and poor sensori-motor coordination are core characteristics of DCD (Wilson, et al., 2013; Geuze, 2005). Interventions that are offered to children with DCD are quite diverse. The recommendation of Wilson and colleagues (2013) based on their systematic review was aimed in two directions: The first track was aimed at improving predictive control by means of augmented feedback and motor imagery training. Theoretically it was assumed that internal models for action and the supporting body schema was the basis to improve motor acquisition (Wilson, Thomas & Maruff, 2002). The second track of intervention was aiming to work with rhythmic coordination and timing within and between limbs, theoretically aiming at cerebellar function (Carson & Kelso, 2004). Task focused and cognitive self-management approaches have also shown benefits to improving motor skills of children with DCD (Araujo et al., 2021). Other interventions have focused on providing additional opportunities for gross motor leisure activities such as Karate (Ghadiri et al., 2022).

## METHODS

**Strategy of data synthesis:** Data bases to be searched: Medline; CINAHL; AMED; CINAHL; Education Collection (includes ERIC and Education Database); SCOPUS and Web of Science.

Grey literature in CrossRef; Directory of Open Access Journals; Google Scholar; and, Index Copernicus with limitations to search terms to capture foreign language publications not indexed in databases.

**Search Terms:** apraxia OR "atypical brain development" OR "clumsy child\*" OR DAMP OR dcd OR "deficits in attention motor control and perception" OR "developmental coordination disorder\*" OR "developmental motor coordination disorder" OR dyscoordination OR dyspraxia OR in-coordination OR "lower motor competence\*" OR "mild motor problem\*" OR "minimal brain damage\*" OR "minimal brain dysfunction" OR "minimal cerebral dysfunction" OR "minimal neurological dysfunction" OR "minor neurological dysfunction" OR "motor coordination difficult\*" OR "motor coordination problem\*" OR "motor delay disorder\*" OR "motor learning difficult\*" OR "motor skills disorder\*" OR "movement difficult\*" OR "non-verbal learning disorder\*" OR "perceptual motor dysfunction\*" OR "perceptual motor impairment" OR "physical\* awkward\*" OR "psychomotor disorder\*" OR "sensory integrative disorder\*" OR "sensory motor difficult\*" OR SPDDMF OR "specific developmental disorder of motor function\*" "developmental coordination disorder\*" OR dcd OR dyspraxia OR "motor skills disorder\*" OR "specific developmental disorder of motor function" OR SPDDMF OR "developmental motor coordination disorder\*"

AND physiotherapy OR rehabilitation OR "physical treatment" OR exercise OR therapy OR OT OR training OR treatment OR "physical education" OR PE OR "motor learning" OR intervention\* OR "cognitive orientation to daily occupational performance" OR CO-OP OR "motor performance" OR "physical activity" OR PA OR sport\* OR play OR "virtual reality training" OR "virtual rehabilitation" OR

yoga OR danc\* OR "handwriting teaching" OR "karate" OR "attention\* focus" OR imagery

**MESH terms:** Motor Skills Disorders, Neurodevelopmental Disorders , Psychomotor Disorders

**COVIDENCE** software will be used for primary screening and data extraction.

**Eligibility criteria:** Children and young people identified with movement disorders not attributable to neurodisability (e.g. Cerebral Palsy), neuromuscular condition (e.g. Muscular Dystrophy, Ehlers Danlos syndrome) to include: child\* OR adolescent\* OR youth OR teenager\* OR kid\* OR "young adult\*" OR "school age\*" three years up to age 25 years.

**Source of evidence screening and selection:** Methods of Scoping review according to Arksey and O'Malley (2005) and Levac, Colquhoun and O'Brien (2010). Stage 1: identifying the research question - undertaken by an international consensus group following PCC.

Stage 2: identifying relevant studies - initial search led by PVN with back checking to international consensus group; manual search of references of identified studies.

Stage 3: study selection - random allocation of identified research/reviews/reports to pairs of reviewers - each individual in a pair to independently review by title and abstract with consensus ratings between pairs, repeated for full-text selection, In the case of disagreements, the two lead researchers (DJ or DG), depending on who is independent of the pair) will act as arbitrator. Pairs of reviewers will be made to ensure independence of discipline eg. a physiotherapist would be matched to a movement scientist rather than another physiotherapist, in order to enhance objectivity of selection.

Stage 4: charting the data - data for extraction were formulated through iterative design amongst the international consensus group to ensure all elements of interest relating to the type, delivery and outcomes of relevance across disciplines were included.

**Stage 5: collating, summarizing and reporting the results - synthesis of results** undertaken by the international consensus group through an iterative process, led by DJ and DG, for presentation of results and preparation of manuscript with input and review by all authors.

**Data management:** Data management will be coordinated using COVIDENCE (backed up and stored with ENDNOTE and Rayyan), managed via JU.

**Reporting results / Analysis of the evidence:** Collating, summarizing and reporting of the results will be undertaken by the international consensus group working in pairs/triplets through an iterative process using COVIDENCE, led by DJ and DG to ensure objective and independent reporting and limit risk of bias. Types of intervention will be categorised according to the underlying approach and subcategorised with respect to the context and mode of delivery with evidence of outcomes recorded.

**Presentation of the results:** Results will be collated and charted and reported in tables and figures for (conference) presentation and reported in a manuscript(s) for publication.

**Language restriction:** None.

**Country(ies) involved:** Netherlands, Sweden, Czechia, Iran, Spain, United Kingdom.

**Keywords:** DCD; training; treatment; contexts.

**Dissemination plans:** Results of this scoping review will be prepared as a manuscript for publication in peer reviewed journals, presentation at international conferences such as the International Developmental Coordination Disorder Conference and European Academy of Childhood Disability and summaries to parent/population groups.

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