



## Manuela Valentini

Associate Professor in Methods and Didactics of motor activities | University of Urbino "Carlo Bo" | manuela.valentini@uniurb.it

## Monica Minucci

Primary School Teacher and Special Education Teacher | University of Urbino "Carlo Bo" | m.minucci1@campus.uniurb.it

# Benefits of Motor Activity in preschool children with infantile cerebral palsy: a systematic review

## Benefici dell'attività motoria in bambini in età prescolare con paralisi cerebrale infantile: systematic review

Altri contributi

### ABSTRACT

The aim of the evaluation is to identify research, investigations, and reviews that have highlighted the beneficial effects of motor activity in children from 3 to 6 years with Infantile Cerebral Palsy. Twenty researches, covering a time span from 2014 to 2022, have been taken into consideration. They concern the age group considered and propose motor activity paths within school contexts, with the aim of abandoning a medical and hyper-specialistic rigidity with which childhood cerebral palsy rehabilitation is often approached. The results of the various investigations show positive aspects not only with regard to the physical development of children with CPI but also to emotional well-being and socialization processes.

**Keywords:** Cerebral Infant Palsy | Cerebral Palsy | Physical activity | motor activity | Preschoolers | preschool children | kindergarten

OPEN ACCESS Double blind peer review

**How to cite this article:** Valentini, M., & Minucci, M. (2023). Benefits of Motor Activity in preschool children with infantile cerebral palsy: a systematic review. *Italian Journal of Special Education for Inclusion*, XI, 2, 193-207. <https://doi.org/10.7346/sipes-02-2023-17>

**Corresponding Author:** Manuela Valentini | manuela.valentini@uniurb.it

**Received:** 19/06/2023 | **Accepted:** 20/12/2023 | **Published:** 29/12/2023

**Italian Journal of Special Education for Inclusion | © Pensa MultiMedia®**  
**ISSN 2282-6041 (on line) | DOI: 10.7346/sipes-02-2023-17**

**Credit author statement:** Although the article is the product of joint ideation and drafting, the "Introduction" and "1. CHAMPPS: Children in Action Motor Program for Preschoolers" paragraphs are by M. Valentini, the paragraphs "2. Objectives", "3. Methodology" and "4. Results" by M. Minucci, while "5. Discussion", "5.1 Benefits of pre-school motor Activity with children with Infantile Cerebral Palsy" and "6. Conclusions" are the result of the work of both authors.



## Introduction

Infantile Cerebral Palsy, although presenting various symptoms, usually results in motor difficulties that can be more or less severe depending on the injury. It is one of the most common motor disabilities in the West, affecting 2 to 2.5 children per 1000 live births each (Ferrari & Cioni, 2005; Bax, Goldstein et al., 2005; Oskoui et al., 2013; Commissione Parlamentare per l'infanzia e l'adolescenza, 2017). Most of these have spastic problems, and about one-third will not be able to move and ambulate independently (Ferrari & Cioni, 2005; Bax & Goldstein et al., 2005; Oskoui et al., 2013). The early identification of problems favors the start of a rehabilitation pathway aimed at promoting, from the earliest years of life, the recovery of deficient functions and the strengthening of residual ones. It is necessary to carry out teamwork, within which every professional, including those of care and education, can and must contribute to the child's integral growth (Cottini, 2017). The current state of research indicates a significant gap between the educational needs of individuals with disabilities and the professional responses provided by schools. It is highlighted that one of the main barriers to the inclusion of students with disabilities is represented by the negative attitudes of teachers (Montesano & Straniero, 2019). In interfacing with a disability, the teacher often feels a sense of inadequacy and unpreparedness and the fear of causing a slowdown in learning for the rest of the section/class (Horne & Timmons, 2009; De Boer et al., 2011). When it comes to physical difficulties, there is a tendency to engage in pure welfare (*social assistance*), limiting the participation of persons with disabilities due to low professional training. On the contrary, physical-sporting activities with people with disabilities can be an opportunity to allow them to express themselves in new and original forms through motor proposals (Berthoz, 1998; Gardner, 2009), creating a dynamic interaction between self-discovery and the world around us through our first channel of communication, which is the body (Dewey, 1896). If we refer to the «Body Being» in its pedagogical and inclusive form, we can say that it allows us to act «with and thanks to our limits», since it is «configured as a dimension that facilitates the emergence of creative aspects» (De Angelis et al., 2022). Perceiving, knowing, and having body consciousness through «psychomotor exercises associated with games and activities of expression, carried out in a meaningful relationship setting, will play an essential role in the structuring of the «Body Scheme» central element of personality» (Le Boulch, 1981). The authors Hastie, Johnson, and Rudisill (2018) in their research emphasize the need to implement programs of physical activity at gradual difficulty just to stimulate the child in a continuous process of personal growth. From a psychological point of view, involvement in motor and sports activities favors the reduction of many symptoms related to mental disorders such as anxiety and depression (Dyson, 2001; Bano, Ikonomi & Muka, 2018). Further scientific studies (De Mei et al., 2018) tend to highlight, in particular, the development of self-esteem and self-efficacy determined by healthy and regular physical activity.

### 1. CHAMPPS: Children in Action Motor Program for Preschoolers

Methodologically, one of the innovative intervention proposals we would like to highlight is the one developed by Favazza and his collaborators in 2022: the CHAMPPS - *Children in Action Motor Program for Preschoolers* (Favazza et al., 2022). This is useful to provide real instrumental guides to support the conscious and intentional planning of motor activities within classrooms that promote the active involvement of each person (Aronson-Ensign et al., 2018), determining not only their bodily development, but also communicative, social, and cognitive ones (Wassenberg et al., 2005; Piek et al., 2008; Iverson, 2010; Fedewa & Ahn, 2011). This approach enhances the importance of acceding to the curriculum by showing objectives, contents, methods, materials, checks, and assessments, suitable for everyone, in line with Universal Learning Design. In this perspective, the commitment required by the United Nations Convention on the Rights of Persons with Disabilities, requires member states to ensure full participation in all life contexts, on the basis of equality and working to eliminate environmental barriers to accessibility, of persons with disabilities (ONU, 2006, Art. 9). The authors of CHAMPPS emphasize the need to adapt the



program guidelines to the unprecedented situation that is built within each section, assessing the originality of each child, identifying their main needs. Especially in working with disabilities, it is essential that educators are careful to enhance the abilities of those with special educational needs, not labeling their deficit as a limitation to participation, but, on the contrary, defining it as the possibility of experiencing a new and stimulating starting point for an educational itinerary. It is important for the planning to be deliberate and precise while allowing a certain degree of flexibility in order to be ready to adapt to any sudden changes, especially when working with individuals with disabilities (Nesti, 2012). In concrete terms, the *CHildren in Action: Motor Program for PreschoolerS* is a semi-structured motor program that uses Universal Design for Learning (UDL) strategies to increase children's motor, social, language, and learning skills (Orkwis, 2003; CAST, 2018). With regard to the pathway with children with Infantile Cerebral Palsy who show particular difficulties from a motor point of view, the UDL principles that support the CHAMPPS program include:

- the use of break times to respect the child's endurance;
- adjusting the length and pace of the activities according to the subject's needs;
- ensuring that the activity is carried out in a sufficiently wide path if the child uses an adaptive tool, such as a wheelchair;
- ensuring the safety of the space, which must be free of any type of obstacle;
- provide more time for the child to complete the activities.

For example, in the first unit in which basic skills are stimulated and strengthened, the program includes the Warm-up, Middle Phase, and Defatigue phase. The second activity, «Follow me home», consists of an imitation game in which movement is stimulated through dramatization. In fact, the teacher will have to show cards depicting animals in order and will stimulate conversation with questions such as: «What animal is it? How does it move? What is its habitat?». Each animal will then be depicted and imitated in its posture. Of course, adaptations are planned according to UDL strategies to ensure everyone's participation. Great importance is attached to the self-determination of the participants, who can be stimulated through the personal choice of the animal to be imitated in verse and movement. The use of visual aids, such as cards and photographs, is also envisaged, not only to show the animal but also to represent the rules to be observed in the various moments of the game (e.g., sitting in a circle, standing). With regard to the enactment of actions and expressions, the possibility of making any imitation original and unique is made explicit, by also identifying partial body movements that can be carried out respecting everyone's characteristics, which in any case allow one to understand the animal being imitated.

Here are some photographs that show an example of a Learning Unit based on the imitation of animal movement proposed to a heterogeneous section of 3- and 4-year-old children, where there is a child with disabilities certified by Italian law 104/92, with slight neuro psychomotor retardation with falls prevalent in the area of motor coordination.



Photograph 1 - How do animals move? (source: own elaboration)



*Photograph 2 - How do animals move? (source: own elaboration)*



*Photograph 3 - What is its habitat? (source: own elaboration, created with children)*



*Photograph 4 - What is its habitat? (source: own elaboration, created with children)*



## 2. Objective

The founding objective of our systematic review is to highlight the effects and benefits that the proposal of motor activity pathways at preschool age determines in children with Infantile Cerebral Palsy. In this sense, we have taken into consideration research, reviews, and articles that underline the positive aspects related to conscious and structured motor activation not only within specific rehabilitation contexts but also in Preschool, which constitutes a place of care and growth for the subject (D'Alonzo, 2018; Brandolini, 2022). The intention is precise to encourage the activation of more educational pathways based on the knowledge of one's own body and on the active participation of each one, increasing awareness also within the teaching corpus of the benevolent feedback derived from them (Gaspari, 2011; Canevaro, 2013). By providing food for thought based on critical research and analytical study of scientific data, then, we could abandon uncertainties and professional awkwardness in order to embrace the holistic educational care of all children from an early age. To specify the main elements of our investigation, we will use the PICO model, which is structured into four main factors:

1. *Factor P*: represents the subject of the question, hence the subjects we refer to in the research (Problem, patient, or population)
2. *Factor I*: indicates the path being addressed, hence the actions being taken on/with the subject (Intervention)
3. *Factor C*: consists of the starting point or control group, which will allow us, at the end of the pathway, to understand the actual changes (Control or comparison)
4. *Factor O*: refers to the results obtained at the end of the intervention (Outcomes). (Brown, 2020; Schiavenato et al., 2021)

Although the PICO model is mainly used to answer health science questions, we will confine its use to focus on the main elements that guided our systematic review, always keeping the educational-didactic point of view that belongs to us clear. Below, the table analyses the population, the type of intervention, the focus, and the results that essentially emerge from the selected articles and research, respectively.

<b>P</b>	<b>I</b>	<b>C</b>	<b>O</b>
Population	Intervention	Control	Outcomes
Kindergarten children, mainly aged 3 to 6 years, with Infantile Cerebral Palsy	Proposal of motor and movement activities also within the school, following different modalities	All the research included in the review follows the development of a medical-rehabilitation process, but not all of them are also executed in the school system. There is still little scientific research on schools	The research analyzed shows an overall physical, social, and emotional growth of children when stimulated and involved in motor activities in the school context

Table 1 - PICO model on this research survey (source: own elaboration)

## 3. Methodology

Following the definition of the objective and the inclusion and exclusion criteria, this systematic review was conducted following several steps to allow the final selection of suitable articles consistent with the research topic.

The survey was conducted in February, March, and April 2023 following the following steps:



- Choice and definition of keywords and insertion in search engines;
- Critical analysis of the titles and abstracts of the articles found and first partial collection of data;
- Reading of the articles and subsequent manual search for experiments and research consistent with our objective;
- Study of grids for the collection of key information;
- Creation of tables for the organization of the fundamental elements emerging from each study/research selected.

The search platforms used were EBSCOhost and PubMed, thanks to which we had access to numerous databases, including MEDLINE, ERIC, APA PsycInfo, APA PsycArticles, SPORTDiscus, Springer Nature Journals, PlosONE, Scopus, Supplemental Index. In both cases, thanks to the '*advanced search*' tool, we entered keywords established in a manner consistent with the objectives of the investigation through the combination of the Boolean operators AND and OR.

A time parameter was also chosen, selecting only articles after the publications of 2014, favoring above all the most recent ones.

- The keywords used were as follows:
- Cerebral Infant Palsy (or Cerebral Palsy)
- Physical activity (or motor activity)
- Preschoolers (or preschool children or kindergarten)

The various information obtained through the search was ordered within a table, in which we outlined two large macro-areas subsequently detailed:

- *Bibliographic indicators*: authors, title, year of publication, geographical area, search engine used;
- *Explanation of the studies*: sample and characteristics (age, number of participants, gender), setting, type of research, method of data analysis, purpose, and results.

#### *Exclusion criteria*

Research studies were excluded:

- with languages other than English;
- with a population that does not include children aged 3 to 6 years;
- when carried out with rehabilitation equipment that cannot be found at school and that has no direct connection with it;
- that do not examine cases of Cerebral Palsy.

#### *Inclusion criteria*

Subjects were included if:

- they included activities carried out not only within the school but also in rehabilitation centers;
- they analyzed broader age targets than the single 3-6-year age group.

#### *Consideration and mitigation of risk of bias*

- Publication bias: scientific publications with significant results were selected, and fewer;
- Time lag bias: scientific publications chosen with a wide time span, between 2014 and 2023;
- Language bias: scientific publications selected from the main search engines and published in scientific journals in the field.

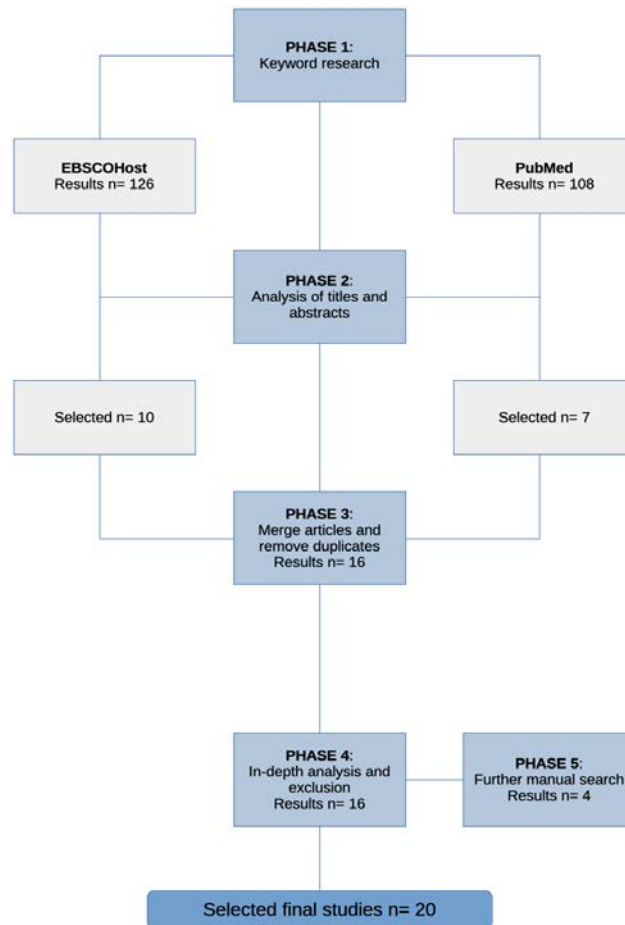


Figure 1 - Flow chart of the various research phases (source: own elaboration)

## 4. Results

In the first phase of keyword entry in search engines, 126 studies (n=126) were found on EBSCOhost and 108 searches (n=108) on PubMed for a total of 234 articles (n=234). Subsequent analysis of titles and abstracts led to the exclusion of 217 studies (n=217). Of the additional 17 protocols considered valid and consistent with our search, duplicates were removed (n=1). The inclusion and exclusion criteria were critically checked and, as a final step, a further manual search was carried out, which resulted in the addition of 4 studies (n=4). In the following table, we have highlighted the inclusion/exclusion pathway performed from the two databases used.

Databases	Total	Removed (phase 1)	Analyzed	Duplicates	Removed (phase 2)	Included
EBSCOHost	126	116	10	1	0	9
PubmED	108	101	7	0	0	7

Table 2 – Survey of the different databases used for this research (source: own elaboration)

A total of 20 protocols (n=20) have been included in our systematic review, grouped in the following table. Authors, year, search engine, sample (and characteristics), type of search, and highlighted results are indicated.



Authors Year	Nation Motor of research Setting	Publication title	Characteristics and age of the population	Research methodology used	Results
Bloemen et al. 2014	Utrecht, Netherlands British Library Document Supply Centre Inside Serials & Conference Proceedings	Factors associated with physical activity in children and adolescents with a physical disability: a systematic review.	Systematic review with the final selection of 6 qualitative and 12 quantitative research articles from 2000 to 2013.	Searches were selected from the following databases: Academic Search Elite, CINAHL, The Cochrane library, EMBASE, PEDro, PsycINFO, PubMed, SPORTDiscus.	Positive aspects associated with participation in physical activities also for children with disabilities (self-efficacy, physical well-being, balance). Need to increase sports equipment to enable everyone to participate in activities and to encourage a correct approach to movement from an early age.
Smits et al. 2014	Netherlands PubMed <i>Keywords: cerebral palsy, motor activity, rehabilitation</i>	How do changes in motor capacity, motor capability and motor performance in children and adolescents with cerebral palsy?	321 children and adolescents (121 females, 200 males) with Infantile Cerebral Palsy. Data were collected at the following developmental stages: 18 months, 30 months, 5 years, 7 years, 9 years, 11 years, 13 years.	Longitudinal study in which the following instruments were used: Gross Motor Function Measure-66 (GMFM-66) to assess gross motor function, Pediatric Evaluation of Disability Inventory (PEDI) and the Functional Skills Scale (FSS) to measure general mobility.	The changes achieved in structured activities do not necessarily lead to improvements in the child's daily motor skills. For this reason, we emphasise the need to stimulate physical activity in all contexts of the subject's life, especially within the school system in which he or she spends most of their days.
Fitzgerald et al. 2016	Ireland PubMed	Six-Minute Walk Test in children with spastic cerebral palsy and children developing typically	145 children with spastic cerebral palsy, aged 4 to 17 years (56 females; 89 males). 137 normally developing children of the same age (66 females; 71 males)	Experimental research using the Gross Motor Function Classification System (GMFCS) for cerebral palsy, considering Level 1 (unrestricted walking) and Level 3 (walking with a manual mobility device).	The 6 Minute Walk Test, i.e. the daily proposal of a short motor intervention programme, applicable in all situations and not only in rehabilitation, supports the physical development of all children, including those diagnosed with Infantile Cerebral Palsy.
Kim et al. 2017	Korea Scopus <i>Keywords: Cerebral palsy, activity of daily living, self care, mobility limitation</i>	Relationship between mobility and self-care activity in children with cerebral palsy	25 children (14 females; 11 males) with cerebral palsy aged between 4 and 6 years.	The following instruments were used for the research: Manual Ability Classification System (MACS), Pediatric Evaluation of Disability Inventor (PEDI), Gross Motor Function Classification System (GMFCS).	Importance of mobility and physical activation for the acquisition of self-regulation and self-care skills. Close correlation between individual well-being and the ability to positively connect to the social sphere.
Taunton et al. 2017	USA SportDISCUS with Full Text <i>Keywords: adapted physical education, fundamental motor skills, motor competence, inclusion</i>	Universally Designed Motor Skill Intervention for children with and without disability	69 children (43% female, 57% male) aged between 3 and 5 years. 42% of the participants have a disability.	Experimental research with working group and control group, proposing a motor intervention based on UDL (SKIP-UDL) for a period of 6 weeks. The Test of Gross Motor Development (TGMD-2) was used to assess motor skills and object control.	The measures taken during the pre-treatment and post-treatment periods show a constancy in the results in the control group. The working group, on the other hand, perceives an improvement in all TGMD-2 items, referring both to children with and without disabilities.
Toovey et al. 2017	Australia Scopus	Task-specific gross motor skills training for ambulant school-aged children with cerebral palsy: a systematic review.	13 qualitative and 6 quantitative synthesis studies were included, analysing children with an average age of 4 years.	The systematic review was carried out using the following databases: Medline, EMBASE, CINAHL, PsycINFO, SPORTDiscus, PubMed.	The studies analysed highlight the low involvement of children with motor difficulties in the various physical activities carried out within the school context. It is recommended that new methodologies and teaching proposals be explored in order to encourage the participation of everyone.
Bur-gess et al. 2018	Australia British Library Document Supply Centre Inside Serials &	Self-care and manual ability in preschool children with cerebral palsy: a longitudinal study	290 children with Cerebral Palsy (112 females; 178 males). Data were collected at the following months of age: 18, 24, 30, 36, 48,	Longitudinal study analysing the well-being and quality of life of children based on the development of their manual skills. The instruments used were: Pediatric Evaluation of	Data collected during the various developmental and growth phases of children show that the greater the physical-manual skills possessed, the greater the subjective well-being, given the improved ability to self-





	Conference Proceedings		60.	Disability Inventor (PEDI) to assess self-regulation and the Manual Ability Classification System (MACS) to test manual skills possessed.	manage. The need to stimulate fine and manual motor skills through daily physical exercises is emphasised.
Cameron et al. 2019	Melbourne, Australia British Library Document Supply Centre Inside Serials & Conference Proceedings	Movement-based interventions for preschool-age children with, or at risk of, motor impairment: a systematic review	The survey was conducted through the study of 14 quantitative and 3 qualitative studies, referring to children aged between 3 and 6 years.	Systematic review using databases such as MEDLINE, CINAHL, Embase, Cochrane Collaboration, PsychInfo, Physiotherapy Evidence Database (PEDro).	The results show that there is still a low awareness of scientific evidence based on motor interventions with pre-school children. The studies analysed show that motor activity enhances the physical potential of children with disabilities, enabling their physical, social and emotional development.
Ramey et al. 2019	USA Scopus <i>Keywords: cerebral palsy; cimt; comparative effectiveness trial; hemiparesis; high intensity treatment; pediatric constraint-induced movement therapy.</i>	Children with Hemiparesis Arm and Movement Project (CHAMP): protocol for a multisite comparative efficacy trial of paediatric constraint-induced movement therapy (CIMT) testing effects of dosage and type of constraint for children with hemiparetic cerebral palsy	135 children between the ages of 2 and 8 years with hemiparetic cerebral palsy.	Experimental research with division into working and control groups. Two types of courses:(a)-motor activity for a total of 60 hours (3 hours per day, 5 days per week for a total of 4 weeks);(b)-motor activity for a total of 30 hours (2 ½ hours per day, 3 days per week for a total of 4 weeks).	The results obtained highlight the need to combine rehabilitation-therapeutic work with motor participation also in non-paediatric contexts. The study wishes to promote precisely an improvement and expansion of the motor education proposal in order to implement the performance of physical activity also in persons with disabilities in contexts that allow the creation of social ties.
Eminel et al. 2020	Turkey Springer Nature Journals <i>Keywords: caregivers, cerebral palsy, musculoskeletal pain, quality of life, workload</i>	Physical workload during caregiving activities and related factors among the caregivers of children with cerebral palsy	291 children with Infantile Cerebral Palsy under the age of 18 and 291 caregivers	Studio trasversale effettuato utilizzando diverse scale: Gross Motor Function Classification System (GMFCS); il Physical Workload Questionnaire (PWQ); il Nordic Musculoskeletal Questionnaire (NMQ); il Neck Pain and Disability Scale (NPAD) insieme al Quick Disability of the Arm, Shoulder and Hand (Quick DASH), al Lower Extremity Functional Scale (LEFS) e al Oswestry Disability Index (ODI); il Beck Depression Inventory (CDI) e il Nottingham Health Profile.	The aim is to investigate and understand the physical work required during motor activities, not only for the child with CP but also for the caregiver caring for the child. The importance of effective motor function for both the physical and emotional development of the child with CP and his or her caregiver is emphasised, with a view to improving Quality of Life.
Ko et al. 2020	Korea British Library Document Supply Centre Inside Serials & Conference Proceedings <i>Keywords: cerebral palsy, children, group therapy, rehabilitation therapy, task oriented</i>	Effect of group-task-oriented training on Gross and Fine Motor Function, and Activities of daily living in children with spastic cerebral palsy	18 children (9 females; 9 males) with spastic PCI, aged 4 to 7 years, divided equally into control and working group.	Experimental research involving a 1-hour meeting twice a week for a total of 2 months with the team. The following assessment instruments were used: GMFM-88 (crawling and rolling, sitting, crawling, standing, walking, running and jumping) and PEDI (self-care, mobility, social functions)	The results show that the control group performs better in balance, walking, running and jumping (GMFM-88) and social functions (PEDI) than the control group subjects.
Novak et al. 2020	Australia PubMed <i>Keywords: cerebral palsy, systematic review, traffic light system, evidence based. GRADE</i>	State of the Evidence Traffic Lights 2019: Systematic Review of interventions for preventing and treating children with cerebral palsy	247 studies were included from 2012 to 2019.	The systematic review was carried out using the following databases: CINAHL, Cochrane, EMBASE, ERIC, PubMed, PsycINFO, MEDLINE, OTSeeker, PEDro, PsycBITE, PsycINFO, PubMed, speechBITE.	The current state of research has identified the various preventive methods and, above all, interventions to be carried out with children with Infantile Cerebral Palsy. In particular, interventions concerning environmental enrichment for motor involvement and active participation, fitness, school motor programme, attention to sense-motor aspects are



					highlighted.
Tanner et al. 2020	USA Supplemental Index	Interventions within the scope of occupational therapy practice to improve motor performance for children ages 0-5 years: a systematic review	56 qualitative studies are collected to analyse the motor involvement of children under the age of 5.	The systematic search was performed using the following databases: CINAHL, MEDLINE, PsycINFO, ERIC, Cochrane, OTseeker. Only articles between January 2010 and March 2017 were selected.	The literature study demonstrates the need to involve children with physical and motor difficulties, from an early age, in active motor activities that holistically involve them in their life programme, in order to ensure not only physical, but also emotional and social growth.
Klevberg et al. 2021	Oslo, Norway Scopus	Hand Use development in children with unilateral cerebral palsy	The research was carried out with a total of 166 children (79 females, 87 males) with cerebral palsy aged between 18 months and 13 years.	Longitudinal study following children with CP from 18 months to 13 years of age. The MACS (Manual Ability Classification System) classification is used to assess the grasping of objects in daily activities. The Mini-MACS is used for children under 4 years of age.	The greatest improvements are observed in the lowest age group, roughly up to 5-6 years. Good performance is also measured with older subjects who follow a targeted and effective motor rehabilitation programme.
Kusumoto et al. 2021	Tokyo PlosOne Scuola e centri riabilitativi	Relevant factors of self-care in children and adolescents with spastic cerebral palsy	76 children aged 5 to 18 years with spastic cerebral palsy (52.6% male and 47.4% female) 11 participants with spastic haemiplegia (14.5% <sup>a</sup> ), 45 with spastic diplegia (59.2%) and 20 with spastic quadriplegia (26.3%).	Cross-sectional study using the Pediatric Evaluation of Disability Inventory (PEDI) to measure each child's personal abilities and performance across three domains: self-care, mobility and social relationships. The Box and Blocks Test (BBT) is also used to assess manual dexterity and the Grip Strength to measure manual strength.	The aim of the study is to investigate the factors relevant to self-care and performance ability in children with Cerebral Palsy of the spastic type. Through the PEDI assessment, it was possible to highlight the positive consequences of daily physical activity for implementing physical and motor skills and self-management and self-regulation abilities in children with Cerebral Palsy.
Ramey et al. 2021	USA Scopus	Constraint-induced movement therapy for Cerebral Palsy: a randomized trial	118 children aged 2 to 8 years with hemiplegic cerebral palsy.	Experimental research with an analysis programme 5 months before starting treatment, at the beginning, during and end, and 6 months after completion. The CHAMP programme is used as a supplement to CIMT, which involves 3 hours of therapy 5 days a week for longer than two weeks. Filming is used to record results and the following tools are used: Assisting Hand Assessment (AHA), Visual Motor Integration (VMI), Child Motor Activity Log (CMAL), Manual Ability Classification System (MACS) and Gross Motor Functional Classification System (GMFCS).	Applying a methodology of motor work that allows children to experiment with their own bodies leads to excellent results in both the short and long term, not only from a physical point of view but also on visual-spatial skills and physical movements.
Redondo-Tebar et al. 2021	Spain Science-Direct	Health-related quality of life in developmental coordination disorder and typical developing children <i>Keywords: health-related quality of life, Motor skills, motor skills disorders, self-report, proxy-report, preschool</i>	115 children (47% female, 53% male) aged between 4 and 7 years from 21 pre-schools in Spain.	Cross-sectional study carried out using the Movement Assessment Battery for Children-Second Edition (MABC-2) to measure motor skills; the Health-related quality of life (HRQoL) to assess quality of life indicators; the Alpha-Fitness test Battery to measure physical abilities.	La ricerca mostra come i bambini con disabilità motoria (derivante da PCI) nel contesto scolastico ottengono punteggi minori per ciò che riguarda il benessere fisico e i legami sociali rispetto agli altri bambini. Tuttavia, questa disparità non è evidenziata nelle valutazioni familiari. Necessità di incrementare i programmi motori inclusivi anche all'interno del contesto scolastico, al fine di favorire dinamiche sociali positive e il benessere fisico di ciascuno.
Cheung et al. 2022	USA PubMed	Exploring the Perspectives of Preschool Teachers on Implementing Structured Motor Programs in Inclusive Classrooms <i>Keywords: physical activity, preschoolers, disabilities, structured motor programs, teacher, perceptions</i>	17 teachers and their respective sections, 17.8% of whom have disabilities.	Semi-structured interview to promote participation during physical activity in children with disabilities within the school by understanding teachers' perceptions and training in this regard.	There is a need to provide structured programmes for teachers to facilitate the inclusion of persons with disabilities in the learning of motor skills within the school, creating inclusive motor programmes.
Miedema et al.	USA	The Effects of an	111 children involved	Experimental research with	The research results highlight



al. 2022	Human Kinetics  <i>Keywords:</i> <i>Motor development, fundamental movement skill, fine-motor, gross motor, health-related fitness</i>	Integrative, Univesally, Designed Motor Skill Intervention for Young Children With and Without Disabilities	(58 females, 53 males) aged between 3 and 6 years. 24 subjects with disabilities, 87 without disabilities.	control group and work group. The Test of Gross Motor Development - Second Edition (TGMD-2) was used to measure the children's gross motor skills, while the Bruininks-Oseretsky Test of Motor Proficiency - Second Edition Brief Form (BOT2-BF) was chosen to measure motor proficiency.	significant improvements in gross motor skills and motor mastery in all children who participated in the programme. For this reason, the study aims to promote the implementation of motor interventions based on an organisation capable of accommodating everyone in order to respond to the motor difficulties of children with and without disabilities.
Walker et al. 2022	USA  Sport-DISCUS with full text  <i>Keywords:</i> <i>Cerebral Palsy, CIMT, Hemiplegic, infants, toddlers</i>	Constraint Induced Movement Therapy in Infants and Toddlers with Hemiplegic Cerebral Palsy: a scoping review	The review led to the final selection of 10 articles, all of which included a target age range of 3 months to 5 years and 11 months.	Scoping Review carried out using databases such as PubMed, Google Scholar, PsychINFO, Cochrane, CINAHL and later with SCOPUS database.	The systematic analysis showed positive reuse with the application of movement-based CIMT therapy. The importance of the teacher's role and the possibility of applying this treatment in a familiar environment for the child, such as the school, and promoting its use, is emphasised.

Table 3 - studies selected for systematic review (source: own elaboration)

## 5. Discussion

After an in-depth analysis of the selected studies, some primary observations can be made. Although the majority of the research was conducted in the United States (n=7), there is a varied and geographically wide distribution of interest in this topic. Indeed, selected studies were conducted in Australia (n=4), the Netherlands (n=2), Korea (n=2), Ireland (n=1), Turkey (n=1), Norway (n=1), Spain (n=1) and Japan (n=1). There are approximately 17 million people with Cerebral Palsy worldwide, with a further 350 million living in close contact with a child or adult with cerebral palsy (WCPD, 2020). These data help us to understand the reasons for the extremely widespread spatial variable. In this sense, we highlight the cultural and social relevance of the selected topic.

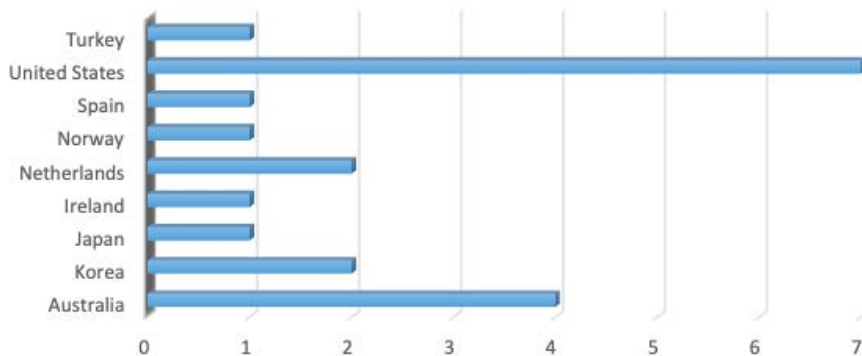


Figure 2 - Analysis of the spatial variable (source: own elaboration)

As far as the time variable is concerned, however, all of the selected surveys fall between 2014 and 2022. Specifically, among those selected, we identify two that were carried out in 2014 (n=2), one in 2016 (n=1), three surveys in 2017 (n=3), one in 2018 (n=1), two in 2019 (n=2), four in 2020 (n=4) and 2021 (n=4), and three in 2022 (n=3), respectively. The topicality of the selected research allows us to understand the urgent need for knowledge about Infantile Cerebral Palsy and its relationship to preschool education.



## 5.1 Benefits of pre-school motor Activity with children with Infantile Cerebral Palsy

All of the selected studies show positive results in proposing physical activity to individuals with cerebral palsy from an early age. The aim of the systematic review is precisely to highlight the need to practice motor activity in living and school contexts, encouraging the participation of each individual. The deeper rationale is driven by the desire to remove the idea that rehabilitation for individuals with Infantile Cerebral Palsy should only be carried out within specialist contexts, but that it can and should be extended to all areas of the child's life. As numerous research studies state, in fact, the possibility of being actively involved in motor programs stimulates the individual's sense of self-efficacy, ability to take care of oneself (self-care), and emotional well-being (Bloemen et al., 2014; Kim et al., 2017; Burgess et al., 2018; Tanner et al., 2020; Kusumoto et al., 2021; Redondo-Tebar et al., 2021). For example, the longitudinal study carried out by Burgess et al. (2018), which analyses children in the growth phase at 18, 24, 30, 36, 48, and 60 months, respectively, is concerned with identifying the manual skills of the subjects involved and the changes they make when stimulated to movement and participation in physical activities. The data collected through MACS (Manual Ability Classification System) allow us to confirm an exponential growth in the manual abilities of subjects taking part in motor activity courses offered not only in rehabilitation centers but also in sectional and family contexts. Moreover, by means of the PEDI (Pediatric Evaluation of Disability Inventor), it was possible to identify the self-regulation indexes of the children involved, highlighting growth in individual well-being parallel to the increase in abilities. In this sense, the aim of the study analyzed is precisely to stimulate the proposal within school contexts of motor education programs that are able to involve each one, allowing them to express their abilities and to increase and improve their functions.

What is highlighted by the critical reading of the selected investigations is not exclusively related to the physical growth of the subjects, but also to their emotional, social, and relational maturation (Kim et al., 2017; Burgess et al., 2018; Cameron et al., 2019; Ramey et al., 2019; Eminel et al., 2020; Ko et al., 2020; Tanner et al., 2020; Redondo-Tebar et al., 2021). For example, experimental research conducted by Ramey and his collaborators (2019) analyzed 135 children with hemiparetic Cerebral Palsy aged 2-6 years, with a few cases aged 7-8 years, testing the value of motor participation in extra-pediatric settings. By dividing working and control groups and collecting pre-, during, and post-treatment data, it is possible to highlight considerable differences in the obtained results. In fact, the experimental groups are offered an intensive motor activity program, in which are carried out either 60 or 30 hours of activities involving everyone within the school context. From the data collected, it is possible to see a greater increase in physical and motor skills in the children in the work group than in the control group, also indicating a positive response in terms of indicators relating to social relations and individual well-being. The study, in fact, aims to promote a broadening of the motor educational-didactic proposal, to guarantee a synergic rehabilitative pathway that does not confine itself exclusively to pediatric or specialized centers but can also involve the school, teachers, and classmates. The same author, with other collaborators, two years later (Ramey et al., 2021) proposed a new experimental research with 118 children with Cerebral Palsy. In this case, the group was administered the CHAMP program as a supplement to CIMT, i.e., shared motor work of 3 hours for 5 days a week, for more than 2 weeks of meetings. The results show that the children acquire greater confidence in physical movement and, above all, that the possibility of experimenting and getting to know one's own body within a context that places subjects with PCI in relation (and inter-relation) with peers increases their sense of self-efficacy. These positive aspects lead to a significant increase in the creation of meaningful social bonds, not only with the reference adults but also with peers.

We decided to report the CHAMPPS as good practice because it is a motor program for very young children, tested on a large sample of subjects. Unfortunately, there is still little research that moves in this direction, and is not always meaningful. The CHAMPPS Program, based on the principles of the UDL, aims to offer teachers a practical guide to creating teaching units that focus on the body and movement, enhancing the characteristics of everyone and ensuring their full participation.

In general, we can say that the research analyzed wants to emphasize the importance of creating con-



scious motor pathways aimed at the growth of each and everyone within the school-educational context. It is not necessary to use medical and specialist tools such as those that children with PCI adopt within the rehabilitation pathway, but even a simple adaptation of the surrounding environment, with the elimination of barriers, can constitute a first step towards a deeper sense of inclusion (Bloemen et al., 2014; Smits et al., 2014; Fitzgerald et al., 2016; Toovey et al., 2017; Ramey et al., 2019; Eminel et al., 2020; Novak et al., 2020; Tanner et al., 2020; Redondo-Tebar et al., 2021; Cheung et al., 2022; Miedema et al., 2022; Walker et al. 2022). In this regard, we would like to reflect on what emerged from the study conducted by Cheung and his collaborators (2022), which aims to explore and understand the interpretative perspectives of preschool teachers with regard to proposing truly inclusive motor programs in the classroom. From the semi-structured interview conducted, it clearly emerges that the majority of teachers do not feel sufficiently prepared to be able to implement a motor-educational program that can involve all children, including those with motor difficulties. Some of them, moreover, state that they would feel safer if there were a practical and theoretical framework behind them ready to support and guide them in the actual planning of inclusive physical activities. In this sense, the survey carried out aims to promote the creation of structured (and semi-structured) programs that teachers can use as a methodological guide to encourage full participation in motor activities for each one. We, for our part, are certain that scientific awareness, theoretical and instrumental knowledge, combined with valid intervention methodologies such as CHAMPPS, will be able to support care professionals in becoming aware of the importance of allowing everyone, no one excluded, to engage and meaningful access to motor activity and knowledge of their own body.

## 6. Conclusions

At the conclusion of the present work, aimed at investigating the benefits of proposing motor activity paths starting from kindergarten with children with Infantile Cerebral Palsy, we can confirm the positive outcomes that scientific evidence points to for such initiatives. The systematic review carried out, on the basis of the 20 selected studies involving an extensive spatial variable, underlining the importance of the issue worldwide, highlighted the beneficial physical, psychological, and social effects of movement and physical activity from an early age, enabling the participation of each and every one. Indeed, the analyzed research confirms that the activation of structured movement proposals within an ecological context, such as the school, moving away from the exclusivity of the medical-rehabilitation environment, allows an increase in the dynamics of socialization and discovery of the self and of others. Children with Infantile Cerebral Palsy who are directly involved in motor activities develop a greater sense of self-efficacy, as the idea of the deficit as a 'lack' is eliminated, and they enter into a new perspective, within which their own difficulties become new perspectives for discovery and innovative starting points for structuring inclusive programs. In this sense, the child re-discovers and re-knows himself, learning to listen to himself and appreciate his own potential (Bloemen et al., 2014; Fitzgerald et al., 2016; Kim et al., 2017; Burgess et al., 2018; Kusumoto et al., 2021). In addition, direct and engaging participation in motor activities, together with the whole class group, also fosters the development of positive and meaningful relational dynamics, which allow the creation of bonds that are woven without the need to use verbal language, but making collaboration and mutual help the drivers of a new relationality (Bloemen et al., 2014; Kim et al., 2017; Cameron et al., 2019; Ramey et al., 2019; Tanner et al., 2020; Redondo-Tebar et al., 2021).

## References

- Aronson-Ensign, K. Favazza, P.C., Stalega, M.V., Ostrosky, M.M., Yang, H., Akamoglu, Y., & Cheung, W.C (2018). CHAMPPS: Filling the Preschool Curriculum Gap. *Palaestra*, 32(4), 29-36.
- Bax, M., Goldstein M. et al. (2005). Proposed definition and classification of cerebral palsy. *Developmental Medicine and Child Neurology*, 47(8), 571-576.



- Bano, E., Ikonomi, E., & Muka, E. (2018). The relationship, motor ability and social behavior in children of age 4-6 years. *Journal of Physical Activities*, 7, 63-72.
- Berthoz, A. (1998). *Il senso del movimento*. Londra: McGraw-Hill Companies.
- Bloemen, M.A.T., Backx, F.J.G., Takken, T., Wittink, H., Benner, J., Mollema, J., & De Groot, J.F. (2014). Factors associated with physical activity in children and adolescents with a physical disability: a systematic review. *Developmental Medicine & Child Neurology*, doi: 10.1111/dmcn.12624.
- Brandolini, R. (2022). Educazione e cura dell'infanzia in prospettiva inclusiva, ecologica e sistemica. *Rivista italiana di educazione familiare*, 21(2), 141-153.
- Brown, D. (2020). A Review of the PubMed PICO Tool: Using Evidence-Based Practice in Health Education. *Health Promotion Practice*, 21(4), 496-498. doi:10.1177/1524839919893361.
- Burgess, A., Boyd, R.N., Ziviani, J., Ware, R.S., & Sakzewski, L. (2018). Self-care and manual ability in preschool children with cerebral palsy: a longitudinal study. *Developmental Medicine & Child Neurology*, doi: 10.1111/dmcn.14049.
- Cameron, K.L., Albeshier, R.A., McGinley, J.L., Allison, K., Cheong, J.L.Y., & Spittle, A.J. (2019). Movement-based interventions for preschool-age children with, or at risk of, motor impairment: a systematic review. *Developmental Medicine & Child Neurology*, DOI: 10.1111.
- Canevaro, A. (2013). *Scuola inclusiva e mondo più giusto*. Trento: Erikson.
- Cheung, W.C., Ostrosky, M.M., Favazza, P.C., Stalega, M., & Yang, H.W. (2022). Exploring the perspectives of Preschool Teachers on Implementing Structured Motor Programs in Inclusive Classrooms. *Early Childhood Education Journal*, 51, 361-370.
- Commissione parlamentare per l'infanzia e l'adolescenza (2017). Indagine conoscitiva sulla tutela della salute psicofisica dei minori. *Documento approvato dalla commissione bicamerale, Atti parlamentari*, 167-254.
- Cottini, L. (2017). *Didattica speciale e inclusione scolastica*. Roma: Carocci.
- D'Alonzo, L. (2018). *Pedagogia speciale per l'inclusione*. Brescia: Editrice Morcelliana.
- De Angelis, B., Greganti, P., Orlando, A., & Pronti, M. (2022). Corporeality, motion and UDL: For special education teachers training. *Italian Journal of Special Education for Inclusion*, X(1), 175-189.
- De Boer, A.A., Pjil, S.J., & Minnaert, A. (2011). Regular primary school teachers' attitudes towards inclusive education: a review of the literature. *International Journal of Inclusive Education*, 15(3), 331-353.
- De Mei, B., Cadeddu, C., Luzi, P., & Spinelli, A. (2018). Movimento, sport e salute: l'importanza delle politiche di promozione dell'attività fisica e le ricadute sulla collettività. *Epidemiologia e Sanità pubblica, RAPPORTI ISTISAN 18/9*, ISSN: 1123-3117, 1-95.
- Dewey, J. (1896). The reflex Arc concept in Psychology. *Psychological Review*, 3 (4), 357-370.
- Dyson, B. (2001). Cooperative learning in an elementary physical education program. *Journal of teaching in physical education*, 20, 264-281.
- Eminel, A.G., Kahraman, T., & Genc, A. (2020). Physical workload during caregiving activities and related factors among the caregivers of children with cerebral palsy. *Iris Journal of Medicine Scienze*, 190, 701-709.
- Favazza, P. C., Ostrosky, M. M., & Stalega, M. (2022). *Children in Action Motor Program for Preschoolers*. Paul H. Brookes Publishing Co.
- Fedewa, A. L., & Ahn, S. (2011). The effects of physical activity and physical fitness on children's achievement and cognitive outcomes: A meta-analysis. *Research Quarterly for Exercise and Sport*, 82(3), 521-535.
- Ferrari, A., Cioni, G. (2005). *Le forme spastiche della paralisi cerebrale infantile: Guida all'esplorazione delle funzioni adattive*. Milano: Springer.
- Fitzgerald, D., Claire, H., Eamonn, D., Walsh, M., & O'Brien, T. (2016). Six-Minute walk test in children with spastic cerebral palsy and children developing typically. *Pediatric Physical Therapy*, 28(2), 192-199.
- Gardner, H. (2009). *Formae mentis*. Milano: Garzanti.
- Gaspari, P. (2011). *Sotto il segno dell'inclusione*. Roma: Anicia.
- Hastie, P. A., Johnson, J. L., & Rudisill, M. E. (2018). An analysis of the attraction and holding power of motor skill stations used in a mastery motivational physical education climate for preschool children. *Physical education and sport pedagogy*, 23(1), 37-53.
- Horne, P.E., & Timmons, V. (2009). *Making it work: Teachers' perspectives on inclusion*. *International Journal of Inclusive Education*, 13(3), 273-286.
- Iverson, J. (2010). Developing language in a developing body: The relationship between motor development and language development. *Journal of Child Language*, 37, 229-261.
- Kim, K., Kang, Y.J., & Jang, D.H. (2017). Relationship between mobility and self-care activity in children with cerebral palsy. *Annals of Rehabilitation Medicine*, 41(2), 266-272.



- Klevberg, G.L., Jahnsen, R., Elkjaer, S., & Zucknick, M. (2021). Hand use development in children with unilateral cerebral palsy. *Developmental Medicine & Child Neurology*. DOI: 10.1111.
- Ko, E.J., Sung, I.Y., Moon, H.J., Yuk, J.S., Kim, H.S., & Lee, N.H. (2020). Effect of group-task-oriented training on gross and fine motor function, and activities of daily living in children with spastic cerebral palsy. *Physical & Occupational Therapy in Pediatrics*, 40(1), 18-30.
- Kusumoto, Y., Takaki, K., Matsuda, T., & Nitta, O. (2021). Relevant factors of self-care in children and adolescents with spastic cerebral palsy. *PlosOne*,
- Le Boulch, J. (1981). *Verso una scienza del movimento umano*. Roma: Armando, 354-355.
- Miedema, S.T., Brian, A., Pennell, A., Lieberman, L., True, L., Webster, C., & Stodden, D. (2022). The Effects of an Integrative, Universally, Designed Motor Skill Intervention for Young Children with and without Disabilities. *Adapted Physical Activity Quarterly*, 39, 179-196.
- Montesano, L., Straniero, A.M. (2019). A survey to investigate pre-service teachers' beliefs and attitudes regarding inclusion and disability. *Italian Journal of Special Education for Inclusion*. doi: 10.7346/sipes-02-2019-23.
- Novak, I., Morgan, C., Fahey, M., Finch-Edmondson, M., Galea, C., Hines, A., Langdon, K., Namara, M.M., Paton, M.C., Popat, H., Shore, B., Khamis, A., Stanton, E., Finemore, O.P., Tricks, A., Velde, A., Dark, L., Morton, N., & Badawi, N. (2020). State of the evidence traffic lights 2019: a systematic review of Interventions for Preventing and treating children with cerebral palsy. *Current Neurology and Neuroscience Reports*, 20(3).
- ONU (2006). *Convenzione sui diritti delle persone con disabilità*. New York: Organizzazione delle Nazioni Unite.
- Oskoui, M. et al. (2013). An update on the prevalence of cerebral palsy: a systematic review and meta-analysis. *Developmental Medicine and Child Neurology*, 55(6), 509-519.
- Piek, J. P., Dawson, L., Smith, L. M., & Gasson, N. (2008). The role of early fine and gross motor development on later motor and cognitive ability. *Human Movement Science*, 27(5), 668-681.
- Ramey, S.L., DeLuca, S.C., Stevenson, R.D., Case-Smith, J., Darragh, A., & Conaway, M. (2019). Children with Hemiparesis Arm and Movement Project (CHAMP): protocol for a multisite comparative efficacy trial of pediatric constraint-induced movement therapy (CIMT) testing effects of dosage and type of constraint for children with hemiparetic cerebral palsy. *BMJ Open*, 9, doi: 10.1136/bmjopen-2018-023285.
- Ramey, S.L., DeLuca, S.C., Stevenson, R.D., Conaway, M., Darragh, A.R., & Lo, W. (2021). Constraint-induced movement therapy for cerebral palsy: a randomized trial. *PEDIATRICS*, 148(5).
- Redondo-Tebar, a., Ruiz-Hermosa, A., Martinez-Vizcaino, V., Martin-Espinosa, N.M., Notario-Pacheco, B., & Sanchez-Lopez, M. (2021). Health-related quality of life in developmental coordination disorder and typically developing children. *Research in Developmental Disabilities*, 119.
- Schiavenato, M., & Chu, F. (2021). PICO: What it is and what it is not. *Nurse Education in Practice*, 56.
- Smits, D.W., Gorter, J.W., Van Schie, P.E., Dallmeijer, A.J., & Ketelaar, M. (2014). How do changes in motor capacity, motor capability, and motor performance relate to children and adolescents with cerebral palsy? *Archives of Physical Medicine and Rehabilitation*, 95, 1577-84.
- Tanner, K., Schmidt, E., Martin, K., & Bassi, M. (2020). Interventions within the scope of occupational therapy practice to improve motor performance for children ages 0-5 years: a systematic review. *The American Journal of Occupational Therapy*, 74(2).
- Taunton, S.A., Brian, A., & Truc, L. (2017). Universally Designed Motor Skill Intervention for Children with and without Disabilities. *Journal of Developmental and Physical Disabilities*, 29, 941-954.
- Toovey, R., Bernie, C., Harvey, A.R., McGinley, J.L., & Spittle, A.J. (2017). Task-specific gross motor skills training for ambulant school-aged children with cerebral palsy: a systematic review. *BMJ Pediatrics Open*, doi: 10.1136.
- Walker, C., Shierk, A., & Roberts, H. (2021). Constraint Induced Movement Therapy in Infants and Toddlers with Hemiplegic Cerebral Palsy: A Scoping Review. *Occupational Therapy in Health Care*, 36(1), 29-45.
- Wassenberg, R., Feron, F., Kesseles, A., Hendriksen, J., Kalff, A., Kroes, M., & Vles, J. (2005). Relation between cognitive and motor performance in 5- to 6-years-old children: Results from a large scale cross-sectional study. *Child Development*, 76(5), 1092-1103.