[RAPID REVIEW]

Occupational therapy intervention for Cerebral Palsy – a rapid review

AUTHORS

Janke van der Walt [a]
https://orcid.org/0000-0001-5012-0121
Hester M van Biljon [b, c]
http://orcid.org/0000-0003-4433-6457
Madri Engelbrecht [d]
https://orcid.org/0000-0002-4606-7572
Shaheed M Soeker [e]
https://orcid.org/0000-0001-5382-1855

AFFILIATIONS

[a] Division Occupational Therapy, Department of Health and Rehabilitation Sciences, Faculty of Medicine and Health Sciences, Stellenbosch University, Francie van Zijl Drive, Tygerberg, Cape Town, South Africa.
[b] Work-Link, Vocational Rehabilitation Practice, Netcare Rehabilitation Hospital, No2 Bunting Road, Aucklandpark, South Africa.
[c] SAJOT, Occupational Therapy Association of South Africa, Hatfield Bridge Office Park, 213 Richard St, Hatfield, Pretoria, South Africa
[d] Division of Disability and Rehabilitation Studies, Department of Global Health, Faculty of Medicine and Health Sciences, Stellenbosch University, Education Building, 4th Floor, Francie van Zijl Drive, Tygerberg, Cape Town, South Africa.
[e] Occupational Therapy Department, Community and Health Sciences, Robert Sobukwe Road, University of the Western Cape, Bellville, South Africa.

CORRESPONDING AUTHOR

Janke van der Walt
Email: Jankevdw@sun.ac.za

KEYWORDS

early intervention, cognitive function, constraint-induced movement therapy, multi-model approach

HOW TO CITE

van der Walt J, van Biljon HM, Engelbrecht M, Soeker, SM. Occupational therapy intervention for Cerebral Palsy – A rapid review. *South African Journal of Occupational Therapy.* Volume 55 Number 1. April 2025. DOI: https://doi.org/10.17159/2310-3833/2025/vol55no1a8

ARTICLE HISTORY

Submitted: 18 June 2024
Reviewed: 26 September 2024
Revised: 18 October 2024
Accepted: 14 November 2024

EDTOR

Blanche Pretorius
https://orcid.org/0000-0002-3543-0743

DATA AVAILABILITY

Upon reasonable request, from corresponding author

FUNDING

The Occupational Therapy Association of South Africa (OTASA) who requested the authors to do this rapid review, remunerated the authors.

ISSN On-Line 2310-3833
ISSN Print 0038-2337

ABSTRACT

Introduction: Cerebral palsy is an early-onset lifelong condition that requires comprehensive care. Occupational therapy contributes to the care of individuals with Cerebral Palsy through various intervention methods which aim to promote independence and well-being in all areas of life. This rapid review aimed to describe the intervention methods used globally by occupational therapists for Cerebral Palsy to inform policymakers on integrating occupational therapy into the healthcare system for effective management of cerebral palsy within the care team.

Method: Searches were conducted of the Cochrane and Medline databases. Systematic reviews published in peer-reviewed journals from January 2014 to December 2023 were included for screening if the search terms "occupational therapy/therapist" and "cerebral palsy" were included in the title or abstract. Screenings took place in Rayyan.ai first by title and abstract by two reviewers, and then by full text. A third reviewer resolved conflicts. The included reviews were analysed and data plotted on a custom excel worksheet. All studies were assessed for bias and quality using the CASP appraisal tool.

Results: Eleven articles were included in the review. Seven themes were identified from the included systematic reviews through thematic analysis: gaming, early intervention, cognitive approaches, interventions that impact cognitive function, constraint-induced movement therapy, interventions that improve motor performance, and a general overview of treatment methods for cerebral palsy among children. Nine approaches with 24 intervention methods were identified from the individual systematic reviews, with varied evidence. Intervention venues and duration also varied widely. A multi-model approach, using more than one intervention method was the preferred intervention approach, yielding better outcomes.

Conclusion: High-quality evidence from eleven systematic reviews supports the role of occupational therapy intervention for Cerebral Palsy.

Implications for practice

- Occupational therapy plays an integral part in supporting individuals with Cerebral Palsy by providing varied interventions aiming to optimise functional abilities, promote independence and enhance overall quality of life.
- A multi-model occupational therapy approach for Cerebral Palsy is supported by research evidence.
- Intervention settings and duration vary widely according to intervention aims and approaches.
- High-quality systematic reviews guide policy development in Africa, however research in the form of scoping reviews is recommended to include lower-level evidence studies and information to plot current practices and gaps in therapy service delivery in Africa.

INTRODUCTION

Cerebral palsy (CP) is a neurological disorder that affects movement and posture. It is caused by a disturbance in the developing brain of an unborn foetus or infant and is a non-progressive, but permanent and

lifelong condition[1]. Cerebral palsy is used as an umbrella term for a group of heterogeneous motor disorders that vary with regards to aetiology, motor type, and severity of impairment[2]. There have been various classification systems of CP, but the more recent *Surveillance of Cerebral Palsy in Europe* (SCPE) classification replaces former classifications[1]. The SCPE groups CP subtypes together into three main categories of spastic type, dyskinetic type and ataxic type[3]. In Africa, the term CP is often used to describe any motor disability syndrome. Furthermore, there is a greater perceived risk for CP in Africa due to postnatal complications that frequently occur such as meningitis, cerebral malaria and traumatic brain injury[4].

The importance of effective medical and therapeutic input to assist people with CP to be as independent as possible is highlighted considering that CP is the most common childhood disorder[5], affecting two to three in 1000 live births[6]. This is a particular challenge in Africa with a limited professional-to-child ratio in most African countries compared to the World Health Organization (WHO) recommendations[4]. Following a discussion at a meeting between doctors from 22 countries in Africa on the evaluation and management of CP in Africa, Donald et al[4] commented on the lack of guidelines for CP intervention on the continent. They recommended research on the aetiology, risk factors and interventions for CP in Africa to inform guidelines[4]. Given that cerebral palsy is usually diagnosed early in a child's life and is a permanent condition , there are many functional challenges present throughout a person's lifespan. A longitudinal review of 72 people with CP through their lives into adulthood showed that although health and rehabilitation intervention decreased as they reached adulthood, motor performance and functional performance of many participants declined into adulthood, and a more independence-orientated therapy approach was recommended[7].

Rapid reviews are often used to provide evidence for informed decision-making[8]. Rapid reviews are considered scientifically imperative with good methodological rigor while being responsive and time-sensitive[9]. Tricco et al[10] explain that rapid reviews are the preferred option to inform policy-making as a timely and affordable approach, in comparison to systematic reviews (SRs). This review forms part of the Occupational Therapy Association of South Africa (OTASA) research project, which commissioned a research team to carry out a series of rapid reviews to contribute to the evidence for occupational therapy practice for various conditions, in preparation for roll-out of National Health Insurance (NHI) in South Africa. Occupational therapists form an integral part of the multispecialty team for CP intervention[6]. Occupational therapy focuses on the promotion of health and well-being through occupation and the primary goal is to enable individuals to participate in activities of daily life, unique to each person's needs. This is achieved through various methods of intervention which aim to promote the active participation of the individual and/or by modification of the environment of the individual[11].

This rapid review specifically focuses on the methods of intervention applied by occupational therapists globally for people with CP from birth and across all lifespans and sub-categories as published in peer-reviewed journals as level I and II evidence[12].

METHOD

Scope and question

The methods guide for rapid reviews for Covid-19 medicine reviews[9], and a practical guide to rapid reviews by WHO guided this rapid review's methodology[13]. The principal researcher (PR) is the first author, assisted by the co-authors through all the stages of this review, The authors form part of a rapid review task team as commissioned by OTASA. The team, comprising of four occupational therapists with research experience in various fields, investigated the question: What evidence exists for occupational therapy intervention for CP through all phases of life?

The research population was defined as any person with any subcategory of CP across the lifespan. "Intervention" includes any form of treatment that involves occupational therapists. Evaluations and assessments did not fall under the definition of intervention for this review.

Eligibility criteria

Systematic reviews classified as level I or II evidence were included in this rapid review. Systematic reviews on level I include randomised controlled trials (RCT) with or without meta-analysis. Level II evidence includes SRs of a combination of RCTs and quasi-experimental studies with or without meta-analysis[12].

Search Approach

Online searches were conducted using the Cochrane and Medline databases through the use of the web-based Stellenbosch University library. The following search string was used: *Cerebral Palsy OR CP AND Occupational Therapy OR occupational therapist AND intervention*. Relevant filters were applied and Boolean markers were used. Initially, SRs published in peer-reviewed journals between January 2013 and December 2022 were included, but the review was later updated to include records from January 2014 to December 2023 due to the time lapse while executing the review, in order to ensure an up-to-date review.

Study selection

Due to the vast number of records identified, and considering the purpose and characteristics of the rapid review, only SRs including the words "cerebral palsy" and "occupational therapy" in the title or abstract were included for further screening. Studies where the CP population made out less than 30% of the total population reported in the SR were excluded. Only articles written in English and with the full text available from Stellenbosch University library were included. References were stored in the online database Mendeley[14] and Rayyan.ai[15] was used to assist with filtering and study selection. Two researchers screened the records independently by the title and abstract, while a third researcher resolved conflicts. The PR then screened the records by full text, while a co-researcher screened 20% of the full-text articles for coherence. Where there was doubt about whether an article should be included, a third researcher was consulted to advise.

Appraisal of study quality

The Critical Appraisals Skills Program (CASP) checklist for SRs[16] was used to ensure consistency in the quality of records included and to limit bias. Points for each question were awarded to obtain an informal quality score per record as follows: Yes = 1; Not clear = 0.5 and No = 0.

Data extraction

Data were extracted and charted on a custom Microsoft Excel® worksheet. The data extraction sheet included the sections: author; study title; study design; CASP score, number and type of records included in the review, population (gender, age, geographical location, setting); intervention method and strategies used; duration, frequency and session length of interventions, comparisons; outcomes measures and outcomes, limitations of studies, and any other comments.

Evidence analysis

Quantitative and qualitative data were collected and charted. The quantitative data were analysed and reported by means of percentage and frequency. Qualitative information was recorded under the relevant headings and thematically analysed through deductive reasoning to be grouped accordingly for effective reporting.

RESULTS

Search results

From the initial Medline and Cochrane searches conducted in March 2023, 4113 records were identified that satisfied the inclusion criteria. These included SRs and RCTs. Applying stricter inclusion criteria, i.e. only SRs identified through the initial search criteria but that contained the words "occupational therapy/ist" and cerebral palsy in the abstract or title, 521 records were included for further screening. Following an update of the review (February 2024), a total of 2014 records were identified for title and abstract screening resulting in 39 articles for full text screening and with 11 articles included in the review for analysis. The search process is illustrated in a Prisma diagram in Figure 1 below:

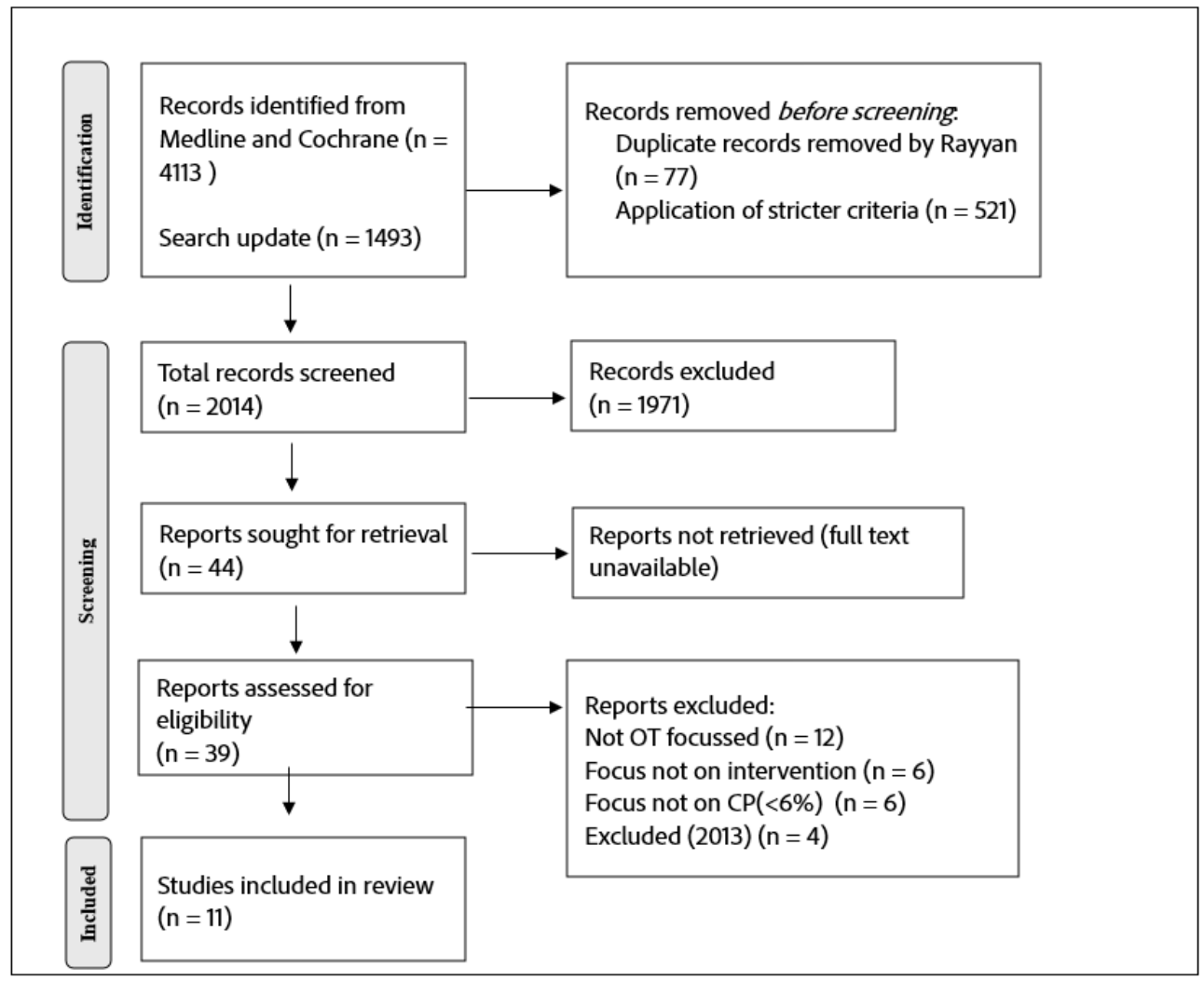

Figure 1 : Prisma Diagram[17]

Quality Control

All studies included in this rapid review scored between 8 - 10 out of 10 on the CASP and is considered to be high quality SRs. The score for each article is included in Table 1. However, some of the SRs included in this review reported on their own limitations[18, 19] i.e. limited availability of well-organised and good-quality RCTs, heterogeneous control interventions[20] of the included studies and varied participant characteristics[21]. To ensure high quality and effective meta-analysis, seemingly important studies were reported to be excluded from the included SR's[22]. Where a risk of bias was identified[23, 24], the studies indicated and explained the risks and consequences.

Table I: Summary of articles included in the Rapid review

Author	Title	Study design	CASP score /10	Number of records included	Population	Outcome
Ain et al,[25]	Role of virtual reality and active video games in motor and executive functions in cerebral palsy: A systematic review	Systematic Review	8	15	Children and youth (8 – 15 years)	14 studies (93%) reported significant effects: Significant improvements in various motor functions when combined with physio/OT (muscle strength, hand function, upper extremity function, functional strength, walking endurance, and eye-hand coordination). Gross and fine motor functions. No major changes were found re executive functions.
Blasco et al.[26]	Interventions with an impact on cognitive functions in Cerebral Palsy: a systematic review	Systematic Review	10	28	Adults and children with CP (18 weeks to 29 years)	Multi-model and physical interventions improve general cognitive functioning. Multi-model and cognitive interventions impact on visual perception, and together with physical interventions impact on executive functions, specifically inhibitory control. Only cognitive intervention impacted on other executive functions e.g. working memory.
Bonnechere et al.[19]	Can serious games be incorporated with conventional treatment of children with cerebral palsy? A review	Systematic Review	9.5	31	Children with CP (6 – 17 years)	Limited evidence to support that SG improved the children's motivation

Author	Title	Study design	CASP score /10	Number of records included	Population	Outcome
Hadders-Algra et al.[26]	Effect of early intervention in infants at very high risk of cerebral palsy: a systematic review	Systematic Reviews	9.5	7	Infants (0 – 12 months) with CP or at risk of CP	Weak evidence to suggest intervention is positive, however according to similarities suggestions made: Early intervention consisting of a combination of developmental stimulation, including trial and error learning in a challenging, enriched environment, and support of parent-infant interaction, minimal application of 'hands-on' postural support techniques of NDT, may be the best means to promoting motor and cognitive development of very high risk infants and family well being. Additionally, the following may provide support: action-observation training, intelligent baby gym, baby constraint induces movement therapy. Uncertainty around NDT hands on techniques
Hoare et al.[24]	Constraint induced movement therapy in children with unilateral cerebral palsy	Systematic Review and Meta-analysis	9.5	36	Children and youth with unilateral CP (0 – 19 years)	Low quality evidence that CIMT is more effective than low dose comparison e.g. OT or parent lead interventions, but not high dose or some dose alternative. CIMT is safe for children.
Liu et al.[22]	Effect of Virtual Reality on balance function in children with Cerebral Palsy: a systematic review and meta-analysis	Systematic Review and Meta-analysis	9.5	16	Children and youth with unilateral CP (4 – 18 years)	14 of 18 studies found significant improvement in static or dynamic balance. Recommended as complementary therapy
Novak et al.[27]	State of the Evidence Traffic Lights 2019: Systematic review of interventions for preventing and treating children with cerebral palsy	Systematic Review	9	247 in total. 83 Allied health interventions	Children and youth	Green, yellow, red system identified: green – do, yellow – probably do, red – stop: Green – (strong/do it) : Action/observation, bimanual, environmental enrichment, CIMT, home program hand function, goal directed training, task specific training, YELLOW (weak/probably do it): AT: robots, adaptive equipment, virtual reality, CO-OP, context focussed, modified sport, hand splinting, seating, mirror therapy, motor training, NDT, parent education. Red. Passive NDT, SI The following areas include OT involvement: management of CP, motor interventions, tone management, contracture prevention and management, physical activity, participation, early intervention, parent intervention

Author	Title	Study design	CASP score /10	Number of records included	Population	Outcome
Roostaei et al.[21]	Cognitive Orientation to Daily Occupational Performance (CO-OP) in children with Cerebral Palsy: a systematic review with meta-analysis	Systematic Review and Meta-analysis	9.5	7	Children with CP (0 – 18 years)	Improvements occurred in occupational performance but no significant difference between CO-OP and alternative interventions. Skill achievement was at 63 - 100 percent
Spittle et al.[28]	Early developmental intervention programmes provided post hospital discharge to prevent motor and cognitive impairment in preterm infants	Systematic Review	9.5	12	Pre-term born children (before 37 weeks gestation) over 4 age groups	Intervention improved cognitive and motor outcomes; however, evidence suggests that cognitive effect was not sustained throughout school years. Little evidence showed positive motor outcomes in the long-term
Tanner et al.[23]	Interventions within the scope of occupational therapy practice to improve motor performance for children	Systematic Review	9.5	28 for children with CP	Children (0 – 5 years) Children with CP was one of 3 groups in the review	Strong evidence that early intervention can improve motor outcomes in children with or at risk of CP; strong evidence for traditional CIMT and BIT to improve motor outcomes in children with unilateral CP; strong evidence for context and child focussed therapies to improve motor skills in children with CP/at risk; moderate evidence to suggest improved motor outcomes with hippotherapy for children with CP, weak evidence for other
Zai et al.[18]	Effect of task-oriented training on gross motor function, balance and activities of daily living in children with cerebral palsy: A systematic review and meta-analysis	Systematic Review	10	16	Children (0 – 18 years)	Meta-analysis indicates that TOT can improve gross motor outcomes, walking and ADL in children with CP. Better results when combined with other approaches e.g. hydrotherapy, biofeedback training

Abbreviations: ADL – Activities of Daily Living; AT – Assistive Technology; BIT Bimanual Training; CIMT - Constraint-induced movement Therapy; CO-OP - Cognitive Orientation to Daily Occupational Performance; CP – Cerebral Palsy; NDT – Neuro-developmental Techniques; OT – Occupational Therapy; SG – Serious Games; SI – Sensory Integration; TOT – Task-oriented Training

Study compositions

All included studies were SRs, with different compositions. Three studies only included RCTs while one study included RCTs and cluster RCTs[18, 20, 22, 24]. Only one study included SRs and RCTs[27]. The remaining six studies included a mix of SRs, RCTs, cohort studies and other quasi-experimental studies[19, 21, 23, 25, 26, 28].Five of the SRs included meta-analyses[18, 21, 22, 24, 28]. The number of records included in the SRs varied between seven and 247. Of the 247 records included in Novak et al.'s comprehensive study of CP interventions, only the 84 records related to various therapies were considered for further discussion in this review. The additional records focussed on medical procedures and interventions[27]. The SR by Tanner et al. included three diagnostic groups of children under five, one group of which was CP[23]. Only the 28 records relating to the CP group of this study were considered for analysis.

All studies included only children under the age of 19 years, in various age bands from pre-term born infants[28], and infants younger than 12 months[20], preschool children under five[23], school-aged children from 4 – 18 years[19, 22, 25], to all children up to 18/19 years[18, 21, 24, 27]. One study included both children and adults[26], however, all included adults were under 30 years of age. All children or adults had a diagnosis of CP, and where infants were involved, they were at risk of CP[20].

Although study settings were not reported for four studies, records included studies from both high-income and low- and middle-income countries, namely; Australia, Brazil, Canada, China, Egypt, Germany, India, Iran, Israel, Italy, Japan, Jordan, Korea, Netherlands, Pakistan, Sweden, Switzerland, Taiwan, United Kingdom and the United States of America.

Interventions

Themes, approaches and techniques

Among the 11 included articles, seven themes were recognised according to the main concept/aim of the specific SR. The most common theme was gaming (virtual reality and serious games) as an intervention method (n=3) for motor and executive function[19,22,25] ('Serious games' refer to virtual reality games, but with the added goal of education and/or rehabilitation and not entertainment only[19]). Two studies focussed on early intervention[20,28] and two studies on cognitive approaches[18,21]. The other themes reflected interventions that impact on cognitive function[26], constraint-induced movement therapy (CIMT)[24], interventions that improve motor performance[23], and a general overview of treatment methods for CP among children[27].

Table II (below) provides a detailed outlay of the different categories of treatment approaches with their associated methods, as reported in the included SRs. Most themes revealed several different treatment approaches, depending on the inclusion of studies in the specific SR. For clarity, themes are indicated in Table II for each named SR. Techniques and strategies were added where the SRs made the information available, Approaches identified include cognitive, neurological, biomechanical, sensory integration, indirect, early intervention, technological, social, and eclectic approaches.

Table II: Intervention methods and techniques

Approach	Intervention method	Studies	Theme	Outcomes	Techniques/Strategies
Cognitive	CO-OP	Blasco et al.[26]	Interventions that impact on cognitive function	Impacts on visual perception and executive functions Improvements occurred, but not significantly more in comparison to other interventions (splinting, stretching, strengthening, task training).	Goal-plan-do check, domain-specific cognitive strategies e.g. self-instruction, body position, environmental modifications, attention to doing
		Roostaei et al.[21]	Cognitive approaches	High level of skill achievement at 63 – 100% *Yellow/weak evidence	
		Novak et al.[27]	General overview of CP intervention methods		
	Conductive education	Novak et al.[27]	General overview of CP intervention methods	*Yellow (weak evidence)	Not described
	Context-focused intervention	Novak et a [27]	General overview of CP intervention methods	* Green (strong evidence)	Not described
		Tanner et a [23]	Interventions that improve motor performance	Strong evidence for motor outcomes	
	Task Orientated Training	Tanner et al.[23]	Interventions that improve motor performance	Weak evidence for motor outcomes TOT can improve gross motor outcomes, walking, and ADL in children with CP. Better results when combined with other approaches e.g. hydrotherapy.	Not described
		Zai et al.[18]	Cognitive approaches		
	Goal-directed training	Novak et al.[27]	General overview of CP intervention methods	Green: Strong Evidence for effective intervention	Not described
		Tanner et al.[23]	Interventions that improve motor performance	Weak evidence for motor outcomes	
	Curriculum and monitoring system (cognitive enrichment)	Hadders-Algra et al.[20]	Early intervention	Weak positive evidence	Not described
	Visual perceptual training	Tanner et al.[23]	Interventions that improve motor performance	Weak evidence for motor outcomes Impacts on visual perception and executive functions	Not described
		Blasco et al.[26]			
	Other	Blasco et al.[26]	Interventions that impact on cognitive function	Impacts on visual perception and executive functions	Cogmed working memory training, narrative intervention programme; web-based computerised programme; conversational therapy, communication application
Neurological	NDT	Hadders-Algra et al.[20]	Early intervention	Weak positive evidence	NDT strategies
		Novak[27]	General overview of CP intervention methods	*Red Weak evidence for motor outcomes	

Approach	Intervention method	Studies	Theme	Outcomes	Techniques/Strategies
		Tanner et al.[23]	Interventions that improve motor performance	Intervention improved cognitive and motor outcomes; however, evidence suggests that cognitive effect was not sustained throughout school years.	
		Spittle et al.[28]	Early intervention	Little evidence showed positive motor outcomes in the long-term	
Biomechanical (physical and movement related)	Bimanual training	Tanner et al.[23]	Interventions that improve motor performance	Strong evidence for motor outcomes, unilateral CP	3 - 6 hours daily, 21 days
		Novak et al.[27]	General overview of CP intervention methods	*Green Strong Evidence for effective intervention	
	CIMT	Hoare et al.[24]	CIMT	Low quality evidence that CMIT is more effective than low-dose comparison e.g. regular OT, but not high or same-dose alternative	sCIMT, mCIMT, hCIMT, forced use therapy (signature=s, modified=m, hybrid=h) Constraints used: mitt/glove, sling, cast, splint, bandage
		Novak et al.[27]	General overview of CP intervention methods	*Green (strong evidence)	
		Tanner et al.[23]	Interventions that improve motor performance	Strong evidence for motor outcomes unilateral CP	
	Motor training/intervention	Blasco et al.[26]	Interventions that impact on cognitive function	Positive impact on executive functions	Equine-assisted activities, dance intervention, Nintendo WII; Bobath therapy; Leap-motion game exercise therapy hippotherapy; kinesiotherapy; climbing; physical therapy
		Hadders-Algra et al.[20]	Early intervention	Weak positive evidence	Goals,Activity and Motor Enrichment programme (GAME) Therapy intervention targeted at motor skills, Child initiated movement
		Novak et al.[27]	General overview of CP intervention methods	*Green: Strong Evidence as effective treatment	Home programmes Fitness training Strength training Stretching dancing; ballet; physical therapy
		Tanner et al.[23]	Interventions that improve motor performance	Strong evidence for motor outcomes	
	Hippotherapy	Novak et al.[27]	General overview of CP intervention methods	*Yellow (weak evidence)	Not described
		Tanner et al.[23]	Interventions that improve motor performance	Moderate evidence for motor outcomes	

Approach	Intervention method	Studies	Theme	Outcomes	Techniques/Strategies
	OT following Botulinum Toxin	Novak et al.[27]	General overview of CP intervention methods	*Green Strong Evidence as effective intervention	Not described
	Hydrotherapy	Novak et al.[27]	General overview of CP intervention methods	*Yellow (weak evidence)	Not described
	Massage	Novak et al.[27]	General overview of CP intervention methods	*Yellow (weak evidence)	Not described
Indirect approach	Assistive technology	Novak et al.[27] Tanner et al.[23]	General overview of CP intervention methods Interventions that improve motor performance	*Yellow (weak evidence) Weak evidence for motor outcomes	Environmental modifications, therasuit, seating and positioning, full body vibration
	Parent intervention	Hadders-Algra et al.[25] Novak et al.[27] Spittle et al.[28]	Early intervention General overview of CP intervention methods Early intervention	Weak positive evidence *Yellow (weak evidence) Intervention improved cognitive and motor outcomes, however, evidence suggests that cognitive effect was not sustained throughout school years. Little evidence showed positive motor outcomes in the long-term	Parent coaching Caregiver interaction in NICU Infant Behavioural Assessment and Intervention Program (IBAIP) Creating Opportunities for Parent Empowerment (COPE, Multisensory stimulation program) Coaching, parent training
Early Intervention	Early intervention	Novak et al.[27] Spittle et al.[28] Tanner et al.[23]	General overview of CP intervention methods Early intervention Interventions that improve motor performance	*Yellow (weak evidence) Intervention improved cognitive and motor outcomes, however evidence suggests that cognitive effect was not sustained throughout school years. Little evidence showed positive motor outcomes long term Weak evidence for motor outcomes	Avon premature Infant programme Supporting Play Exploration and Early Developmental Intervention (SPEEDI), Infant Health and Developmental Program (IHDT) Early intervention programmes (GAME - goals activity motor enrichment home based pg); COPCA (coping and Caring for infants with special needs)
Sensory Integration	Sensory interventions	Hadders-Algra et al.[25]	Early intervention	Weak positive evidence	Multisensory stimulation Sensory enrichment
Technology	Virtual reality	Ain et al.[25] Bonechere et al.[9]	Virtual reality and serious games Virtual reality and serious games	(93%) reported significant effect: Significant improvements in various gross and fine motor functions when combine with physio/OT. No major changes found re executive functions. Limited evidence to support that SG improved the children's motivation	Nintendo wii together with physical therapy, other virtual reality games: Mitti, Xbox, Microsoft Kinect, Eye Toy focussing on motor control and executive function Serious games: soccer, volleyball, music, cycling, Nintendo Wii sports and Wii fit, Sony PlayStation 2, Evel ov game Plays, RE-

Approach	Intervention method	Studies	Theme	Outcomes	Techniques/Strategies
		Liu et al.[22]	Virtual reality and serious games	14 of 18 studies found significant improvement in static or dynamic balance. Recommended as complementary therapy	ACTION system, Kinect Xbox 360, bird ball, conveyer, Kinerehab, SG hand-telerehabilitation Interventions with a game component and realtime feedback/interactive exercise in the virtual world including Nintendo, X-box, virtual cycling, customised PC gaming, Kinect-based virtual reality game, personalised balance games, training, Forceplate
Social	Play therapy	Novak et al.[27]	General overview of CP intervention methods	*Yellow (weak evidence)	Not described
	Social stories	Novak et al.[27]	General overview of CP intervention methods	*Yellow (weak evidence)	Not described
Eclectic	Multi-model approaches	Blasco et al.[26]	Interventions that impact on cognitive function	Improve general cognitive functioning, visual perception and executive functioning	Web-based programmes. Virtual reality, mindfulness yoga, family-centred motor programmes, parent coaching, environmental enrichment, OT programme; programme of intensified habilitation; winter sports camp; robot assisted therapy

*Novak et al.[27] used a traffic-light system to indicate the levels of evidence: Green = high levels of effectiveness/ "Do it"; Yellow = weak levels of effectiveness/"probably do it" or red = ineffective/"don't do it"
Abbreviations: ADL: Activities of Daily Living, CMIT: Constraint-induced Movement Therapy; CP: Cerebral Palsy; CO-OP: Cognitive Orientation to Daily Occupational Performance; NDT: Neuro-Developmental Training; TOT: Task Orientated Training

Recommended intervention regimes

Recommendations for intervention regimes were described in two papers.

Hadders-Algra et al. suggested that a combination of developmental stimulation and parent-infant interaction support, with minimal application of 'hands-on' postural support techniques of NDT, might be the best early intervention regime to promote motor and cognitive development of at-risk infants and family well-being[20]. Action-observation training, intelligent baby gym, and baby CIMT were seen as additional supportive interventions, while the effectiveness of NDT hands-on techniques was mentioned as uncertain.

Novak et al. made recommendations for standard care for all children with CP. This included medical and therapy care as follows: medication for spasticity management and bone density, anticonvulsants, pressure care, casting for improved mobility, hip surveillance, bimanual training, CIMT, context-focused therapy, goal-directed or functional training, and/or home programmes to improve motor activities or self-care, and fitness training[27].

Intervention structure

Interventions were delivered in various modalities including group interventions, individual treatment, home programmes, parent groups, written information, and audiotapes. Intervention venues varied and included clinical treatment centres, hospitals (including neonatal intensive care units (NICUs)), community centres, child development centres, preschools, schools, theme camps and homes, or a combination of venues. The duration of interventions varied widely according to the specific intervention from a single once-off session, to a 14-month treatment period. Session times ranged from 20 minutes to 120 minutes, while frequency ranged from one single session to daily intervention.

DISCUSSION

This rapid review reports on evidence of occupational therapy interventions for CP from high-quality SRs over the past 10 years up to December 2023. The included SRs represent global research across varied socio-economic areas, however, sub-Saharan Africa was not represented, so affirming Donald et al.'s concerns about limited CP research and guidelines specific to Africa[29].

The 11 included SRs reported on seven themes, nine different approaches, and 24 intervention methods with occupational therapy involvement aiming to optimise functional abilities, promote independence and enhance overall quality of life so strongly affirming the role of occupational therapy within the multi-professional CP care team. The many approaches and methods associated with occupational therapy intervention reflect the complexity and heterogeneous nature of CP[2] affecting participation in everyday life activities. This is confirmed in the comprehensive systematic review by Novak et al. where 247 studies describing 383 different intervention outcomes were analysed to determine best practice for CP intervention. Of these 247 studies, 10% were related to therapy services[27]. Novak et al.'s study included only children, as did most of the included studies (n=10). Only one SR extended their inclusion criteria to adults up to the age of 30[26]. Considering that adults with CP often decline in functional and motor skills[7], the lack of recent research contributions describing occupational therapy input for adults with CP is evident and concerning.

Cognitive approaches were most frequently reported, with outcomes varying from motor skills to visual perception and executive function or ADLs. Different intervention methods however had varied levels of effectiveness with positive

outcomes for context-focussed intervention and goal-directed training[23,27]. Biomechanical approaches included positive outcomes for bimanual training[27], CIMT[23, 27], and general gross motor skills training using various techniques[23,26,27]. Strong evidence for effectiveness was further reported for occupational therapy intervention following Botulinum Toxin treatment[27]. Motor outcomes, but also positive effects for executive functions were reported[26].

Other intervention approaches that were reported in the SR's had less positive outcomes. Although NDT was reported in four SRs, only weak evidence for positive outcomes was reported - Spittle et al..'s SR on early development reported positive evidence for motor and cognitive outcomes when using NDT, but with uncertainty around long-term outcomes[28]. The use of technology, predominantly virtual gaming, was reported in three studies and recommended as a complementary intervention in combination with other occupational therapy and physiotherapy techniques such as NDT, general physical activity, treadmill training, and modified CIMT[19, 22, 25]. Indirect intervention approaches, including family-centred intervention and the provision of assistive devices, as well as early intervention approaches, were well represented in four SR's included in this review, but concluded with weak evidence for positive outcomes. Sensory integration and social approaches were each represented in a single SR, with weak positive outcomes.

Blasco et al.[26] found strong evidence that multi-model approaches improved cognitive, visual perception, and executive functioning. In fact, several studies suggest that a multi-model approach is the preferred option, yielding stronger positive outcomes[18-20,26,27]. Cognitive approaches such as TOT showed improved results when combined with movement techniques such as hydrotherapy[18], while virtual reality interventions were recommended as supplementary therapy in combination with other occupational therapy or physiotherapy techniques[22, 25]. Novak et al. suggested early intervention regimes that combined interventions with strong evidence for positive outcomes[27]. This was also suggested by Hadders-Algra, focussing on intervention for children with CP[20].

Intervention settings varied according to the type of intervention. The wide range of settings indicates involvement from occupational therapists across sectors. Early intervention therapists initiate intervention in hospitals, NICUs, and home settings[20, 23, 27, 28]. Therapists providing intervention to young children may be involved in a community setting, pre-school or school setting, child development centre, or clinic[23, 25, 27].

Intervention frequency, session time and duration were variable and depended on the type of intervention, treatment aims, and location of the intervention. Cerebral Palsy as a life-long condition affects multiple functional aspects[2] of a person's life. It is thus expected, as reflected in this review, that occupational therapists are involved in a multi-facetted way over the lifespan, but according to each individual's unique needs[6, 11].

Limitations

The rapid review included only systematic reviews, which may have excluded South African and other important RCTs as well as evidence of a lower quality rating. Results from this review thus need to be considered against factors such as socio-economic environments, resources, infrastructure and developing health systems.

Ethics

Ethical clearance was not required for this study as primary data collection was not required.

CONCLUSION AND RECOMMENDATIONS

This review contributes to the knowledge base of occupational therapy interventions for CP and iterates the essential part that occupational therapists play through many different facets to enhance quality of life for persons with CP and their caregivers. This may also highlight a challenge for the South African health system – while evidence demonstrates positive outcomes associated with occupational therapy this raises notable concerns in the context of low-resourced countries across Africa, where the scarcity of trained therapists presents a significant challenge[4]. Further research is recommended to inform health policy development for defining and managing CP in an African context to close the gap between service provision in the region and global recommendations and guidelines[30]. Scoping reviews that include grey literature and qualitative studies may assist in mapping out South African and African studies describing OT interventions for people with CP, while high-quality quantitative research will improve the evidence base.

Conflicts of Interest and other declarations.

The authors declare they received remuneration from the Occupational Therapy Association of South Africa (OTASA) for this review. They declare that this did not affect their decision making in the review and they have no bias to declare. The authors do not have any conflict of interest.

Author contribution

All four authors (Janke van der Walt, Madri Engelbrecht, Hester van Biljon and Shaheed M Soeker) contributed substantially to the design of the study and the screening process. Janke van der Walt analysed and interpreted the data with the support of the other authors as critical reviewers. Janke van der Walt wrote the article which was revised by the other three authors. All authors agreed on the final content as presented.

REFERENCES

1. Sadowska M, Sarecka-Hujar B, Kopyta I. Cerebral Palsy: current opinions on definition, epidemiology, risk factors, classification and treatment options. Neuropsychiatric Disease and Treatment. 2020;16:1505–1518. doi:https://doi.org/10.2147/ndt.s235165
2. Te Velde A, Morgan C, Novak I, Tantsis E, Badawi N. Early diagnosis and classification of Cerebral Palsy: an historical perspective and barriers to an early diagnosis. Journal of Clinical Medicine. 2019;8(10):1599. doi: https://doi.org.10.3390/jcm8101599
3. SCPE. Surveillance of Cerebral Palsy in Europe (SCPE) Scientific report 1998 - 2018. 2018 [accessed 2024 Apr 25]. https://scpe.edu.eacd.org/sites/default/files/SCPE%20Scientific%20report%201998-2018.pdf
4. Donald KA, Kakooza AM, Wammanda RD, Mallewa M, Samia P, Babakir H, Bearden D, Majnemer A, Fehlings D, Shevell M, et al.. Pediatric Cerebral Palsy in Africa: where are we? Journal of Child Neurology. 2015;30(8). doi: https://doi.org/10.1177/0883073814549245
5. Metz C, Jaster M, Walch E, Sarpong-Bengelsdorf A, Kaindl AM, Schneider J. Clinical phenotype of Cerebral Palsy depends on the cause: is it really Cerebral Palsy? A retrospective study. Journal of Child Neurology. 2022;37(2).doi: https://doi.org/10.1177/08830738211059686
6. Vitrikas K, Dalton H, Breish D. Cerebral palsy: an overview. American Family Physician. 2020;101(4).[accessed 2024 April 27] https://www.mendeley.com/catalogue/f3f273fd-dc89-39fc-b67f-6b341b0e3ab7/
7. Bottos M, Feliciangeli A, Sciuto L, Gericke C, Vianello A. Functional status of adults with cerebral palsy and implications for treatment of children. Developmental Medicine and Child Neurology. 2001;43(8). doi: https://doi.org/10.1111/j.1469-8749.2001.tb00755.x

8. Dobbins M. Rapid Review Guidebook. Steps for conducting a rapid review. Public Health Agency of Canada. 2017. doi:https://www.nccmt.ca/uploads/media/media/0001/01/a816af720e4d587e13da6bb307df8c907a5dff9a.pdf
9. Department of Health RSA. Methods guide for rapid reviews for Covid-19 medicine reviews, 2022 [accessed 2022 Mar 12].https://www.health.gov.za/wp-content/uploads/2022/03/Protocol-Template-for-rapid-reviews-of-COVID-19_v4.0_12March2022.pdf
10. Tricco AC, Antony J, Zarin W, Strifler L, Ghassemi M, Ivory J, et al. A scoping review of rapid review methods. BMC Medicine. 2015;13(1).https://iris.who.int/handle/10665/258698
11. WFOT. WFOT. About Occupational Therapy. 2023 [accessed 2023 Jun 24]. https://wfot.org/about/about-occupational-therapy.
12. Burns PB, Rohrich RJ, Chungh KC. The levels of evidence and their role in evidence-based medicine. Plastic and Reconstructive Surgery. 2011;128(1):305–310. doi: https://doi.org/10.1097/prs.0b013e318219c171
13. Longlois EV, Straus SE, Mijumbi-Deve R, Lewin S, Tricco AC. The need for rapid reviews to inform health policy and systems. In: Tricco AC, Langlois E V, Straus SE, editors. Rapid reviews to strengthen health policy and systems: a practical guide . Geneve: World Health Organization; 2017 [accessed 2023 Jun 24]https://iris.who.int/handle/10665/258698
14. Elsevier. Mendely. 2020 [accessed 2020 Jun 26]. https://www.elsevier.com/solutions/mendeley
15. Rayyann. Rayyan. 2022 [accessed 2023 Jun 24]. https://www.rayyan.ai/
16. CASP. CASP Checklists. 2023 [accessed 2023 Jun 27].https://casp-uk.net/casp-tools-checklists/
17. The PRISMA Group (2009) Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med. 2009;6(7: e1000097).[accessed 2024 Nov 24]https://www.prisma-statement.org/prisma-2020-flow-diagram
18. Zai W, Xu N, Wu W, Wang Y, Wang R. Effect of task-oriented training on gross motor function, balance and activities of daily living in children with cerebral palsy: A systematic review and meta-analysis. Medicine. 2022;101(44).doi: http://doi.org/10.1080/01942638.2019.1642287
19. Bonnechère B, Jansen B, Omelina L, Degelaen M, Wermenbol V, Rooze M, Van Sint Jan S. Can serious games be incorporated with conventional treatment of children with cerebral palsy? A review. Research in Developmental Disabilities. 2014;35(8):1899–1913. doi: https://doi.org/10.1016/j.ridd.2014.04.016
20. Hadders-Algra M, Boxum AG, Hielkema T, Hamer EG. Effect of early intervention in infants at very high risk of cerebral palsy: A systematic review. Developmental Medicine and Child Neurology. 2017;59(3):246–258.doi: https://doi.org/10.1111/dmcn.13331.
21. Roostaei M, Dalvand H, Rassafiani M, Kelly G, Razi B. Cognitive Orientation to Daily Occupational Performance (CO-OP) in children with Cerebral Palsy: a systematic review with meta-analysis. Canadian Journal of Occupational Therapy. 2022;89(1):72–91. doi: https://doi.org/10.1177/00084174211066651
22. Wei Liu, Wei Liu, Yuanyan Hu, Junfeng Li, Jindong Chang. Effect of virtual reality on balance function in children with Cerebral Palsy: a systematic review and meta-analysis. Frontiers in Public Health. 2022;10. doi: https://doi.org/10.3389/fpubh.2022.865474
23. Tanner K, Schmidt E, Martin K, Bassi M. 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. 2020;74(2):7402180060p1-7402180060p40. doi: https://doi.org/10.5014/ajot.2020.039644
24. Hoare BJ, Wallen MA, Thorley MN, Jackman ML, Carey LM, Imms C, Hoare BJ. Constraint-induced movement therapy in children with unilateral cerebral palsy. Cochrane Library. 2019;2019(5). doi: https://doi.org/10.1542/peds.2020-033878
25. Ain AQU, Fatima A, Yousaf F, Shoukat F, Siddiqui K, Ahmed A. Role of virtual reality and active video games in motor and executive functions in Cerebral Palsy: a systematic review. Journal of the Pakistan Medical Association. 2022;72(5):929–934. doi: https://doi.org/ 10.47391/JPMA.2140
26. Blasco M, García-Galant M, Berenguer-González A, Caldú X, Arqué M, Laporta-Hoyos O, Ballester-Plané J, Miralbell J, Jurado MÁ, Roser Pueyo. Interventions with an impact on cognitive functions in Cerebral Palsy: a systematic review. Neuropsychology Review. 2023;33(2):551–577. doi: https://doi.org/10.1007/s11065-022-09550-7
27. Novak I, Morgan C, Fahey M, Finch-Edmondson M, Galea C, Hines A, Langdon K, Namara MM, Paton MC, Popat H, et al.. State of the evidence traffic lights 2019: systematic review of interventions for preventing and treating children with Cerebral Palsy. Current Neurology and Neuroscience Reports. 2020;20(2):3. doi: https://doi.org/10.1007/s11910-020-1022-z
28. Spittle A, Orton J, Anderson PJ, Boyd R, Doyle LW, Spittle A. Early developmental intervention programmes provided post hospital discharge to prevent motor and cognitive impairment in preterm infants. Cochrane Library. 2015;2015(11). doi: https://doi.org/10.1002/14651858.cd005495.pub4
29. Donald KA, Samia P, Kakooza-Mwesige A, Bearden D. Pediatric Cerebral Palsy in Africa: a systematic review. Seminars in pediatric neurology. 2014;21(1):30–35. doi: https://doi.org/10.1016/j.spen.2014.01.001
30. Damiano DL, Longo E, Carolina de Campos A, Forssberg H, Rauch A. Systematic review of clinical guidelines related to care of individuals with Cerebral Palsy as part of the World Health Organization efforts to develop a global package of interventions for rehabilitation. Archives of Physical Medicine and Rehabilitation. 2021;102(9):1764–1774. doi: https://doi.org/10.1016/j.apmr.2020.11.015