



Η Εργοθεραπεία για τα πρόωρα νεογνά στη Μονάδα Εντατικής Νοσηλείας Νεογνών: Μία συστηματική ανασκόπηση

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ΠΕΡΙΛΗΨΗ

Εισαγωγή: Στη Μονάδα Εντατικής Νοσηλείας Νεογνών, καθίσταται αναγκαία η υποστήριξη των ζωτικών λειτουργιών των πρόωρων νεογνών, σε συνάρτηση με την έγκαιρη παρέμβαση στην αισθητηριακή και ψυχολογική τους κατάσταση υπό το πρίσμα ειδικοτήτων όπως η Εργοθεραπεία.

Σκοπός: Σκοπός της παρούσας συστηματικής ανασκόπησης ήταν να διερευνηθούν οι εργοθεραπευτικές παρεμβάσεις που πραγματοποιούνται στη Μονάδα Εντατικής Νοσηλείας Νεογνών, για τη φροντίδα και την υποστήριξη των πρόωρων νεογνών που βρίσκονται σε αυξημένο κίνδυνο, ενώ παράλληλα αποσκοπεί στην περιγραφή των θεωριών και των προσεγγίσεων που υιοθετεί η Εργοθεραπεία στα πλαίσια της διεπιστημονικής ομάδας.

Υλικό και Μέθοδος: Για τη συλλογή των δεδομένων, αναζητήθηκαν και συμπεριλήφθηκαν σχετικά άρθρα από τις επιστημονικές δεδομένων PubMed, ScienceDirect και Medline που δημοσιεύθηκαν τη χρονική περίοδο 2004-2024. Η στρατηγική αναζήτησης άρθρων περιλάμβανε προκαθορισμένες λέξεις-κλειδιά σχετικές με τη θεματολογία της ανασκόπησης, όπως “πρόωρα”, “νεογνά”, “εργοθεραπεία”, “μονάδα εντατικής νοσηλείας νεογνών”, καθώς και ο συνδυασμός αυτών.

Αποτελέσματα: Από τα 204 άρθρα που εντοπίστηκαν στην αρχική αναζήτηση, 23 άρθρα πληρούσαν τα κριτήρια για τη συμπερίληψη στην ανασκόπηση, αναφέροντας κατευθυντήριες οδηγίες της Εργοθεραπείας, καθώς και θεωρίες και θεραπευτικές προσεγγίσεις που υιοθετεί η επιστήμη της Εργοθεραπείας για τα πρόωρα νεογνά στη Μονάδα Εντατικής Νοσηλείας Νεογνών. Σύμφωνα με τα αποτελέσματα των μελετών, η Εργοθεραπεία αξιοποιεί το θεωρητικό μοντέλο Άτομο-Περιβάλλον-Έργο, το οποίο πλαισιώνει το πρόωρο νεογνό σε σχέση με το περιβάλλον του και τα έργα που εμπλέκεται. Η συμβολή της Εργοθεραπείας στη Μονάδα Εντατικής Νοσηλείας Νεογνών βασίζεται σε αναπτυξιακές και οικογενειοκεντρικές προσεγγίσεις, στοχεύοντας αφενός στην προαγωγή της αυτορρύθμισης των πρόωρων νεογνών απέναντι σε στρεσογόνες συνθήκες, αφετέρου στη βελτίωση της νευροανάπτυξης.

Συμπεράσματα: Υπό το πρίσμα της διεπιστημονικής προσέγγισης στη Μονάδα Εντατικής Νοσηλείας Νεογνών, η Εργοθεραπεία ενσωματώνει καινοτόμες προσεγγίσεις και τεκμηριωμένες θεραπευτικές μεθόδους για τη φροντίδα των αναγκών των πρόωρων νεογνών σε σωματικό, αισθητηριακό και ψυχοσυναισθηματικό επίπεδο, προάγοντας την υγεία, την ευεξία και τη συμμετοχή σε αναπτυξιακά κατάλληλα βασικά καθημερινά έργα.

Λέξεις Κλειδιά: Εργοθεραπεία, πρόωρα νεογνά, μονάδα εντατικής νοσηλείας νεογνών

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Occupational Therapy theory and practice for preterm neonates in the Neonatal Intensive Care Unit: A systematic review

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ABSTRACT

Introduction: In the Neonatal Intensive Care Unit, supporting the vital functions of preterm neonates is necessary, along with timely intervention in their sensory and psychological state, through specialties such as Occupational Therapy.

Aim: The purpose of the present systematic review was to explore occupational therapy interventions for preterm neonates at high risk in a Neonatal Intensive Care Unit. In addition, it also ascertains the theories and approaches adopted by Occupational Therapists within the interdisciplinary team for neonates a high risk in a NICU.

Methodology: Relevant articles published between 2004-2024 were searched in PubMed, ScienceDirect, and CINAHL scientific databases. The search strategy consisted of controlled search terms relevant to the search topic, such as “preterm”, “neonates”, “occupational therapy”, and “neonatal intensive care unit”, along with their combinations.

Results: Out of 204 studies, 23 studies met the inclusion criteria, reporting Occupational Therapy guidelines, as well as theories and approaches consistent with Occupational Therapy for intervention in the Neonatal Intensive Care Unit. Findings suggest that Occupational Therapy utilizes the Person-Environment-Occupation theoretical model, framing the preterm neonate in relation to their environment and the occupations they engage in. Occupational Therapy's contribution to the Neonatal Intensive Care Unit is based on developmental and family-centered approaches, aiming both to promote the self-regulation of preterm neonates in stressful conditions and to improve neurodevelopment.

Conclusions: Within the framework of the interdisciplinary approach in the Neonatal Intensive Care Unit, Occupational Therapy integrates innovative approaches and evidence-based therapeutic methods to address the needs of preterm neonates on physical, sensory, and psychosocial levels. This promotes health, well-being, and participation in developmentally appropriate basic daily activities.

Keywords: Occupational therapy, preterm neonates, neonatal intensive care unit.

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INTRODUCTION

Pretermaturity is a major public health issue, being the leading cause of mortality in children under 5 years old.¹ According to the World Health Organization (WHO), approximately 15 million neonates are born preterm each year. The rates of preterm births, ranging from 5% to 18%, often result in long-term health issues in more than half of the cases, while 75% are associated with perinatal mortality.² The main causes of neonatal death among preterm neonates include respiratory distress syndrome, neonatal sepsis, hypothermia, asphyxia, jaundice, and hypoglycemia.^{3,4,5} Therefore, to ensure the survival and proper development of the preterm neonate,

immediate admission to the Neonatal Intensive Care Unit (NICU) is necessary.

The NICU healthcare personnel focus on the systematic care and support of the preterm neonate during hospitalization, addressing a wide range of medical and biological needs. Due to the critical condition of the preterm neonates in the NICU environment, less emphasis is placed on ensuring their sensory self-regulation and psychological state. A characteristic example is the absence of standardized intervention protocols based on the sensory needs of preterm neonates.⁶ However, sensory disorganization in preterm neonates equally affects the stabilization of their vital signs. Given the increased organic, sensory, and psychosocial needs of preterm

neonates, the implementation of evidence-based intervention protocols under the principle of interdisciplinarity, involving parental caregivers in the therapeutic process, is deemed essential.⁷ A interdisciplinary team including occupational therapists works for preterm neonates in NICU's in order to address holistically the challenges faced by preterm neonates in the NICU. Interdisciplinary-framed intervention protocols in the NICU appear to be more effective in the care of preterm neonates compared to traditional medico-centric intervention models.⁸

This systematic review maps the literature of Occupational Therapy interventions for preterm neonates at high risk in a Neonatal Intensive Care Unit (NICU). In addition, it also ascertains the theories and approaches adopted by Occupational Therapists within the interdisciplinary team for neonates a high risk in a NICU.

MATERIALS AND METHOD

The framework for systematic studies⁹ is underpinned by six stages as follows: 1) Identifying the research question, 2) Identifying the relevant studies, 3) Study selection, 4) Charting the data, 5) Collating, summarizing and reporting the results, 6) Consultation.

Identifying the research questions

This systematic review intends to address the following review questions: a) what is the contribution of OT for preterm neonates in the NICU? b) which approaches are consistent with OT for intervention in the NICU? c) which theories/ intervention methods are consistent with OT for intervention in the NICU?

Identifying the relevant studies and selecting studies

This systematic review was conducted following the preferred reporting items for scoping reviews, systematic reviews and meta-analyses (PRISMA) guidelines.¹⁰ The study's PICO (population, intervention, comparison and outcome) framework focused on searching for the contribution of OT for preterm neonates in the NICU⁹ The search strategy consisted of controlled search terms relevant to the search topic, such as "preterm", "neonates", "occupational therapy", and "neonatal intensive care unit", along with their combinations. Relevant articles were searched and included from scientific databases such as PubMed, ScienceDirect, and CINAHL, published between 2004-2024. The broad time range for article inclusion is due to the limited availability of relevant articles identified during the literature search. Inclusion criteria required articles to 1) be written in English, 2) be published between 2004-2024, and 3) refer to theories,

approaches, or intervention methods used by OT science for preterm neonates in the NICU.

Charting the data

Charting of selected articles guided by Arksey and O'Malley.⁹ This charting process ensured extraction of relevant details including year, author, location of study, objective, study design, study methods, study population, as well as brief summaries of study findings.

Collating, summarizing and reporting results

The authors independently screened all initially retrieved papers based on their titles and abstracts, followed by a full-text review. This was crosschecked in both phases. The study selection was guided by the review question and inclusion and exclusion criteria. Disagreements were resolved through joint discussion until a consensus was reached, using the predefined criteria for study selection. Articles that were not available in full text or open access were excluded.

RESULTS

In this systematic review, 204 potential articles were identified via database and citation searches. After reviewing the titles and abstracts, a total of 181 articles were excluded based on the inclusion and exclusion criteria of PICO's framework.⁹ This systematic review included a total of 23 articles (see Table 1). Included studies conducted in the United States (n=11), Spain (n=2), Italy (n=2), France (n=2), Australia (n=1), Korea (n=1),

(n=1), Spain (n=1), South Africa (n=1) and Canada (n=1).

The reviewed articles included reports of theories, approaches, or intervention methods used by OT for preterm neonates in the NICU, such as 1) occupational therapy theory and guidelines^{12,16}, 2) developmental care^{11,15,17,18,19,24,25,32,33}, 3) family-centered care^{11,15,18,24,25,39}, 4) neurodevelopment and neurodevelopmental therapy^{11,15,17,18,34,36,39,41,42}, 5) Synactive Theory of Development^{11,21,23,39}, 6) Sensory Integration Theory and Therapy.^{11,15,17,26,29,30,31}

DISCUSSION

Occupational Therapy in the Interdisciplinary Team of the Neonatal Intensive Care Unit

OT is considered an integral part of the interdisciplinary team in the NICU, establishing its unique identity within neonatology.¹¹ OT interventions are guided by the practices and guidelines of the World Federation of Occupational Therapists (WFOT) and the American Occupational Therapy Association (AOTA).¹² These organizations aim to empower and facilitate individuals or groups to participate in various roles, habits, and routines in different environments, including home, school, work, and community. This therapeutic approach uses basic activities of daily living (occupations) to enhance participation. The

OT approach aligns with the principles of the International Classification of Functioning, Disability, and Health (ICF) established by the WHO.¹³ Additionally, within neonatology, OT interventions are guided by the Person-Occupation-Environment (PEO) model. This theoretical model emphasizes the dynamic and interactive relationship between the individual and various components of occupational performance, such as synergistic participation in occupations (between neonate and family), adaptation, and communication skills. The environment, including physical, social, cultural, and temporal factors, is recognized as a critical factor for occupational performance. These factors influence behavior and occupational performance, underscoring the importance of a holistic approach in OT practice.^{13,14}

OT considers the preterm neonate as an "occupational being," actively participating in patterns of actions and activities arising from interaction with the environment.¹⁵ Occupational performance involves the neonate engaging in a meaningful occupation or activity, as set by the family environment or NICU personnel. The experiences of occupational performance by the preterm neonate align with those of their caregivers. Based on this reasoning, the occupational therapist frames the preterm neonate's environment with adaptations and modifications to facilitate synergy in

occupational performance between the neonate, caregivers, and NICU personnel.¹⁶ Relying on the dynamic relationship of the preterm neonate with meaningful occupations and activities within interacting frameworks, OT aims to therapeutically engage the neonate in basic activities of daily living. OT science strengthens or activates this participation in creating habits and routines, as well as sensory experiences of the environment.

From the above, it becomes clear that OT's role in neonatology addresses intervention and research for acquiring and maintaining capabilities in neonates at risk for developing disorders or disabilities, limiting activity, and excluding participation in occupations, including caregiver involvement.

Approaches Consistent with Occupational Therapy for Intervention in the Neonatal Intensive Care Unit

OT practices for intervention in the NICU are based on theories and approaches adopted within the biopsychosocial model and the care of beneficiaries requiring OT intervention. These approaches frame the neonate, the NICU environment they are connected to and interact with, and their caregivers. Developmental care promotes the process of neurodevelopment and is characterized by individualized care starting from observing behaviors, promoting standardized training methods, providing an environment that supports participation in expected activities,

reducing environmental stress factors, and adapting the environment (light, sound, movement, position, touch, calmness, and physical support) to maintain optimal tone and a calm and restorative sleep in a relaxed, comfortable, or alert environment.¹⁷ Another approach is family-centered care. Through family-centered care, the intervention revolves around parents recognizing their children's behaviors and integrating into their care, guided by the principles of family proximity and involvement in the neonate's care.¹⁸ Actions in the environment are common to developmental care. On the other hand, it revolves around professionals functioning as NICU staff, participating in interdisciplinary collaboration and their scientific specialty. The next approach is neurodevelopment. The neurodevelopment approach is based on the premise that stable and appropriate neonate posture promotes proper perception and a variety of stimuli for future design and motor coordination.^{11,15,17} OT science often adopts this approach with other rehabilitation professionals to achieve self-regulation and organization in movement transitions, posture alignment providing exposure to sensory stimuli, and helping the neonate mature at motor, perceptual, and sensory levels.¹⁹

Theories Consistent with Occupational Therapy for Intervention in the Neonatal Intensive Care Unit

Synactive Theory of Development

The most recognized theory incorporated into the clinical reasoning of OTs in the NICU is the Synactive Theory of Development. The Synactive Theory focuses on the neonate and how it interacts with its environment. Developed by Heidi Als (1986),²⁰ the theory posits that the interaction of the neonate with its environment occurs through five behavioral subsystems, which develop hierarchically and interact dynamically. The five subsystems are defined as:

1. Autonomic subsystem - related to the body's proper functioning for the neonate's survival. Indicators include body temperature, respiratory rate, and skin color.
2. Motor subsystem - related to the neonate's motor control. Indicators include muscle tone, body position, and posture.
3. State subsystem - related to arousal levels, enabling conscious reactions such as deep sleep, wakefulness, crying, and transitions between them.
4. Attention-interaction subsystem - related to the neonate's ability to focus, respond, alert, and interact with external environmental stimuli.
5. Self-regulation subsystem - related to maintaining balance among the other four subsystems. Proper functioning allows the neonate to remain organized, even after stressful conditions.^{20,21,22}

The importance of synergy in the above theory lies in the need for stability among the subsystems. Dysfunction in an earlier subsystem implies dysfunction in later-developing subsystems.²³ For example, the emergence of motor control, requiring proper functioning of the motor subsystem, predisposes the stability of the autonomic subsystem. Also, for the maturation of the self-regulation subsystem, harmonious collaboration among all four subsystems is necessary. If an inappropriate stimulus affects the neonate in one subsystem (e.g. respiratory distress or increased/decreased heart rate), imbalance among the subsystems will be observed, leading to the neonate's disorganization. Conversely, if there are plenty of appropriate stimuli, the neonate will turn towards and seek them, resulting in organization and development. Comparatively, preterm neonates in the hospital environment exhibit greater imbalance among the subsystems, resulting in negative interaction with their environment, leading to disorganization and stress manifestations.⁸ In practical terms, the goal of the Synactive Theory for preterm neonates in the NICU is to stabilize the subsystems, aiming for their organization and self-regulation. Application of the theory includes systematic monitoring of preterm neonates' reactions, appropriate and individualized developmental care, environmental

adaptation to promote mainly positive stimuli, and close collaboration between therapists, staff, and family.²²

Regular monitoring and evaluation of preterm neonates' reactions contribute to the formation of an effective therapeutic program for achieving stability and organization. The Neonate Individualized Developmental Care and Assessment Program (NIDCAP) is a specialized assessment program for preterm neonates, focusing on caregivers' understanding of neonates' self-regulation capabilities through behavioral observation as communication itself.²³ NIDCAP focuses individually on each neonate's skills and capabilities. It emphasizes sensory system integration and subsystem stability while supporting all caregivers: parents and professionals.²⁴ NIDCAP starts with observing the neonate's response to care procedures. Based on this, individual recommendations and strategies for care are formulated. These recommendations support the neonate's physiological stability and self-regulation and behavioral organization. Combining Synactive Theory with NIDCAP aligns with OT philosophy, considering interaction with the environment and the performance of preterm neonates as follows:

Neonate Activities: a) Activities with Sensory Stimuli: Auditory, oral, tactile, proprioceptive, vestibular. b) Basic Daily Activities: Feeding, sleeping, and rest.

Individual Factors of the Neonate: a) Self-Regulation: Muscle tone, strength, endurance, postural control, oral control. b) State of Alertness: Regulation, transition of states. c) Skills: Visual, auditory, and developmental skills.

Environmental Factors: a) Physical Environment: Activity level, connection, regulation. b) Social Environment (Caregiver-NICU Staff): Sensitivity, commitment, willingness, number. c) Temporal Environment: Rhythm, routine, medical needs.^{8,25}

Sensory Integration Theory and Therapy

Through the theoretical framework of Sensory Integration (SI), A. Jean Ayres (1979)²⁶ suggested that the brain can receive, process, and organize sensory information from the environment and the body to develop appropriate adaptive responses and behaviors.^{11,15} The organization of the responsible sensory systems contributes to the self-regulation and functionality of the individual.¹⁷ The sensory systems include:

1. Somatosensory system (tactile and proprioceptive system): Responsible for the sense of touch, temperature, pressure, and pain.
2. Vestibular system: Responsible for the sense of balance and spatial orientation for movement.
3. Visual system: Responsible for the sense of sight.

4. Auditory system: Responsible for the sense of hearing.

5. Olfactory system: Responsible for the sense of smell.

6. Gustatory system: Responsible for the sense of taste.^{11,15,17}

In case of any dysfunction in sensory processing, there is a limitation in the individual's participation in occupations and basic daily activities.²⁸

The introduction of a preterm neonate into the NICU addresses its medical needs. However, its placement in an environment with a multitude of intense, uncontrolled sensory stimuli, alongside medical interventions causing discomfort, has consequences for the neonate's self-regulation.²⁹ In the incubator, the preterm neonate is exposed to an atypical multi-sensory experience that does not resemble the typical intrauterine environment of the third trimester of pregnancy. Due to the preterm neonate's confinement in the limited space of the incubator and the systematic absence of parental caregiving figures, appropriate sensory opportunities for movement and physical contact and suitable stimulation of vestibular and somatosensory receptors are not provided. Additionally, the preterm neonate experiences negative sensory experiences in its tactile system when exposed to necessary medical techniques such as frequent blood sampling and

catheterization.³⁰ The noisy environment of the NICU seems to overstimulate the visual and auditory systems of the preterm neonate. Continuous machine noises combined with intense and irregular lighting and the environmental sounds distorted by the walls of the incubator are associated with symptoms of physiological deregulation such as tachycardia or bradycardia, apnea, reduced oxygenation, high blood pressure, and intracranial pressure, as well as hearing loss.³¹ This imbalance between positive and negative sensory experiences hinders the neurobiological process of cortical processing of sensory stimuli, leading to sensory overload and immediate disruption of the neonate's biological cycles.³²

The implementation of an intervention program oriented towards the SI of the preterm neonate aims to reduce sensory overload while exposing it to developmentally appropriate sensory experiences to enhance its self-regulation and organization.^{11,15,17} Creating stable and predictable sensory experiences will allow the preterm neonate to develop adaptive responses to environmental demands, maintaining the balance between cycles of wakefulness-sleep, nutrition, and rest-activity. At the same time, the SI intervention improves the mental health of the preterm neonate, reducing behaviors of anxiety and intense stress, while strengthening the bond with the caregiving

parent.²⁷ Indicatively, the following SI strategies are proposed:

- Tactile system strategies: Skin-to-skin contact with caregivers, gentle touch/stroking, kangaroo care technique, and neonate massage.
- Proprioceptive system strategies: Passive mobilization and gentle joint compression, free and unrestricted active movement.
- Vestibular system strategies: Positioning the neonate in a flexion pattern during feeding and sleep to simulate the intrauterine environment and rocking the neonate from the 32nd week PMA.
- Visual system strategies: Exposing the preterm neonate to a low-light environment until the 32nd week PMA, contact with natural light, cyclic light changes from the 32nd week PMA, encouraging visual attention through interaction, and lighting from 25-100 LUX.
- Auditory system strategies: Exposing the preterm neonate to the voices of caregivers naturally or recorded, reading short stories and lullabies, using soft music while avoiding stereo systems, and maintaining auditory stimuli intensity at 45 dB.
- Olfactory system strategies: Using fabrics with the mother's scent or soaked with breast milk or colostrum, and close contact with the caregiving parents.^{8,33,34,35}

Neurodevelopmental Treatment

The neurodevelopment of a neonate is closely linked to its physical growth. When a neonate's growth measurements, such as weight, height, and head circumference, show an increasing trend, they serve as indicators of typical development and good health quality. Therefore, neonates showing typical physical growth tend to exhibit good neurodevelopmental performance compared to those not growing as expected and simultaneously experiencing delays in their neurodevelopment.

The NICU environment acts as an inhibitory factor in the neurodevelopment of preterm neonates.³⁶ The limited space in which a preterm neonate stays, combined with body immobilization by various life-support medical devices, leads to atypical postural and movement patterns that significantly differ from the stimuli provided by contact with amniotic fluid in the intrauterine environment. These atypical postural and movement patterns burden the physical development of the preterm neonate, affecting its feeding, sleep, and activity cycles. Based on the neurodevelopmental approach, Karl and Berta Bobath developed the method of Neurodevelopmental Treatment (N.D.T).³⁷ N.D.T. is defined as the intervention method used in neurological rehabilitation to allow beneficiaries with atypical central nervous system behaviors to adopt expected postural and movement patterns to promote

development.³⁸ Through N.D.T., various sensory stimuli are promoted to all sensory systems to improve the beneficiary's health. N.D.T. is safely applied to preterm neonates in the NICU environment by specialized occupational therapists and physical therapists.^{39,40}

In the NICU, specialized therapists focus on improving the posture of preterm neonates, which is essential for digestion, feeding, and breathing functions. They also work to maintain the range of motion, improving head positioning and movement control, contributing to the feeding process, environmental adaptation, and the behavioral stability of the neonate.⁴¹

N.D.T. programs in the NICU aim to counteract the atypical postures and movement patterns exhibited by preterm neonates during hospitalization. To promote comfort and support the respiratory and musculoskeletal systems of preterm neonates, exposure to prenatal flexion positions is attempted, such as proper head and neck alignment after relaxing the neck extensor muscles, slight chin flexion, anterior shoulder blade traction, centering of the hands and arms, posterior pelvic tilt, and flexion of the trunk and legs. This experience with normal flexion positions is expected to improve the psychological stability of the preterm neonate and form the basis for maintaining muscle length, promoting correct joint alignment, and

gradually developing anti-gravity positions. Frequent changes from supine to prone and lateral positions with slow and smooth movements are also recommended. Additionally, positioning the upper and lower limbs of preterm neonates so they touch their own body is suggested.⁴²

CONCLUSIONS

Occupational Therapy, as an integral part of the interdisciplinary team in the NICU, significantly contributes to the holistic care of preterm neonates. Based on theoretical OT models, occupational therapists apply therapeutic methods to promote sensory and psychosocial support. They also aim to involve caregivers as supportive members in the therapeutic process, while simultaneously modifying the environment to facilitate the organization and self-regulation of preterm neonates in the NICU. Overall, OT plays a crucial role in the NICU by offering specialized care tailored to the individual needs of each preterm neonate. Continuous research and the application of evidence-based intervention protocols strengthen the intervention applied to preterm neonates, contributing to their survival, development, and quicker discharge from the NICU.

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ANNEX

FIGURE 1. PRISMA Extension for Scoping/Systematic Reviews flow diagram for article selection (Tricco et al., 2018).

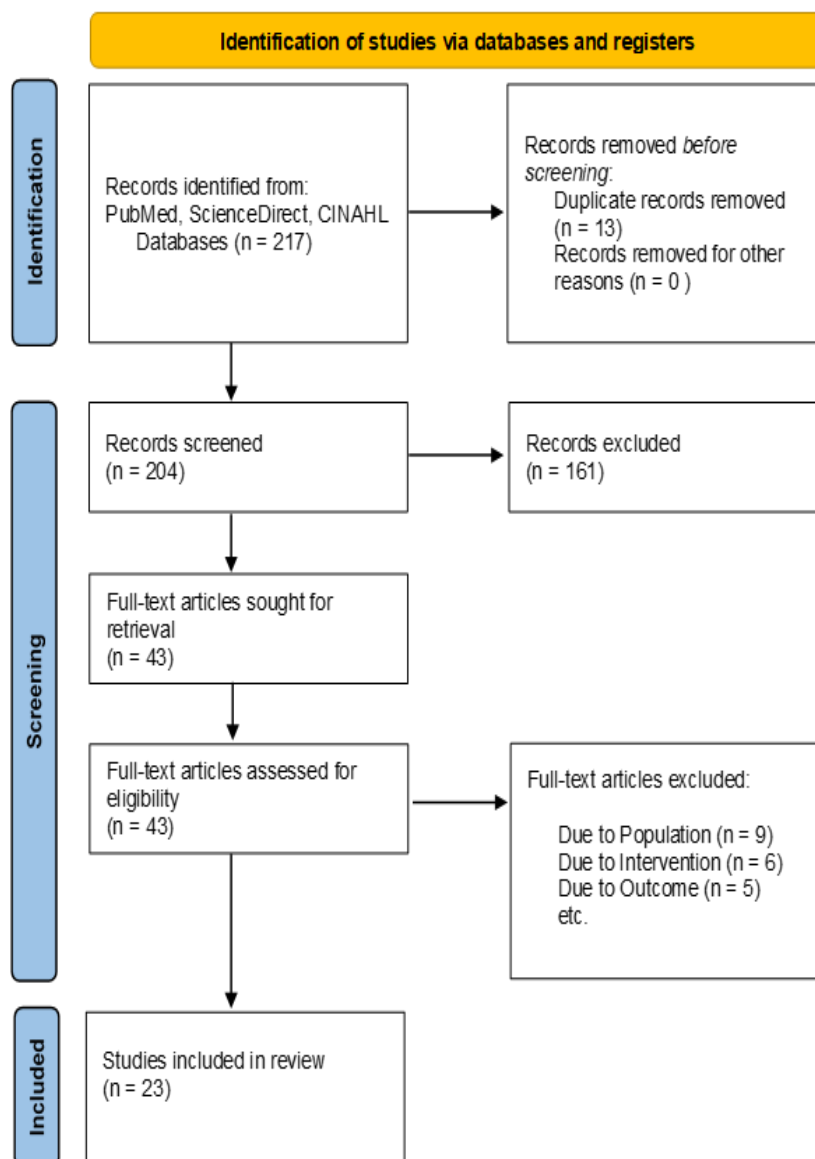


TABLE 1: Findings of included studies

Author	Date	Study design	Country	Outcome
Rubio-Grillo MH	2019	Systematic review	Spain	Synactive theory of development, Developmental Care, Family Centered Care, Neurodevelopment, Sensory Integration.
Clark GF et al	2020	Systematic review	USA	Occupational Therapy Theory and guidelines
Nightlinger K	2011	Review	USA	Sensory Integration, Family Centered Care, Neurodevelopment, Developmental Care
<i>The American Journal of Occupational Therapy</i>	2018	Review	USA	Occupational Therapy Theory
Griffiths et al	2019	Systematic Review	Australia	Developmental Care, Neurodevelopment, Sensory Integration, NICU Environment
Ding X et al	2019	Systematic Review- Meta analysis	UK	Neurodevelopment, Family centered Care, Developmental Care
Silva NF	2018	Systematic Review	Brazil	Developmental Care
Blanchard Y et al	2015	Review	USA	Synactive theory of development, neurodevelopment
Maltese A et al	2017	Review	Italy	Synactive theory of development
Klein V et al	2021	Clinical Trial	France	Family Centered Care, Developmental Care
Moody C et al	2017	Retrospective Cohort	USA	Family Centered Care, Developmental Care
Lecuona E et al	2017	Controlled Trial	South Africa	Sensory Integration
Crozier SC et al	2015	Retrospective Cohort	USA	Sensory Integration
Maitre NL et al	2017	Cohort	USA	Sensory Integration
Vitale FM et al	2021	Review	Italy	Sensory Integration
Séassau et al	2023	Review	France	Developmental Care, Sensory Integration
Cañadas DC et al	2022	Meta-analysis	Spain	Developmental Care, Sensory



				Integration
Greenberg J et al	2023	Clinical Trial	USA	Sensory Integration, Neurodevelopment, Neurodevelopmental therapy
Zimmerman E et al	2012	Clinical Trial	USA	Sensory Integration
Painter L et al	2019	Quasi-experimental	USA	Neurodevelopment, Neurodevelopmental Therapy
Aita M et al	2021	Systematic Review and Meta-analysis	Canada	Synactive theory of development, Sensory integration, Developmental Care, Family Centered Care, Neurodevelopment
McManus B et al	2008	Case Report	USA	Neurodevelopment
Lee EJ et al	2018	Experimental	Korea	Neurodevelopment, Neurodevelopmental Therapy