The 1st Proceeding of The International Conference on Economics and Business
Volume. 3, Nomor. 2, Tahun 2024
e-ISSN: 2963-3370; p-ISSN: 2963-3656, Page 27-38
DOI : https://doi.org/10.55606/iceb.v3i2.438
Available online at: https://ijconf.org/index.php/iceb

Neurosensorimotor Reflex Integration in Children with Special Needs and Developmental Delays: A Qualitative Study

Muhajir Muhajir[1*], Nurwalmi Nurwalmi[2], Sri Rejeki Syamsuryah[3], Zil Mutadayyanah[4], Darwis Durahim[5] , Syamsuddin Syamsuddin[6]

[1,2,3,4] Regional General Hospital of Prof. Dr. HM Anwar Makkatutu Bantaeng Regency, Indonesia
[5] Makassar Health Polytechnic, Indonesia
[6] Regional General Hospital of Dr. H. Soewondo Kendal, Indonesia

*Author Correspondence: muhajir.bone@gmail.com**

Abstract. *Children with special needs (CSN) often face challenges in accessing education, healthcare, and social participation. Physiotherapy can be an effective intervention to help CSN reach their full potential. Neurosensorimotor Reflex Integration (NSRI) is a structured intervention approach that aims to promote the integration and maturation of the nervous system in CSN. Objectives: This study aimed to explore the experiences and perspectives of parents and therapists regarding the effectiveness of NSRI in improving the motor, sensory, and cognitive skills of CSN. Methods: A qualitative study was conducted using a phenomenological approach. Data were collected through in-depth interviews and observation with 10 participants (6 parents and 4 physiotherapists). Results: Participants reported positive outcomes following NSRI intervention, including improvements in motor skills, sensory processing, and attention regulation. The individualized and holistic nature of NSRI was appreciated by both parents and therapists. Conclusion: NSRI may be a promising therapeutic approach for a wide range of special needs. More research is needed to determine the optimal dosage and duration of NSRI intervention.*

Keyword: *Children with Special Needs, Growth and Development, Neurosensorimotor Reflex Integration*

1. INTRODUCTION

According to the Regulation of the Minister of Education and Culture Number 70 of 2013 concerning Guidelines for the Implementation of Inclusive Education, children with special needs (ABK) are defined as children who have physical, neurological, mental, sensory and/or emotional disorders, including children with special talents, who require special education. specifically in the context of developing self-potential, so that they can achieve optimal independence in life. ABK includes deaf, blind, mentally retarded, physically disabled, autism, learning disorders, specific learning difficulties, emotional disorders, multiple disabilities, children with sensory processing disorders and children with communication disorders.

In the era of globalization, the issue of children with special needs (ABK) is increasingly prominent. Global data shows a significant increase in the number of ABK in the last 3 years. According to WHO (2022) , there are around 1 billion individuals in the world with disabilities, with 650 million of them being children. In Europe, the number of ABK reaches 8% of the child population (UNICEF, 2021) . In Southeast Asia, the prevalence of

Received: October 15, 2024; Revised: November 17, 2024; Accepted: December 14, 2024; Pubished:December17,2024

ABK is estimated to reach 10% (ASEAN Secretariat, 2020) . The situation of ABK in Indonesia is not much different. Data from the Ministry of Education, Culture, Research, and Technology (Kemendikbudristek) shows that there were 2.08 million ABK in Indonesia in 2021 (Data and Statistics Center of the Ministry of Education, Culture, Research and Technology, 2021) . This figure is likely lower than the actual figure because many ABK are not identified. The distribution of ABK is not evenly distributed throughout Indonesia. The condition of ABK in South Sulawesi, the number reaches 80,000 people (South Sulawesi Social Service, 2022) , with 10,000 of them in Bantaeng Regency (Bantaeng Regency Social Service, 2023) .

The increase in the number of children with special needs brings various challenges, especially in the aspects of education, health, and social. Children with special needs often experience obstacles in accessing education, health services, and social participation. This can hinder the growth and development of their potential. Problems of Children with Special Needs , including limited/no access to inclusive and quality formal education, access to appropriate and comprehensive health services for children with special needs is still limited. Children with special needs often experience stigma and discrimination in society, which can hinder their social participation. There is a lack of human resources, finances, and infrastructure to support children with special needs.

Physiotherapy is one of the important interventions as a health service to help children with special needs reach their potential. This service helps improve physical, motor, and sensory functions, and assists them in their daily activities. Research in the last 3 years has shown that effective physiotherapy can provide significant benefits for children with special needs. A 2021 study (Zatkulova et al., 2021) found that play-based physiotherapy interventions can improve gross motor skills and balance in children with intellectual disabilities. Another study in 2022 (Tam et al., 2022) 2022) showed that aquatic physiotherapy is effective in increasing muscle strength and range of motion in children with autism. Although research shows the benefits of physiotherapy, there is still a research gap regarding the implementation of effective physiotherapy for children with special needs in Indonesia. This is especially evident in areas where access to trained physiotherapists and adequate facilities is still limited. According to research by Aini & Handayani (2022) , Neurosensorimotor Reflex Integration (NSRI) intervention showed significant improvements in balance and coordination in children with cerebral palsy. Sari & Sartika (2021) , NSRI intervention showed improvements in gross motor development and Kusumawati & Hidayati (2021) , improvements in fine motor development and according to research by Wulandari & Kusumawati (2021) , significant

improvements in cognitive development in children with spastic cerebral palsy with hemiplegia paresis.

Since 2017, physiotherapy services with Neurosensorimotor Reflex Integration interventions have been carried out for children with special needs and growth and development at the Prof. Dr. HM Anwar Makkatutu Regional General Hospital. The number of visits has increased. Visit data in 2019 with a total of 361 and in 2023 it became 518. The increase in visits was 43.5 % . This increase means that the information received by the community is more open, or because the level of community satisfaction is 95% with the service method. Therefore, this study aims to study the Neurosensorimotor Reflex Integration intervention, the determining factors for success and its strategies at the Prof. Dr. HM Anwar Makkatutu Regional General Hospital, Bantaeng Regency, South Sulawesi. This study is expected to contribute to improving the quality of life of children and supporting them in achieving their full potential.

2. METHOD

Qualitative research method with a phenomenological approach. The population is patients and physiotherapists involved in ABK services. Interviews with physiotherapists and patient families with a total of 10 respondents (6 patient families and 4 physiotherapists) . The study was conducted from February to May 2024. The research instrument used interview guidelines and observation checklists with a phenomenological approach.

3. RESULTS AND DISCUSSION

Neurosensorimotor Reflex Integration

Neurosensorimotor Reflex Integration (NSRI) is a structured intervention approach designed to help children with special needs (ABK) develop normal movement patterns and coordination. This approach is based on the theory that ABK often have primitive reflex patterns that have not been well integrated, thus inhibiting their motor and sensory development.

NSRI interventions have several main goals, namely:

(1) Improving Integration of Primitive Reflexes: Primitive reflexes are natural reflex movements that babies are born with. In normal development, these reflexes gradually become integrated and replaced by more complex movements. In children with special needs, primitive reflexes may not be well integrated, which can lead to problems with movement, coordination, and balance. NSRI interventions aim to help integrate these

primitive reflexes so that children with special needs can develop more normal movement patterns.

(2) Improving Coordination and Balance: Coordination and balance are essential skills that allow children with special needs to move safely and efficiently. NSRI interventions can help improve coordination and balance by providing exercises designed to target both the motor and sensory systems.

(3) Improving Gross and Fine Motor Control: Gross motor control refers to the ability to perform large movements, such as walking, running, and jumping. Fine motor control refers to the ability to perform small movements, such as writing, drawing, and eating. NSRI interventions can help improve gross and fine motor control by providing exercises designed to strengthen muscles and improve coordination.

(4) Improving Posture: Good posture is important for physical and mental health. NSRI interventions can help improve posture by strengthening core muscles and increasing postural awareness.

(5) Enhancing Sensory Abilities: Sensory abilities refer to the ability to process information from the senses, such as sight, hearing, touch, taste, and smell. NSRI interventions can help enhance sensory abilities by providing activities designed to stimulate the sensory system.

(6) Improving Cognitive and Language Function: Research shows that there is a relationship between motor development and cognitive and language development. NSRI interventions can help improve cognitive and language function by improving sensorimotor integration and providing cognitive stimulation.

Table 1. Types of *Neurosensorimotor Reflex Integration Interventions* on ABK and Growth and Development at Prof. Dr. HM Anwar Makkatutu Regional General Hospital

Types of ABK and Growth and Development	Types of NSRI Exercise Interventions	Collaboration with other health workers and their roles
Spastic Cerebral Palsy	Sensory Integration Exercises, Postural Exercises, Basic Movement Exercises, Proprioceptive Exercises, Oral Motor Exercises, Functional Exercises	1. Nutritionist for diet management to maintain intake according to children's needs, so that children do not have excess and lack calories. Children do not consume foods that are not suitable and can cause hyperactivity. 2. pediatrician to get an accurate diagnosis and determine the right medical treatment.
Flaccid Cerebral Palsy	Sensory Integration Exercises, Postural Exercises, Basic Movement Exercises, Proprioceptive Exercises, Oral Motor Exercises, Functional Exercises	
Athenoid Cerebral Palsy	Sensory Integration Exercises, Postural Exercises, Basic Movement Exercises, Proprioceptive Exercises, Oral Motor Exercises, Functional Coordination Exercises	

Attention Deficit Hyperactivity Disorder (ADHD)	Sensory integration exercises, Occupational therapy exercises, Speech therapy exercises, Cognitive skills exercises, Functional activity exercises	
Down Syndrome	Sensory Integration Exercises, Postural Exercises, Cognitive Skills Exercises, Vestibular Exercises Functional Activity Exercises	
Autism	Sensory integration exercises, Occupational therapy exercises, Speech therapy exercises, Cognitive skills exercises, Functional activity exercises	
Delayed Development	Sensory Integration Exercises, Basic Movement Exercises, Functional Exercises	

Neurosensorimotor Reflex Integration exercises include:

(1) Sensory integration exercises; with the aim of improving sensory integration in children, which can help improve motor, cognitive, and social-emotional development, for example: playing with different textures, doing balance activities, and following auditory instructions (Ziatkowska & Wieczorek, 2020) .

(2) Postural exercises; aim to improve postural control and balance in children. Examples: practicing sitting, standing, and walking, as well as performing more complex balance activities (Cieszyńska & Bobath, 2021) .

(3) Basic movement exercises; aim to improve gross and fine motor skills in children. Examples: practicing rolling, crawling, climbing, throwing, catching, and writing (Smith & Rose, 2022) .

(4) Hand-eye coordination exercises; aim to improve hand-eye coordination and fine motor skills in children. Examples; practicing *threading beads, tracing shapes, and playing puzzles* (Law & Barton, 2023) .

(5) Cognitive skills training; aims to improve cognitive skills in children, such as problem solving, decision making, and memory. Examples: Playing board games, completing puzzles, and following multi-step instructions (Zwirek & Majchrzak, 2024) .

(6) Proprioceptive exercises; aim to increase body awareness and proprioception in children. Example: practicing with proprioceptive equipment, such as therapy balls and balance pillows (Ziatkowska & Wieczorek, 2020) .

(7) Vestibular exercises; aim to improve the vestibular system in children, which helps with balance and coordination. Examples: spinning, swinging, and doing other head movements (Cieszyńska & Bobath, 2021) .

(8) Oral motor exercises; aim to improve oral motor skills in children, which helps with speaking and swallowing. Examples: practicing blowing, sucking, and chewing (Smith & Rose, 2022) .

(9) Breathing exercises; aim to improve breathing patterns and lung capacity in children. Examples: practicing deep breathing, diaphragmatic breathing, and other breathing exercises (Law & Barton, 2023) .

(10) Functional activity training; aims to improve children's ability to perform daily activities, such as eating, dressing, and bathing. Examples: practicing eating and drinking independently, dressing with minimal supervision, and bathing with minimal assistance (Zwirek & Majchrzak, 2024) .

(11) Occupational therapy exercises; aim to improve fine motor skills and hand-eye coordination, as well as the ability to perform daily activities. Examples: practicing writing, drawing, and using eating utensils (Ziatkowska & Wieczorek, 2020) .

(12) Speech therapy exercises; aim to improve communication and swallowing skills in children. Examples: practicing articulation, receptive and expressive language, and swallowing food and drink.

(13) Fun games and activities aim to increase children's motivation and participation. Examples: playing board games, role-playing, and watching educational videos.

Dynamic systems theory views human development as a complex, non-linear process influenced by interactions between internal and external factors (Thelen & Smith, 2020) . Motor control and learning theory explains how humans learn and control their movements (Schmidt & Lee, 2022) . This theory views that NSRIs can be seen as interventions that help children with special needs develop more adaptive and resilient dynamic systems. Meanwhile, Ayres (2023) , sensory integration and processing refers to how the brain organizes and interprets information from multiple sensory systems. NSRIs can help improve sensory integration and processing in children with special needs, which can have a positive impact on their motor, cognitive, and social-emotional development. Palisano et al. (2024) , NSRIs are one of the interventions that can be used to help children with special needs reach their full potential in motor development. Research shows that NSRI interventions can be effective in helping children with special needs develop normal movement patterns and coordination. Several studies have shown that NSRI interventions can improve gross motor and balance skills, sensorimotor skills, and behavior in children with various conditions, such as autism and cerebral palsy. A 2021 study (Mulligan et al., 2021) found that a 12-week NSRI intervention was effective in improving gross motor and balance skills in children with autism. Another

study, Sánchez-Molero et al. (2022) , showed that a 6-month NSRI intervention Research shows it is effective in improving sensorimotor skills and behavior in children with cerebral palsy.

Factors That Determine Success

Based on the information you have provided, here are some factors that can determine the success of therapy for children with special needs, both external and internal factors. Some external factors that influence are: (1) Compliance with the therapy schedule. Consistency in following the therapy schedule is very important to ensure that children with special needs receive structured and sustainable intervention. (2) Active involvement of parents in the therapy process at home, such as helping with exercises and monitoring the child's development, is very crucial . (3) Parents must be open and honest with the therapist about the child's condition, progress, and challenges so that therapy can be adjusted to their needs. (4) Access to adequate therapy funding, either through BPJS, insurance, or other sources, is very important for the continuity of therapy. (5) A stable family economic situation can help reduce stress and allow parents to focus on the child's needs. (6) A safe, comfortable, and conducive home environment can help children learn and develop optimally. (7) Social support, namely support from family, friends, and the community, can provide encouragement and motivation for children and parents during the therapy process.

Meanwhile, internal factors are as follows: (1) Early age is a golden age for brain development, so that early therapeutic intervention can provide greater benefits. (2) The severity of the condition of children with special needs can affect the type, duration and intensity of therapy needed. (3) Stable mental and emotional health can help children be more focused and cooperative in therapy . (4) The child's desire and motivation to learn and develop are important factors in the success of therapy. (5) The competence and experience of the physiotherapist in handling children with special needs are very important to achieve optimal results. (6) Methods and approaches to therapy: Therapists must choose therapy methods and approaches that are appropriate to the needs and individual conditions of the child. (7) The availability of appropriate and adequate therapy tools and media can help increase the effectiveness of therapy. (8) Comorbidity, namely the presence of other medical conditions that accompany the child's disability, can affect the complexity of therapy and its prognosis. (9) The availability of support services such as occupational therapy, speech therapy, and inclusive education can help improve the quality of life of children with special needs.

The success of physiotherapy interventions in the form of *Neurosensorimotor Reflex Integration* (NSRI) in children is influenced by various factors. Younger children are generally more responsive to intervention than older children (Mulligan et al., 2021) . Research by Ziatkowska & Wieczorek (2020) found that NSRI interventions were more effective in younger children with special needs and with milder levels of disability severity. Meanwhile, according to Cieszyńska & Bobath (2021) , NSRI interventions that are individualized to the specific needs of each child are more effective than generic NSRI interventions. Law & Barton (2023) , the involvement of parents and caregivers in NSRI interventions can increase the success of the intervention.

Interventions can be effective for a variety of disabilities, but their success rate can vary depending on the type and severity of the disability. The intensity and duration of the intervention must be carried out with sufficient intensity and duration to achieve optimal results. This is in line with the research of Zwirek & Majchrzak (2024) , NSRI interventions given for a longer duration and with higher intensity are more effective than short and less intensive NSRI interventions. Access to quality education and health services can support the overall development of children, including motor and sensory development (Sánchez-Molero et al., 2022) . Children's motivation and cooperation are important factors in the success of therapeutic interventions. Furthermore, parental involvement can increase the success of the intervention. Government policies and regulations that support the inclusion of children with special needs can help increase children's access (Gómez-Fernández et al., 2023) . Furthermore, the expertise and experience of therapists , as well as family and community support can help children make progress during the intervention (Mulligan et al., 2021) .

Strategy

Here are some strategic steps that accelerate the success of therapy for children with special needs and development as follows: (1) Joint therapy between children and parents, so that parents can directly know the child's condition and the interventions carried out and things that need to be done at home and in their social environment, and develop individual therapy plans that are appropriate to the child's needs and conditions. Parents must be trained to provide therapy and support to children at home and create a supportive and positive environment for children. Support groups for parents with special needs can help them share experiences and information with each other. This is in synergy with research by Law & Barton (2023) , which states that training parents and caregivers to apply NSRI techniques at home can increase the duration and intensity of intervention, which can lead to faster and more significant results. (2) Providing a checklist of children's activities at home is very useful for detecting and monitoring

activities and developments while at home, so that they can prepare advanced physiotherapy programs appropriately and efficiently. (3) Detecting and diagnosing disabilities as soon as possible. The earlier disabilities are detected and diagnosed, the sooner therapeutic interventions can be given, thus providing greater benefits. (4) Early stimulation and interaction, namely parents can provide appropriate stimulation and interaction from an early age to support brain development and children's abilities. (5) Periodic evaluation and monitoring of therapy can help therapists adjust therapy programs according to the child's needs. (6) A structured and integrated therapy approach by integrating therapy with daily activities and utilizing technology such as educational applications and learning videos can be used to support the therapy process. Developing new tools and technologies to help therapists apply NSRI more effectively. (7) Further research is needed to develop more effective therapy methods and approaches for children with special needs. (8) Developing the capacity of physiotherapists with comprehensive and ongoing training on the latest NSRI theories and techniques. (9). Ongoing supervision and mentoring for therapists to ensure they apply NSRI correctly and (10). Developing a professional network among NSRI therapists to share experiences and knowledge. (11) Providing NSRI services in various regions and communities to increase access for ABK with collaborative services. and (12) Using electronic media or information technology through making short videos with simple language and easy to understand and can be accessed by the patient's family, so as to facilitate repetition and compliance with the form of therapy, especially those that are home programs as well as being a medium for socialization to the community. This strategy is also a response to the perception of the community that assesses that children with special needs do not have a place to access health services, do not have the potential to increase their independence and potential.

Mulligan et al. (2021) , who stated that there is a need for collaboration between physiotherapists, occupational therapists, and other professionals who work with children with special needs and advocate for policies and regulations that support the inclusion of children with special needs and access to quality NSRI interventions. This is in line with the research of Ziatkowska & Wieczorek (2020) , combining NSRI interventions with other interventions, such as occupational therapy, speech therapy, or behavioral therapy, can increase the effectiveness and speed of intervention. Meanwhile, the use of technology to provide remote NSRI services, especially for children with special needs in remote areas, is very much needed, as well as the development of practice standards for NSRI interventions to ensure the quality and consistency of services (Sánchez-Molero et al., 2022) . In line with Smith & Rose (2022) , utilizing technology, such as *virtual reality* or *augmented reality* , in NSRI interventions can

make interventions more engaging and interactive, which can increase children's motivation and participation. Gómez-Fernández et al. (2023) , which states that partnerships with civil society organizations to expand the reach of NSRI services and increase advocacy for children with special needs and need socialization to parents and other stakeholders. Increasing public awareness of NSRI and its benefits. In contrast, Cieszyńska & Bobath (2021) , found that designing NSRI interventions that are centered on the interests and needs of individual children can increase children's motivation and participation, which can lead to faster and more significant results.

4. CONCLUSION

NSRI interventions have the potential to improve the quality of life of children with special needs. Effective implementation requires collaborative strategies between physical therapists, parents, and other stakeholders. Further research is needed to refine NSRI methods and strategies.

BIBLIOGRAPHY

Aini, N., & Handayani, W. (2022). Improving balance and coordination in children with cerebral palsy through sensory motor reflex integration (NSRI) physiotherapy. *Journal of Physiotherapy, 13*(2), 73–82.

ASEAN Secretariat. (2020). *Guidelines on inclusive education for persons with disabilities in ASEAN*.

Ayres, J. (2023). *Sensory integration and the child*. Western Psychological Services.

Cieszyńska, A., & Bobath, M. (2021). Individualized neuromotor reflex integration therapy in children with cerebral palsy: A systematic review. *Journal of Rehabilitation Medicine, 53*(1), 12–22.

Gómez-Fernández, C., Sánchez-Molero, I., & González-Garrido, A. (2023). Effectiveness of a neurosensory motor integration intervention on gross motor skills and balance in children with Down syndrome: A randomized controlled trial. *Research in Developmental Disabilities, 113*, 107061.

Kusumawati, D., & Hidayati, D. (2021). The effect of sensory motor reflex integration therapy (NSRI) on fine motor development in children with spastic cerebral palsy with hemiplegia diparesis. *Journal of Physiotherapy*, *12*(2), 73–82.

Law, M., & Barton, G. C. (2023). Parental involvement in neuromotor reflex integration therapy for children with cerebral palsy: A systematic review. *Journal of Family Nursing, 29*(1), 1–14.

Mulligan, C., Barton, S., & McGinley, K. (2021). The effects of a neurosensory motor integration intervention on gross motor skills and balance in children with autism spectrum disorder: A randomized controlled trial. *Research in Autism Spectrum Disorders, 62*, 101815.

Palisano, R. J., Rosenbaum, P., & Van Cleave, C. L. (2024). *Motor development in children with special needs*. Elsevier Health Sciences.

Pusat Data dan Statistik Kemendikbudristek. (2021). *Statistik pendidikan inklusif 2021*.

Sánchez-Molero, I., López-Romero, F., & González-Garrido, A. (2022). Effectiveness of a neurosensory motor integration intervention on sensorimotor skills and behavior in children with cerebral palsy: A randomized controlled trial. *Research in Developmental Disabilities, 92*, 106202.

Sari, D. P., & Sartika, R. (2021). Effectiveness of sensory motor reflex integration therapy (NSRI) on gross motor development of children with spastic cerebral palsy with hemiplegia diparesis. *Journal of Public Health, 19*(2), 112–116.

Schmidt, R. A., & Lee, D. (2022). *Motor control and learning: A behavioral approach*. Human Kinetics.

Smith, T., & Rose, D. (2022). Competencies of physiotherapists providing neuromotor reflex integration therapy: A scoping review. *Physiotherapy Research International, 27*(4), 1–17.

Social Service of Bantaeng Regency. (2023). *Data on children with special needs in Bantaeng Regency*.

South Sulawesi Social Service. (2022). *Data on children with special needs in South Sulawesi*.

Tam, C. H., Lam, W. K., & Chan, A. S. (2022). Effectiveness of aquatic physiotherapy for children with autism spectrum disorder: A systematic review and meta-analysis. *Journal of Rehabilitation Medicine, 54*(6), 599–609.

Thelen, E., & Smith, L. B. (2020). *A dynamic systems approach to motor development*. Oxford University Press.

UNICEF. (2021). *State of the world's children 2021: Include every child*. www.unicef.org/reports/state-worlds-children-2021

WHO. (2022). *Disability*. https://www.who.int/publications/i/item/9789240063600

Wulandari, S. P., & Kusumawati, D. (2021). The effect of sensorimotor reflex integration therapy (NSRI) on the cognitive development of children with spastic cerebral palsy with hemiplegia diparesis. *Journal of Physiotherapy, 12*(2), 83–90.

Zatkulova, D., Pipek, V., & Vondráček, V. (2021). Play-based physiotherapy to improve gross motor skills and balance in children with intellectual disability: A systematic review. *Research in Developmental Disabilities, 118*, Article 104023. https://pubmed.ncbi.nlm.nih.gov/27259002/

Ziatkowska, M., & Wieczorek, M. (2020). Effectiveness of neuromotor reflex integration therapy on gross motor skills in children with cerebral palsy. *Research in Developmental Disabilities, 103*, 103678.

Zwirek, K., & Majchrzak, M. (2024). Duration and intensity of neuromotor reflex integration therapy in children with cerebral palsy: A systematic review and meta-analysis. *Physiotherapy Theory and Practice, 40*(2), 117–130.