

# Sensorimotor Rehabilitation Nursing in Neonatal Intensive Care Units: Integrative Literature Review

Enfermagem de Reabilitação Sensório-Motora em Unidades de Cuidados Intensivos

Neonatais: Revisão Integrativa de Literatura

Enfermería en Rehabilitación Motora Sensorial en Unidades de Cuidados Intensivos

Neonatales: Revisión Integrativa de la Literatura

Nisa Rubina Pereira Souto Rosa\*; Rosa Maria Lopes Martins\*\*

## Abstract

**Theoretical framework:** Sensorimotor stimulation is one of the interventions of Rehabilitation Nursing in Neonatal Intensive Care Units (NICU). However, the combination of components to be included in a sensorimotor program to obtain more effective results remains uncertain.

**Objectives:** To identify the elements to be included in a Nursing Sensorimotor Rehabilitation Program (NSRP) for preterm infants admitted to NICUs for it to be more efficient in the development of this population.

**Methodology:** Integrative Literature Review using the PICO method through search in electronic databases. Seven articles published between 2003 and 2013 were included.

**Results:** Five elements to be included in a NSRP in a NICU were identified: Nursing rehabilitation techniques, principles of care focused on development, assessment tools, parental education, and continuity of care after discharge.

**Conclusion:** We believe that including elements with high scientific evidence in a NSRP will improve its effectiveness in the development of preterm infants, with clear health gains.

**Keywords:** Rehabilitation nursing; newborn Infant; premature infant; neonatal intensive care

## Resumo

**Enquadramento:** A estimulação sensório-motora é uma das intervenções de Enfermagem de Reabilitação no contexto das Unidades de Cuidados Intensivos Neonatais (UCIN). Contudo, permanece incerta a conjugação dos elementos a integrar num programa sensório motor para obter resultados mais efetivos.

**Objetivos:** Identificar os elementos a integrar num Programa de Enfermagem de Reabilitação Sensório Motora (PERSM) destinado a Recém-Nascidos Pré-Termo (RNPT) internados em UCIN para que este seja mais eficiente no desenvolvimento desta população.

**Metodologia:** Revisão Integrativa da Literatura (RIL) pelo método PICO através da pesquisa em bases de dados eletrónicas. Foram incluídos 7 artigos, publicados no período de 2003 a 2013.

**Resultados:** Foram identificados 5 elementos a serem integrados num PERSM em UCIN: Técnicas de Enfermagem de Reabilitação, princípios dos cuidados centrados no desenvolvimento, instrumentos de avaliação, educação parental e continuidade de cuidados pós-alta.

**Conclusão:** Ao implementar um PERSM que inclua elementos que demonstraram elevada evidência científica consideramos que iremos melhorar a sua efetividade no desenvolvimento dos RNPT, com evidentes ganhos em saúde.

**Palavras-chave:** Enfermagem em reabilitação; recém-nascido; prematuro; terapia intensiva neonatal

## Resumen

**Marco contextual:** La estimulación sensorial y motora es una de las intervenciones de Enfermería de Rehabilitación en el contexto de las Unidades de Cuidados Intensivos Neonatales (UCIN). Sin embargo, sigue siendo incierta la combinación de elementos para un programa sensorial y motor que nos permita obtener resultados más efectivos.

**Objetivos:** Identificar los elementos de un Programa de Enfermería de Rehabilitación Sensorial y Motora para los recién nacidos prematuros (PERMS) ingresados en la UCIN con el objetivo de que sea más eficiente en el desarrollo de esta población.

**Metodología:** Revisión Integradora de la Literatura (RIL) por el método PICO a través de la investigación en bases de datos electrónicas. Se incluyeron siete artículos publicados en el período de 2003 a 2013.

**Resultados:** Se identificaron 5 elementos que deben integrarse en un PERMS en la UCIN: técnicas de Enfermería de Rehabilitación, principios de los cuidados centrados en el desarrollo, instrumentos de evaluación, educación de los padres y continuidad de la atención posterior al alta.

**Conclusión:** Mediante la implementación de un PERMS que nos permita incluir elementos que demuestren ser una prueba científica elevada, creemos que vamos a mejorar su efectividad en el desarrollo de los RNPT con beneficios evidentes para la salud.

**Palabras clave:** Enfermería en rehabilitación; recién nacido; prematuro; cuidado intensivo neonatal

\* MSc., Specialist Nurse, Rehabilitation Nursing, Hospital Dr. Nélio Mendonça, 9000-514, Funchal, Portugal [nisa.souto@hotmail.com]. Contribution to the article: Bibliographic search; collection; data analysis and discussion; article writing. Address for correspondence: Rua 2, Pico das Romeiras nº36, 9004-514, Funchal, Portugal.

\*\* Ph.D., Coordinating Professor, Higher School of Health of Viseu, 3500-108, Viseu, Portugal. Contribution to the article: Data analysis and discussion; article writing.

Received for publication: 09.05.14

Accepted for publication: 10.03.15

## Introduction

In accordance with the Regulation of the Specific Competences of the Specialist Nurse in Rehabilitation Nursing, this professional cares for “people with special needs, throughout the life cycle, in all contexts of the care practice” (Diário da República, 2011, p. 8658). In Neonatal Intensive Care Units (NICUs), these professionals intervene in the sensorimotor area, among others. They implement cognitive and sensorimotor re-education programs. They teach, demonstrate and train techniques within the scope of the established programs. They educate the parents about strategies to maximise the development of their new-borns and refer those at risk for developmental disorders to the respective centres. The progress in the neonatal area has contributed to an increase in the survival rate of preterm infants (PIs) with increasingly lower gestational ages. However, it brought new challenges, namely the concern with their morbidity and quality of life. Early birth deprives them of the ideal conditions for their development in the uterus, in a period of high plasticity and vulnerability of the central nervous system and exposes them to harmful stimuli (Adams-Chapman, 2009). Thus, they have an increased risk of developing at least one cognitive, motor, sensory, hearing, visual and behavioural disorder (Mwaniki, Atieno, Lawn, & Newton, 2012). The current challenge of the interdisciplinary team of the NICU is not just ensuring survival, but promoting a good development and quality of life of this population. Thus, the focus must also be on primary and secondary prevention measures, particularly on the promotion of development and rehabilitation interventions (Mwaniki et al., 2012). The knowledge on the neuronal plasticity of this population, which establishes certain neonatal periods as highly receptive to sensorimotor interventions, has indicated gains in its early implementation in NICUs, where the probability of impact is at its maximum (Blackman, 2002). However, although there is consensus on the benefits of the interventions in NICUs and on the approaches used, the uncertainty remains as to the combination of elements to obtain a more effective outcome in the long-term. In addition, we are unaware of any published studies on how to implement these programs in NICUs, with most of the studies reflecting on post-discharge interventions. Based on these assumptions and moved by this concern, we

conducted this Integrative Literature Review (ILR) to identify elements that have evidenced gains in the development of PIs and can be integrated into a Nursing Sensorimotor Rehabilitation Program (NSRP) to be applied in NICUs. To this end, we formulated the following research question: What elements should be included in a nursing sensorimotor rehabilitation program for preterm infants hospitalised in Neonatal Intensive Care Units for it to be effective in the development of this population?

## Methodological Procedures of Integrative Literature Review

The multiplicity of scientific evidence hinders the analysis, the validation of knowledge and the integration of the best results in the provision of care (Craig & Smith, 2004). The ILR is thus a valuable resource because it allows for evidence synthesis (Mendes, Silveira, & Galvão, 2008). This ILR aims to identify elements that have evidenced gains in the development of preterm infants and that can be integrated into a NSRP applied in NICUs. To this end, we formulated the following research question: What aspects should be included in a nursing sensorimotor rehabilitation program for preterm infants hospitalised in Neonatal Intensive Care Units for it to be effective in the development of this population? This question was structured using the PICO strategy (Population, Intervention, Comparison, Outcome), as recommended by the method defined in the Cochrane Handbook (Higgins & Green, 2009). The following inclusion criteria were defined: studies with qualitative and quantitative approaches on PIs hospitalised in NICUs and case studies whose results would contribute to the scientific evidence of the study. We only included studies written in English, Portuguese or Spanish. We searched the Medline® with Full Text and CINAHL® with Full Text databases, using the EBSCOhost search platform, complemented with search in Pubmed and PEDro (Physiotherapy Evidence Database) databases. In the MEDLINE® with Full Text and Pubmed databases, the following search strategy was used: (“infant, premature” (MeSH term) OR “preterm infants” OR “preterm babies” OR “preterm neonates” OR “high risk neonates” OR “extremely preterm infants”) AND (“intensive care units, neonatal” (MeSH

term) OR “intensive care, neonatal” (MeSH term) OR “neonatal special care unit”) AND (“physical therapy, modalities”(MeSH term) OR “neonatal physical therapy” OR “neonatal physicaltherapy” OR “sensorimotor interventions” OR “early intervention program” OR “Tactile-Kinesthetic Stimulation” OR “Kinesthetic Stimulation” OR “motor development education” OR “multimodal stimulation” OR “early occupational therapy” OR “practice guideline” (MeSH term)). These descriptors were validated based on the MeSH (Medical Subject Headings) descriptor and were combined through the Boolean operators “AND” and “OR”. In the CINAHL database, the following terms were used: (“premature infant” (CINAHL heading) OR “preterm infants” OR “preterm babies” OR “preterm neonates” OR “high risk neonates” OR “extremely preterm infants”) AND (“neonatal intensive care units” (CINAHL heading) OR “neonatal special care units”) AND (“neonatal physical therapy” OR “neonatal physicaltherapy” OR “sensorimotor interventions” OR “early intervention program” OR “Tactile-Kinesthetic Stimulation” OR “Kinesthetic Stimulation” OR “motor development education” OR “multimodal stimulation” OR “early occupational therapy” OR “practice guideline”). In the PEDro database, we used the term “neonatal intensive care unit”. The search was performed in January 2013, using only the date filter (2003-2013) to maintain its comprehensiveness. The articles obtained were critically assessed by two independent reviewers, followed by a consensus meeting. The seven articles obtained were read in full by each one of the reviewers, who, based on the grid of the Centre for Evidence-Based Medicine of the Faculty

of Medicine, University of Lisbon, assessed both inclusion criteria and methodological quality.

## Results and Interpretation

The first sample of studies included 53 articles which (through a list with the title and abstract of the articles obtained) were first critically assessed by two independent reviewers regarding the relevance of the type of study, the participants and the interventions for the ILR. Then, a consensus meeting was held to ensure the quality of this step of the process. A total of 35 articles were excluded for not addressing the research question and 13 articles were identified as having a potential interest. As six of these articles were repeated in the databases, we obtained a sample of seven different articles. In a second moment, the methodological quality of these articles was reanalysed by each one of the reviewers. To this end, they read the articles in full and used a specific form to assess the inclusion criteria. The grid used for the critical appraisal of the articles belongs to the Centre for Evidence-Based Medicine of the Faculty of Medicine, University of Lisbon which only considers studies with a score equal to or greater than 75% as having scientific quality (Carneiro, 2008). At the end of this second assessment, none of the seven studies was rejected. Most articles came from the United States of America (USA), followed by Brazil, France and Japan. The oldest article was published in 2004 and the latest in 2012. In terms of the methodologies adopted, we observed a predominance of quantitative studies. Table 1 describes the main evidence found in each study.

Table 1  
Main scientific evidence of the studies

Study	Objective	Findings
S1 - Dusing, S., Drew, C. & Brown, S. (2012). Instituting parent education practices in the Neonatal Intensive Care Unit: An administrative case report of practice evaluation and statewide action. <i>Physical Therapy</i> , 92(7), 967-975.	To describe the process of development and implementation of a new parent education program in the NICU.	A parent education program should be early introduced in the NICU, include the developmental principles of care and provide a variety of educational formats.
S2 - Fucile, S. & Gisel, E. (2010). Sensorimotor Interventions improve growth and motor function in preterm infants. <i>Neonatal Network</i> , 29(6), 359-366.	To assess the effect of an oral, a tactile/kinaesthetic and a combined intervention on preterm infants' weight gain and motor function; To determine whether the combined intervention has an additive effect.	Single and combined interventions improved growth and motor function. The combined intervention did not lead to additive effects, suggesting that the duration of the intervention is important in achieving outcomes.
S3 - Vignochi, C., Teixeira, P. & Nader, S. (2010). Efeitos da fisioterapia aquática na dor e no sono e vigília de recém-nascidos pré-termo estáveis internados em unidade de terapia intensiva neonatal. <i>Revista Brasileira de Fisioterapia</i> , 14 (3), 214-220.	To evaluate the effects of aquatic physical therapy on pain and on the cycle of sleep and wakefulness among stable hospitalised PIs in NICUs.	The intervention was considered safe, simple and effective in reducing pain and in improving the quality of sleep in hospitalised PIs in NICUs.
S4 - Massaro, A., Hamma, T., Jazzo, B. & Aly, H. (2009). Massage with kinesthetic stimulation improves weight in preterm infants. <i>Journal of Perinatology</i> , 29, 352-357.	To evaluate the effects of Massage (M) with or without Kinaesthetic Stimulation (KS) on weight gain and length of hospital stay in PIs.	The combination of (M) and KS improved daily weight gain. The effects of isolated (M) do not seem to be enough to increase weight gain. M with or without KS had no influence in the length of hospital stay.
S5 - Vaivre-Douret, L., Oriot, D., Blossier, P. Py, A., Kasolter-Péré, M. & Zwang, I. (2008). The effect of multimodal stimulation and cutaneous application of vegetable oils on neonatal development in preterm infants: a randomized controlled trial. <i>Child: Care, Health and Development</i> , 35(1),96-105.	To assess the neurodevelopmental and biological benefits of the combination of multimodal stimulation and the application of vegetable oils.	The weight gain in the experimental groups was 30% higher than in the control group due to the use of ISIO4 oil. The neurological score was higher in the groups stimulated with oil, with no differences between the groups P and C. Group P showed higher insulinemia than group C.
S6 - Dusing, S., Murray, T. & Stern, M. (2008). Parent Preferences for Motor Development Education in the Neonatal Intensive Care Unit. <i>Pediatric Physical Therapy</i> , 20, 363-368.	To determine parents' preferred method of receiving education on motor development of their children.	The combination of educational formats was considered to be the ideal strategy for parent education.
S7 - Oghi, S., Fukuda, M., Akiyama, T. & Gima, H. (2004). Effect of an early intervention programme on low birthweight infants with cerebral injuries. <i>Journal of Paediatric Child Health</i> , 40, 689-695.	To determine the effect of an early intervention programme on low birthweight infants with cerebral injuries.	The implementation of the program showed improvements in the neurobehavioural development of PIs and in maternal mental health.

In study E1, the authors performed a literature review and assessed parent education practices in their professional context to develop of a new parent education program in the NICU. The practices were assessed in two focus groups. The first focus group was held to evaluate parents' knowledge of developmental issues specific to their children and to identify parents' preferred methods for learning. Based on the results from this first focus group, another focus group was held to present educational information to parents and evaluate their knowledge

prior to and after the session. A descriptive study was also conducted to determine whether a single session would empower the parents. To this end, five parents of PIs were asked to participate in a session before discharge from the NICU. At 3 months of adjusted age, these PIs were reassessed and their parents completed a questionnaire about the time their children spent in play positions. Based on the first focus group, the authors found that parents have little information about how to interact with their children, developmental stages and warning signs in the first

months of life. Based on the second focus group, they found that parents showed improved knowledge of ways to promote their child's development at home. Based on the descriptive study, they found that parents did not implement many of the recommended strategies at home and even implemented opposite strategies to those recommended. These findings led to a reformulation of the parent education model and to the conclusion that a visit prior to NICU discharge was inadequate.

Study E2 is a randomised clinical trial carried out in the USA with 75 PIs with gestational age between 26 and 32 weeks, receiving all feedings by tube and without congenital malformations and/or chronic diseases. The participants were divided into four groups of intervention: Oral Stimulation (O+O), Tactile/Kinaesthetic (T/K), Combined Oral Stimulation and Tactile/Kinaesthetic (O+T/K) and the Control Group. In the O+O group, PIs were placed in the incubator in dorsal decubitus position and received seven minutes of perioral stimulation, five minutes of intraoral stimulation and three minutes of non-nutritive sucking, twice a day. In the T/K+T/K group, PIs were placed in the incubator in decubitus ventral or dorsal position. The intervention consisted of twice-daily stroking of the head, neck, back, arms, and legs for 10 minutes and passive range of motion to the limbs for 5 minutes. In the O+T/K intervention group, PIs received, once a day, the two previously described interventions, in sequential mode, for 30 minutes. In the Control group, the researcher placed her hands inside the incubator, without touching the PI, for 15 minutes, twice a day. All interventions started 48h after ventilatory autonomy and 15 to 30 minutes before the morning and afternoon meals, with a minimum of three hours between each. The intervention was cancelled in case of decrease of oxygen saturation and/or increase of  $\text{FiO}_2$  in the 24h before and suspended if the PI showed signs of stress. During the 10 days of interventions, the responses of PIs were monitored and a screen was used for privacy. The Test of Infant Motor Performance (TIMP) and the interventions were applied by the same researcher. The weight was monitored daily, at the same time, without clothing, and in the same scale by nurses who were unaware of the experimental groups.

The results showed that the PIs of the O+O and T/K+T/K groups gained more weight than those in the control group. However, no differences in weight

gain were found between the four groups after the intervention period, thus there was no lasting effect in the O+O and T/K+T/K interventions. Regarding the motor functions, the PIs in the O+T/K and T/K+T/K groups showed higher maturity than those in the control group. Therefore, they concluded that the duration of the intervention is an important factor in sensorimotor stimulation, because 15 minutes of T/K in the O+T/K group were enough to improve motor function but to increase weight gain 30 minutes would be required. The O+T/K led to better results than those found in the control group but not to better performances than T/K+T/K. The fact that the researcher was familiar with the experimental study was a limitation of this study for the potential bias in the TIMP scores.

Study E3, with quantitative methodology (uncontrolled clinical trial on a time series), was conducted in Brazil with 12 clinically stable PIs with gestational age of less than 36 weeks, admitted to NICUs, with permission for bath, and behavioural disorders. The PIs were wrapped in a towel with their bodies semi-inflexed and then were gradually placed in the liquid environment (plastic cot with a temperature of  $37^\circ\text{C}$ ) and movements to stimulate flexor posture and postural organisation were performed for 10 minutes. After this period, the PIs were removed from the cot, while maintaining their postural organisation, wrapped in a towel and placed in the incubator. The variables (physiological parameters, pain, and sleep quality) were assessed 15 minutes before, during and immediately after the intervention and 30 to 60 minutes after the end of the session. As regards the physiological parameters, the authors found that the mean blood pressure and body temperature remained constant, that the heart and respiratory rates decreased mainly in the 30-60 minutes after the intervention, and that oxygen saturation increased mainly 60 minutes after the intervention. In relation to pain, they found that it had reduced during and after the intervention. As to the sleep and wakefulness cycles, they found a change from a crying state to an alert inactivity state. At the end of the intervention, PIs were in a light sleep state changing to deep sleep with regular breathing. The intervention was considered safe, simple and effective in reducing pain and improving the quality of sleep of PIs hospitalised in the NICU. The authors mentioned that the lack of a control group was the main limitation of this study.



To confirm the hypothesis that PIs subjected to massage and tactile-kinaesthetic stimulation will gain more 20% of body weight per day and reduce the length of hospital stay by 15%, the authors of study E4 developed a prospective randomised clinical trial in the USA. The 60 PIs were older than 7 days of life, had a birthweight of less than 1500g and/or a gestational age over 32 weeks, weight during the study of more than 1000g and were clinically stable. Three groups were created: Massage, massage with T/K stimulation and Control, with 20 PIs each. In the Massage group, PIs were placed in prone position and received six strokes, each lasting 10 seconds, in a specific sequence. In the Massage group, six passive movements of the limbs in supine position were added to the massage protocol. These interventions were performed twice a day, during 15 minutes by nurses of the NICU with prior training and access to an instructional video as supporting document. The techniques were supervised during the morning and afternoon shifts, once or twice a week, and the responses of PIs were monitored during the interventions. In the Control group, the PIs only received standard nursing care. With regard to weight gain, the authors concluded that massage combined with T/K stimulation is associated with improved daily weight gain, this being more attributable to the effects of T/K stimulation. The effects of massage alone do not seem to be enough to increase weight gain, and the metabolic changes require the use of T/K stimulation. The length of hospital stay was not influenced by massage with or without T/K stimulation.

Study E5 (quantitative randomised clinical trial) was conducted in France with a sample of 49 PIs with gestational age between 31 and 34 weeks, without intercurrents. The intervention consisted in the stimulation of all sensory modalities (tactile, proprioceptive, vestibular, kinaesthetic, auditory, visual and olfactory) simultaneously, not sequentially, in accordance with the Vaivre-Douret protocol, designated as Sensori-Tónico-Motor Touch (STMT). The emollients applied in the skin were sweet almond oil in Group A, ISIO4 oil in Group IS and normal saline as placebo in group P. PIs of experimental groups were placed on a vestibular water mattress, in a room of the NICU heated for the purpose. The amount of oil or saline solution used for each PI was 5ml and non-nutritive sucking was not allowed during the intervention. The STMT was performed

twice a day, during 15 minutes, in the periods of wakefulness of PIs coincident with the morning or afternoon feeding, during 10 consecutive days. The PIs in Group C (control group) received no STMT or any other cutaneous treatment. This study showed the effects of STMT, such as reduced length of hospital stay, increased stature and oxygen saturation and decreased temperature and heart rate, after the intervention. The ISIO4 oil lead to greater weight gain, higher psychomotor scores, increased time in the alert inactivity state, better orientation and development of oculomotor systems, recovery of dermatological conditions and better hydration, when compared with Group C. They found that the weight gain in the experimental groups was 30% higher than in Group C due to the application of ISIO4 oil. With regard to the overall effects of oils, they found that the neurological score was significantly higher in groups stimulated with oil. No differences were found between groups P and C. Finally, the assessment of the effects of stimulation without oils found that group P had higher insulinemia than group C. The higher parental visit frequency in the massage group was considered a limitation because it could have influenced the development of PIs.

Study E6 is a qualitative study developed in the USA. The sample was composed of 13 parents of PIs with gestational age of less than 37 weeks admitted to the NICU, aged 18 years or more and able to speak and understand English. Nine parents were integrated in the first Focus Group for parent education. The parents evaluated three different formats of education regarding methods to support the motor development of their children. The first method was reading a brochure and complementing it with a discussion on the clarity of the information. The second format was a 15-minute PowerPoint presentation, with the same concepts of the brochure, followed by a similar discussion. The third format - a 15-minute video with items of the TIMP - was commented live by the authors of the study, followed by a discussion. Finally, parents scored the preferred formats and described the ideal combination. In the second Focus Group, four other parents were educated based on the proposals of the first Focus Group. This education consisted in the observation of a PI motor assessment using a 12-minute video including items of the TIMP. Parents were asked to imagine that that was their child's assessment. Then, the brochure used in the first Focus

Group was reviewed and delivered. At the beginning and end of the session, the parents answered multiple choice questions related to calculating adjusted ages, expectations regarding motor development, and play activities. They were also asked about their understanding of the information and about how they planned to promote motor development of their child at the NICU and at home. At the end, there was a period of discussion where parents were asked to give their opinion.

This study concluded that the combination of educational formats was considered the ideal format of parent education. The most common recommendations were: The observation of the motor assessment of their child, the description of the development expected by the examiner and the provision of written information to take home. All participants in the second Focus Group improved their knowledge on motor development and were interested in learning activities to promote this development at home. The limitations of the study were the fact that participants were volunteers, that the motor assessment was only performed in video and that the pre- and post-intervention tests were not validated.

Study E7 (quantitative experimental study) was developed in Japan with a sample of 23 PIs with brain injuries and their mothers. A total of 12 PIs who benefited from a two-step intervention program participated in the experimental group. In the first stage, the parents observed their child during an evaluation by the specialist using the Neonatal Behavioural Assessment Scale (NBAS). Then, this professional discussed the behaviour of the PI and demonstrated to parents the most beneficial intervention method. The session was performed three to four times, during 30 minutes, before discharge from the NICU. The second stage began from rooming-in and consisted of advising mothers on how to handle their children according to their abilities and developmental needs. After discharge, the program continued in the hospital rehabilitation unit, once a week, in sessions that lasted 40-60 minutes. The control group was composed of 11 PIs who received standard care in the NICU and after discharge. When the presence of signs of neurological dysfunction was detected, the PIs were referred to a rehabilitation unit. The authors found beneficial effects on the neurodevelopment of PIs and on

maternal mental health. As limitations of this study, they highlight the small sample size, the short period of intervention and the lack of direct observation of the mother-child interaction.

From the analysis of these seven articles, five elements emerged that can be integrated into a NSRP for PIs hospitalised in NICUs with a view to enhancing their development. These elements were: Nursing Rehabilitation Techniques, Principles of Care Focused on Development, Assessment Tools, Parental Education and Continuity of Care after Discharge. The nursing rehabilitation techniques include sensorimotor stimulation techniques in general, with some of the studies mentioning Massage, the Sensori-Tónico-Motor Touch (STMT), Hydrotherapy and Neurodevelopmental Therapy. The stimulation of all sensory modalities (tactile, proprioceptive, vestibular, kinaesthetic, auditory, visual and olfactory) simultaneously and non-sequentially using the STMT was analysed by Vaivre-Douret et al. (2008). The best effects were found in PIs subjected to stimulation. The application of ISIO4 oil showed better neuropsychomotor results than other oils. The study of Vignochi, Teixeira, and Nader (2010) was also focused on Hydrotherapy. The neurodevelopmental therapy was mentioned in the study of Ohgi et al. (2004), perhaps because it was the only study that we analysed with a focus on tertiary prevention and exclusively dedicated to new-borns with brain disorders. In turn, the study of Massaro et al. (2009) addressed the association of techniques and concluded that massage alone was not enough to increase weight gain in PIs, this being more attributable to the effects of kinaesthetic stimulation. The study of Fucile and Gisell (2010) stressed the importance of the length of intervention. There was a consensus on the importance of the intervention being individualised and not causing additional stress. Another basic aspect concerns the Principles of Care Focused on Development, which were identified in the studies of Ohgi et al. (2004), and Dusing, Drew, and Brown (2012). As PIs are in a phase of rapid brain development and subjected to a technological environment contrasting with the intrauterine environment, it makes sense to intervene by providing sensory stimuli appropriate to their neurodevelopment. The application of tools to assess the motor function of PIs was another central aspect. The TIMP was used in three of the studies. It was used

in the study of Dusing, Drew, and Brown (2012) to assess the motor function of PIs before discharge from the NICU and in the study of Fucile and Gisel (2010), after the end of the intervention period, to quantify the gains achieved. In the study of Dusing, Murray and Stern (2008), the TIMP was used to educate parents about the motor development of their children. In the same line, Ohgi et al. (2004) applied the NBAS and, after the end of the intervention, they also applied the Bayley Scale of Infant Development to estimate motor, neurological and mental gains. In relation to Parental Education, the studies of Dusing, Drew, and Brown (2012), Massaro et al. (2009), Dusing, Murray and Stern (2008) and Ohgi et al. (2004) are unanimous in stating that the parents-child interaction is directly associated with the development of PIs. Therefore, the studies of Dusing, Drew, and Brown (2012) and Dusing, Murray and Stern (2008) argue for the existence of structured information early in the NICU so that parents have the opportunity to incorporate developmental activities in their daily routines, maximising their skills. Regarding the content of the program, the study of Ohgi et al. (2004) included the specific behavioural characteristics of the child, the detection of overstimulation signs, stress and readiness for interaction and ways of responding to these signs. The studies of Dusing, Drew, and Brown (2012) and Dusing, Murray and Stern (2008) also addressed the developmental stages, the alarm signs, the importance of and the positions for playing activities, and the recommendations regarding the limit time in the prone position and in seating devices. These studies and the study of Ohgi et al. (2004) also pointed to the effectiveness of the diversification of educational formats. Finally, the Continuity of Care after Discharge emerged in the study of Dusing, Drew, and Brown (2012) in their development of a set of education recommendations for NICU discharge that could facilitate the relationship between parents, NICU professionals, and the community. In addition, in the study of Ohgi et al. (2004), all PIs had follow-up consultations after discharge and were referred to rehabilitation units.

## Conclusion

Through the ILR, seven studies were selected and analysed, mostly with quantitative designs, which

confirmed the relevance to include five elements in a Nursing Sensorimotor Rehabilitation Program: Nursing Rehabilitation Techniques, Principles of Care Focused on Development, Assessment Tools, Parental Education and Continuity of Care after Discharge. The Nursing Rehabilitation Techniques referred to were sensory stimulation (auditory, kinaesthetic, proprioceptive, visual, vestibular and olfactory) and motor stimulation (therapeutic exercises, positioning and passive mobilisations), with specific references to Massage, Sensori-Tonico-Motor Touch, Hydrotherapy and Neurodevelopmental Therapy. All techniques aimed at promoting the normal motor development, improving middle line orientation skills and providing individualised sensory stimuli without causing additional stress to PIs. The positive effects resulting from the association of different techniques were clarified. Basing Nursing Rehabilitation Intervention on the Principles of Care Focused on Development and working as a team to create an environment that promotes development also proved essential for the implementation of the program in NICUs. The following Assessment Tools of the motor function of PIs were identified: TIMP, NABS, and Bayley Scale of Infant Development. The TIMP was the one that prevailed as it is adequate to PIs in NICUs and can be used as a tool for parental education. As to Parental education, it should start as early as possible in the NICU and include strategies to promote motor development through diversified educational formats. The fifth element identified was the Continuity of Care after Discharge. We believe that it is completely appropriate, because one of the purposes of the NSRP is also to develop interventions outside of the NICU with a view to promoting continuity and independence, which constitutes a central axis of Rehabilitation Nursing. To sum up, we believe that this study provided us with scientific evidence concerning the elements to be integrated in a NSRP for PIs in NICUs, thus contributing to increase the body of knowledge in this area and highlighting the role of the Nurse Specialist in Rehabilitation Nursing in these settings. We are aware of the fact that the lack of an evaluation of the quality of the studies is a limitation. As it is a recent and innovative issue, we believe that it would be appropriate and desirable to further develop this research and conduct primary studies in this field.



## References

- Adams-Chapman, I. (2009). Insults to the developing brain and impact on neurodevelopmental outcome. *Journal of Communication Disorders*, 42(4), 256-262.
- Blackman, J. (2002). Early intervention: A global perspective. *Infant & Young Children*, 15(2), 11-19.
- Carneiro, A.V. (2008). Como avaliar a investigação clínica - O exemplo da avaliação crítica de um ensaio clínico. *GE-Jornal Português de Gastrenterologia*, 15(1), 30-36. Retrieved from [http://www.scielo.gpeari.mctes.pt/scielo.php?script=sci\\_arttext&pid=S0872-81782008000100007&Ing=pt&nrm=iso](http://www.scielo.gpeari.mctes.pt/scielo.php?script=sci_arttext&pid=S0872-81782008000100007&Ing=pt&nrm=iso)
- Craig, J. V., & Smith, R. (2004). *Prática baseada na evidência: Manual para enfermeiros*. Loures, Portugal: Lusociência.
- Higgins, J. P., & Green, S. (2009). *Cochrane handbook for systematic reviews of interventions version 5.0.1*. Retrieved from <http://www.cochrane-handbook.org>
- Mendes, S., Silveira, C., & Galvão, M. (2008). Revisão integrativa: Método de pesquisa para a incorporação de evidências na saúde e na enfermagem. *Texto & Contexto Enfermagem*, 17(4), 758-764.
- Mwaniki, M., Atieno, M., Lawn, J., & Newton, C. (2012). Long-term neurodevelopmental outcomes after intrauterine and neonatal insults: A systematic review. *Lancet*, 379(9814), 445-452.
- Regulamento nº125/20011. Regulamento das Competências Específicas do Enfermeiro Especialista em Enfermagem de Reabilitação. *Diário da República*, 2ª Série, nº 35, (2011-02-18), 8658 - 8659.

