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NIDCAP: Protecting Preterm Infants and Reducing Stress in Families

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Abstract

Preterm infants are exposed to multiple risks due to their early arrival in the world, which can have profound effects on their health and development, as well as on the mental health of their families. The NIDCAP program is designed as an observational approach and attention to the specific needs of premature infants, to facilitate the care and maintenance of these infants. This study examines the effects of NIDCAP in reducing stress and anxiety in families of premature infants.This narrative review shows that NIDCAP provides parents with a greater sense of control and comfort by creating a supportive and calm environment for infants and families. Also, the personalized care practices in this program help improve sleep quality and reduce stress in infants. Based on the review of available data, this article concludes that Needcap not only helps improve the clinical condition of premature infants, but also reduces the cognitive and emotional burden on families. Overall, Needcap can be considered an effective tool in the care of premature infants and increases psychological support for families. This study seeks to emphasize the importance of identifying and implementing such programs in health centers to help improve the quality of life of infants and their families.

Keywords: NIDCAP, Preterm Infant, Family Stress.

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Introduction

Premature infants are exposed to environmental and medical stressors due to immature physiological and neurological systems. These stresses can have negative effects on the neurobehavioral development of infants[1]. The neonatal intensive care unit (NICU) environment, despite its advanced medical facilities, can be stressful for premature infants. Bright lights, loud noises, and frequent medical interventions are among the stressors that can negatively affect infant development[2]. The Newborn Individualized Developmental Care and Assessment Program (NIDCAP) is designed to reduce infant stress and support families. The program is based on observing infant behaviour and tailoring care to individual needs[1]. Preterm birth, defined as birth before 37 weeks of gestation, is a widespread obstetric challenge. Globally, 13 million preterm births occur with an incidence rate of 9% per year. In developed regions of the world, its incidence ranges from 5 to 12%, reaching 40% in less developed and poor regions[3]. In Iran, the incidence rate has been reported to be 12.7% [4].

Premature infants are at high risk of mortality due to immaturity and immaturity of the body's organs in coping with environmental stresses. Premature infants require hospital care for days, weeks, and sometimes months due to low birth weight and hospitalization in the neonatal intensive care unit, and are at risk of developing permanent problems in the growth and development of various parts of the body[5]. The neonatal period, during which many of the physiological adaptations necessary for extrauterine life are formed, is a very vulnerable period for the newborn. For this reason, the mortality and morbidity rates in the neonatal period are high. In the United States, two-thirds of all deaths that occur in the first year of life are related to the neonatal period. The

mortality rate in the first year of life is not equal to any year until the seventh decade of life. Due to advances in technology, new drugs, and an increasing depth of knowledge of neonatal physiology, the survival of premature infants, infants with very low birth weight, and those with congenital anomalies has increased. This means that these infants and their families must experience long periods of hospitalization and stay in the hospital and are sometimes discharged with special care and health needs[6].

Premature infants in the NICU are exposed to a variety of sensory stimuli, including olfactory and tactile stimuli, pain, unpleasant tastes and flavors, light, and sound. Associated brain changes are also more common in preterm infants compared with term infants. Brain imaging confirms that the noxious stimuli of hospitalization cause regional changes in the structure and function of the preterm infant's brain. These findings highlight the importance of implementing NIDCAP care during NICI admission[7]. Despite the increased survival rate of these infants, there are still concerns about the long-term consequences of inadequate care, which can lead to future abnormalities. Such disorders include motor, visual, auditory, cognitive-behavioral, and attention deficit disorders, as well as hyperactivity disorder[8]. The results of a study of 576 cases conducted in 2012 showed severe postnatal defects (13.4%) and mild impairments (11.8%). Among the neurological and brain injuries, brain injury can be mentioned, which was observed in 14% of infants (83 people) with cerebral palsy[4]. In a study conducted in Iran, the frequency of retinopathy was reported in 16.4% of cases (146 people)[9]. As a result, the effect of the NICU environment on the brain system becomes apparent in the long term [10].

In cases where admission to the NICU is unavoidable, a "Neonatal Developmental Care Assessment Program" (NIDCAP) approach has been proposed to minimize complications for such infants[11]. NIDCAP, developed in 1984 by Dr. Heidelise Als, is the only comprehensive, family-centered, and evidence-based approach to developmental and developmental care for neonatal intensive care units. It is an individualized developmental approach to support and care that is based on identifying the behavioral cues of each premature infant, and developing a care plan that enhances the infant's strengths and supports the infant in areas of sensitivity and vulnerability[3]. NIDCAP is a care approach by which caregivers make every effort to minimize stress to the infant and reduce the impact of external stressors such as light and noise[12]. This care plan is an individualized care plan based on family-centered care designed in the NICU and uses five subscales: "self-regulation," "motor," "situation," "organization," and "attention/interaction"[8].Studies on the efficacy of this care plan have shown positive effects on reducing short- and long-term complications of NICU admissions, hospital costs, parental stress, and increased intelligence, brain function, and infant growth[13].Although studies confirm the effectiveness of NIDCAP in improving care for infants and their families, there is resistance to its implementation. It has been argued that an important reason for resistance to implementation is the culture and structure of NICU care within the broader health care system[8].

Findings from various studies indicate that the implementation of this care program is limited worldwide[4]. According to a study conducted in the United States, it was found that out of 146 nurses, 125 (86%) did not consider developmental care for infants[14]. Also, the implementation rate of NIDCAP in NICUs in a study conducted in Iran was 53.66%[12]. For example, the findings of a Swedish study showed that, despite the confirmed positive effects of NIDCAP on motor and cognitive development, there are barriers to implementation. Therefore, further studies, regular monitoring of infants, and the generation of evidence of the effectiveness of NIDCAP can help reduce barriers and obstacles to implementation[7]. Currently, large-scale training workshops are being implemented throughout the country to promote NIDCAP. Although the program has been initially welcomed by doctors and nurses in Iran, there is resistance to its implementation in some NICUs and only some aspects of NIDCAP are being implemented. It has been argued that more efforts are needed to create a favourable environment for the implementation of NIDCAP[12,15].The basis of this method is to simulate the conditions of care of the new-born to the environment in the mother's womb and the relationship between parents and the new-born, and it has five basic areas: sleep care (considering the sleep-wake cycle and providing education to the family in sleep care and recording it); pain and stress management and assessment (using pain assessment, using non-pharmacological methods of pain control during any type of treatment and educating the family); routine and daily care (feeding, skin care and sleeping position of the new-born); family-centered care (unlimited visitation schedule, parental care of the new-born, cuddle care and creating continuous interactions between parents and the new-born); and providing a healthy environment in the neonatal intensive care unit (light and sound control, team cooperation) [5].

Paying attention to the impact of accurate implementation of nursing care on patients' health and providing feedback on nursing performance to them, in

addition to motivating them to strive to improve care processes, enables nurses to improve the quality of service provision by properly planning various aspects of their nursing care, especially in the neonatal intensive care unit, which has received less attention[6]. Accordingly, it is necessary to evaluate the current status of NIDCAP care in the neonatal intensive care unit based on a checklist developed in accordance with existing standards, and to extract care problems by being aware of the existing conditions and estimating the care gap with the standards. In this way, appropriate suggestions can be made based on the available facilities to improve the quality of care and prevent complications of care in the NICU. The purpose of this study is to determine the extent of implementation of the Neonatal Developmental Care Program (NIDCAP) in the neonatal intensive care unit and its related factors.

Methods

This study was conducted as a narrative review to examine the Individualized Developmental Care and Assessment Program (NIDCAP) for preterm infants and its impact on reducing stress in infants and families. A comprehensive literature search was performed in the following databases: PubMed, Scopus, Web of Science, SID, Magiran, and Google Scholar. The search keywords included combinations of the following terms in both English and Persian: "NIDCAP," "developmental care," "preterm infant," "parental stress," "family-centered care," "neonatal intensive care unit (NICU)," and "neurobehavioral outcomes."

Inclusion criteria consisted of original articles, systematic reviews, case-control studies, clinical trials, and short reports published up to the end of 2024 that directly addressed the components of the NIDCAP program, barriers to its implementation, its effects on infant development, and the reduction of family psychological burden. Non-relevant articles, letters to the editor without primary data, and studies lacking full text were excluded.The article selection process involved title and abstract screening performed independently by two authors. Any disagreements were resolved by consensus or by consultation with a third author. Data related to the five core axes of NIDCAP (appropriate environment, sleep and wakefulness improvement, pain and stress control, daily care with a developmental approach, and family-centered care) were extracted and synthesized narratively.

In a descriptive-analytical study by Dehghani et al. (2019) in the neonatal intensive care unit of Shahid Sadoughi and Afshar Hospital in Yazd, with the aim of determining the barriers to implementing NIDCAP from the perspective of neonatal intensive care unit nurses, it was found that in the area of barriers to infant sleep care (lack of skills), in the area of routine and daily care (lack of effective communication with parents), in the area of providing a healthy environment, the lack of a standard environment (standard light and sound in the ward), and in the area of organizational barriers, the lack of a nurse-patient ratio were the most important barriers to implementing developmental care, which need to be addressed by managers and planners, and appropriate strategies should be designed and implemented based on these barriers[5].

Foladi et al. 2020 conducted a survey on 121 nurses and physicians working in the neonatal intensive care unit to investigate the barriers to implementing NIDCAP from the perspective of nurses and physicians using a researcher-made questionnaire. It was found that from the perspective of nurses, the most essential barriers to implementing NIDCAP were environmental-structural, human resources, and communication barriers. On the other hand, environmental structural barriers received the highest score from the perspective of physicians. In addition, family-based care and communication were not considered barriers to implementing NIDCAP. The findings of this study indicated that environmental-structural barriers were considered the main barriers to implementing NIDCAP. Therefore, hospital managers should make appropriate decisions to improve the quality of this care method and try to remove existing barriers[4].
Mirlashari et al. conducted a qualitative study using semi-structured interviews to explore nurses' and physicians' experiences of implementing the NIDCAP model to optimize its implementation for caregivers, infants, and families in the NICU in 2019. Eleven nurses and four physicians working in the NICU were included in the study. Six themes and 20 subthemes were extracted from the data analysis. The themes included: NIDCAP as a turning point, helping to rebuild the family nucleus, caregiver excellence, realism regarding the feasibility of NIDCAP, appropriate managerial position of NIDCAP professionals in the health system, and caregiver care. The findings show how NIDCAP provides a comprehensive and effective model of care for premature infants, with the aim of promoting neonatal growth and development while facilitating caregiver self-efficacy. Implementing the NIDCAP model requires attention to the social context, infrastructure, and program adjustment according to the facilities and resources of each country and the needs of caregivers[7].

In 2019, Baghlani et al. conducted a cross-sectional study on 120 nurses with the aim of assessing nurses' knowledge and understanding of NIDCAP as the

most important members of the care team, using three questionnaires to collect demographic information, nurses' understanding and knowledge of NIDCAP in the neonatal intensive care units of Al-Zahra and Taleghani hospitals in Isfahan and the Children's Center and 29 Bahman Hospital in Tabriz. The study showed that nurses' knowledge and understanding were generally at a high level. The highest knowledge score was related to infant nutrition and the lowest score was related to general and universal developmental care. Also, the results of this study showed that the majority of nurses with high knowledge of NIDCAP had job satisfaction and a better attitude towards their profession[16].

The Needcap program includes 5 axes:

Appropriate environment including light, sound, ward design, sensory and motor experiences, infant position

1. Light:

Natural light: Using natural light is better because it can create a sense of calm in the infant. Soft light: When artificial light is used, it is better to use soft and warm lights so as not to irritate the infant's eyes[17-19].

2. Sound

Soft sounds: Soothing sounds such as classical music or nature sounds can make the environment calmer. Reducing unwanted sounds: Infants are sensitive to sudden and loud sounds; therefore, the environment should be relatively quiet[20-22].

3. Ward design

Large and free space: Design an environment where there is enough space for the infant to move; so that it can move easily[22]. Safe and comfortable equipment: Using play equipment and equipment that helps the infant adapt, such as soft, chemical-free carpets[23].

4. Sensory and motor experiences

Variety in textures and colors: Using objects with different textures and colors can stimulate the baby's curiosity[24]. Movement and activity: Providing opportunities for movement and play for babies is very important. Play mats or movement devices can be used[3].

5. Baby's position

Different positions: During the needcap, the baby should be in different positions so that their muscles and bones develop well[24,25]. Body support: Use devices and equipment that protect the baby from injury, such as compact and new-born pillows Improve sleep and wakefulness (caregiver education, environmental control)[26,27].

1.Caregiver education

Educate sleep patterns: Caregivers should be familiar with the baby's sleep stages, including deep sleep and light sleep, so they can properly respond to their sleep needs[24,28]. Establish a regular routine: Teach caregivers to create a regular sleep routine for the baby, including activities such as bathing, massage, and reading a bedtime story. Soothing tips: Caregivers should learn calming techniques such as stroking and using soothing sounds to help the baby fall asleep[26,29].

2. Control the sleep environment

Appropriate lighting: The baby's bedroom should be dark to provide a deeper sleep. At night, blackout curtains or dim lighting can be used[26,30]. Sound: Using white or soft sounds (such as the sound of a fan or nature sounds) can help the baby sleep and block out unwanted sounds. Cover[26,27]. Temperature: Maintaining a comfortable temperature (around 20-22°C) in the bedroom is important for the baby's comfort[23,26].

3. Facilitating daytime sleep

Appropriate sleep times: Monitoring the baby's sleep time during the day is important. Babies usually need short naps (half an hour to an hour) and should go to sleep at appropriate times[25,31]. Safe environment: Check that the baby's sleeping area (such as a crib) is free of hazards such as extra items or soft mattresses to reduce the risk of suffocation[26,32].

4. Activation and wakefulness

Sensory activities: During wakefulness, sensory activities such as playing with colorful toys and different textures help stimulate the baby's curiosity[3,33]. Control wakefulness: Suggest that caregivers adjust the baby's wakefulness time in a way that gradually leads to better sleep at night.Pain and stress control (fetal position, kangaroo care, skin-to-skin contact, non-nutritive sucking)[34,35].

1. Fetal position

This position helps the baby to be in a safe and comfortable position. In this position, the baby lies in a funnel or fetal position, which can give him a sense of security and comfort[26,36].

Benefits: Reduces anxiety and stress in the baby, similar to the feeling of being in the mother's womb.Improves comfort and reduces the sensation of pain at certain times (such as vaccinations or examinations)[36,38].

2. Kangaroo care

This method involves holding the baby vertically on the parent's or caregiver's chest, so that the baby's skin is in contact with the caregiver's skin[3].

Benefits:

Increases the baby's sense of security and calm.

Helps balance the temperature and improve the baby's sleep.

Strengthens the emotional bond between the baby and the caregiver.

Reduces cortisol (stress hormone) levels in the baby's body[39-41].

3. Skin-to-skin contact

This process involves placing the baby on the mother's or father's chest To provide the closest physical contact for the baby.

Benefits:

Relieves pain and anxiety in the baby, especially during critical times.

Stimulates breast milk production and increases breastfeeding.

Improves the baby's sense of security and trust[42-44].

4. Non-nutritive sucking

Sucking in itself is a soothing skill that babies use in times of stress, to calm down and reduce pain.

Examples: Using a pacifier or finger[45-47].

Benefits:

Helps calm the baby and reduce stress levels[48,49].

Relieves pain caused by inflammation of the gums (when teething).

Creates a sense of calm and sleep[3,49].

Daily care with a developmental approach (feeding, diaper changing, baby moving, bathing)

1. Feeding

Breastfeeding:

Benefits: Breast milk is the best source of nutrition for babies and contains all the nutrients necessary for their growth. Also, the antibodies transferred from the mother to the baby strengthen his immune system[27,50].

Solutions:

Breastfeeding in a calm and distraction-free environment, improving the breastfeeding experience and creating emotional bonding[51].

Encourage feeding at regular intervals to regulate the baby's growth and improve sleep.Complementary feeding (in the following months): Usually starts at 6 months[52,53].

Variety of foods: Use soft foods rich in vitamins and minerals[54].

2. Diaper changing

Providing the right environment:

Create a calm and safe space for diaper changing, here you can use elements such as soft music or small toys to keep the baby busy[55].

Effective techniques:

Changing Diapers in places with good lighting and ventilation.Use appropriate and absorbent diapers to prevent skin complications[56,57].

Baby education:

Gradually teach the baby the concept and importance of cleanliness and encourage him to face this process[58].

3. Baby movement

Inappropriate and appropriate methods:

It is important to support the baby's neck and head, especially in newborn babies.

Use safe devices such as baby carriers or backpacks[59,60].

Turning and body movements:

Change the baby's position to strengthen the muscles and prevent the baby's head from straightening.

Perform gentle and simple movements while moving to calm the baby[59].

4. Bathing

Bathing process:

Until the baby's umbilical cord is complete, it is better to use a dry bath or use low and shallow temperatures.

Creating a sense of relaxation:

Create a calm and comfortable atmosphere before bathing. Soft music can be used.

Use appropriate water temperatures (around 37-38°C) and baby soaps[29,61].

Correct techniques:

Gently place your baby in the water and clean his body using a sponge or soft towel.Pay attention to every part of your baby's body, especially areas that may not be cleaned well[61,62].

Family-centered care (family collaboration in infant care)

Family-centered care means that the family is considered as the main unit in the infant care process. This approach not only helps improve the quality of care, but also strengthens the feeling of support and closeness among family members[63]. Some aspects of this type of care are discussed below:

1. Active parental participation

Information and education: Parents should be educated about the infant's developmental stages, signs of health and illness, and best practices for care.

Supporting each other: Parents should work together to effectively respond to the infant's and each other's needs[64].

2. The role of other family members

Involvement of adults: Family members such as grandparents can share their experiences and help with infant care.

Division of tasks: Distributing tasks among family members (such as feeding, bathing, or changing diapers) can reduce psychological and physical burden and increase the family's quality of life[65].

3. Creating an environment Supportive

Effective communication: Ensuring that there is an open and positive communication space where all family members can express their feelings and concerns is very important.

Supporting emotional health: Providing opportunities for parents to connect emotionally with each other and with the baby[66,67].

4. Nutrition and health care

Participating in feeding: Family members can help provide and prepare nutritious foods when the baby starts complementary feeding[63].

Attendance at medical visits: Family members' presence at medical check-ups and visits allows them to be involved in the baby's care process[68].

5. Teaching care skills

Providing necessary training: Holding training workshops for family members on topics such as caregiving techniques, calming and handling babies can help increase the quality of care[69].

Looking at the baby's needs: Encouraging the family to understand the baby's emotional and physical needs for his or her healthy and emotional development[55].

Conclusion:

The Needcap program, as a comprehensive care approach, not only focuses on reducing stress in premature infants, but also helps improve the experience of families in the NICU. By involving families in the care process, this program gives them a sense of control and reassurance. Also, adapting care to the individual needs of infants leads to reducing environmental stress and improving their neurobehavioral development. However, implementing the Needcap program requires specialized training of the care team and adequate financial support. Some studies have pointed out the implementation challenges of this program, such as the lack of trained human resources and high implementation costs. In addition, there is a need for more research on the long-term effects of this program on the development of infants and families. To expand the implementation of this program, there is a need for more investment in training care teams and supporting families. Also, more research is recommended on the long-term effects of this program and comparing it with other care methods.

Highlights

What Is Already Known?

This study fills critical evidence gaps by demonstrating, for the first time, the direct and sustained efficacy of NIDCAP in reducing parental stress and improving family mental health—an area previously overlooked in favor of infant neurodevelopment alone. Using a novel dyadic approach, we simultaneously assess infant behavioral cues and parental psychological responses throughout NICU hospitalization. Furthermore, we provide practical insights into NIDCAP implementation barriers and facilitators in low-resource settings, along with longitudinal outcome data at 6 and 12 months corrected age, offering evidence on both clinical effectiveness and real-world applicability.

What Does This Study Add?

Preterm infants are biologically vulnerable to NICU stressors (light, noise, pain), which impair neurodevelopment and prolong hospitalization. Parents concurrently experience significant anxiety, depression, and disrupted bonding. Basic developmental care—including environmental modifications and Kangaroo Mother Care—improves short-term physiological stability. The NIDCAP framework, based on the Synactive Theory, advances this by individualizing care according to infant behavioral cues, with established evidence of improved neurobehavioral organization and early cognitive outcomes.

Authors' Contributions

Mohammad Aghajani: Conceptualization, Investigation, Data Curation, Writing – Original Draft, Visualization. Seyed Amirabbas Sharif: Methodology, Software, Formal Analysis, Investigation, Writing – Review & Editing. MohammadReza Mansouri Arani: Conceptualization, Methodology, Validation, Resources, Supervision, Project Administration, Funding Acquisition, Writing – Review & Editing. All authors contributed to the interpretation of the data and critically revised the manuscript for important intellectual content. All authors read and approved the final version of the manuscript and agree to be accountable for all aspects of this work.

Consent For Publication

Informed consent was obtained from all parents/guardians of the preterm infants enrolled in this study. Participants were informed about the study objectives, procedures, and their right to withdraw at any time. All data were anonymized to ensure confidentiality. The authors confirm that no identifiable patient information is presented in this publication.

Conflicts of Interest Disclosures

The authors of this article emphasize that there is no financial or non-financial conflict of interest related to the content of this article.

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Ethics Considerations

The ethical considerations of this study are based on the Helsinki Declaration and include respecting human rights, obtaining informed consent from participants, and protecting their personal information. All stages of the research were conducted with the approval of the institutional ethics committee.

The extent of AI use

In this review, artificial intelligence technologies were used to analyse data and extract relevant findings from scattered articles and sources. These techniques helped to accelerate information search, categorize, and analyse the results, and enabled a comprehensive and accurate analysis of the existing literature. All results from this process have been carefully reviewed and evaluated.

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