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Gravens By Design: NIDCAP Nursery Program: Implementation of the NIDCAP model of care

Dorothy Vittner PhD, RN, FAAN, Deborah Buehler, PhD

The NIDCAP Nursery Program: Implementation of the NIDCAP model of care

Abstract

The Newborn Individualized Developmental Care and Assessment Program, NIDCAP, was established to provide education and consultation in neurodevelopmental evaluations with healthcare professionals caring for infants and families in hospital settings. Systematic behavioral observation and assessment methodologies include the NIDCAP Observation and the Assessment of Preterm Infant Behavior, APIB. These instruments were designed to document the complexity of preterm and at-risk newborn infants' neurobehavioral functioning by focusing on the interplay of the infant's autonomic, motoric, state organizational, and attentional functioning. NIDCAP and APIB assessments provide the basis for estimating the infant's current behavioral functioning and goals, which form the basis for individualized recommendations to support the infant's developmental trajectory. The NIDCAP Nursery Program, NNP is a model and guide toward consistently well-integrated NIDCAP careThe NIDCAP Nursery Program offers educational and consultative support to healthcare organizations towards effective infant care in an individualized neuro-developmentally supportive, family-centered framework (https://nidcap.org).

Keywords: NIDCAP; high-risk infants; individualized developmentally supportive care; infant & family

Introduction

Over 15 million premature infants are born annually around the world. One million children die from related complications. (1) Perinatal and newborn intensive care advances support infants returning home with their families. However impressive the advanced medical technology, the incidence of disability and neurodevelopmental problems among survivors of newborn intensive care remains high and problematic. (3-5) Neurodevelopmental dysfunctions such as learning disabilities; low intellectual functioning; attention deficit; hyperactivity disorder; neuropsychological deficits, including visual motor integration and executive function; varying temperament difficulties; language delays; emotional problems; and overall regulatory disorders are present in up to 50-70% of extremely prematurely born infants. (6-9) More than 50% of infants born prematurely will go on to require special education and mental health services, and more than 20% will require self-contained disabilities management. (5,7) These challenges are significantly exacerbated in developing countries with sparse or lacking resources.

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For survivors, the long-term implications of prematurity, including differences in brain development, cognition, educational achievement, and behavior (including social and emotional regulation), are significant. (3, 7) Research indicates that the early social environment influences the neurobiology of the infant's brain; thus, opportunities for and assurance of parent engagement are essential factors in the health of a premature infant. (8-10) Mothers of preterm infants are more likely to have difficulty with attachment than mothers of full-term infants. (7,12) This can be attributed to decreased synchrony or responsiveness with parent-infant interactions as well as the contribution of the subtle behavioral cues among premature infants that may be difficult to interpret. (6,12) Evidence suggests that early dysfunctional contacts due to the infant's disorganized behavioral patterns during infant and parent interactions lead to poorer attachment and behavioral problems in childhood. (7-8, 13) Conversely, early responsive and synchronous contacts may positively influence cognitive and developmental outcomes for the infant. (11,13)

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The NICU Environment and Infant Brain Development

The preterm infant's sensory experience may include exposure to bright lights, high sound levels, and frequent noxious interventions in hospital settings. These inputs and experiences appear to exert deleterious effects on the immature brain and alter its subsequent development. (8,14-16) The match between the environment and the brain's expectations is critical during these critical or sensitive periods of brain development to support developing relationships between infants and their families. (15-17) For term infants, axonal and dendritic proliferation and the massive increase in outer layer cortical cell growth and differentiation leading to the human brain's enormous gyri and sulci formation (8) occurs within mother-mediated protection from environmental perturbations. The intrauterine environment provides a steady supply of nutrients, temperature control, and the multiple regulating systems, including those of chronobiological rhythms. (8, 15) For preterm infants, these mechanisms are replaced by stimuli from a very differently organized Newborn Intensive Care Unit, NICU environment. There is increasing evidence that the NICU environment involves sensory overload and stands in stark sensory mismatch to the developing nervous system's growth requirements. (8, 15) How does one estimate the potential effects on an infant's nervous system when the infant moves from the relative equilibrium of the intrauterine aquatic environment to the extra uterine terrestrial environment of the NICU? (14-15) How does one identify an infant's current vulnerabilities, strengths, and strivings in the mismatch of the brain's expectations and the input from the physical and social/emotional environment?

Newborn Individualized Developmental Care and Assessment Program

The Newborn Individualized Developmental Care and Assessment Program, NIDCAP, provides formal developmental observation and assessment education for healthcare professionals responsible for high-risk infants and families' long- and short-term care. (14) The NIDCAP model of care evolved from the seminal work of the Synactive Theory. (14-15) This theory holds that individuals constantly interact with their environments from the womb to the extra-uterine environments, from the NICU with transitions to home. Further, infants are understood as actively striving for their next developmental steps. Based on these principles, a priority of the NIDCAP program is the educational and consultative support to organizations towards effective infant and family care in a neuro-developmentally supportive, individualized, and family-centered framework. (15) The evidence suggests early experiences alter the premature and critically ill infant's brain structure and functioning. (8,16) NIDCAP care is a system-based, process-oriented, attuned, responsive support of individualized, family-centered developmental care for each infant and family. (14-15) Results show that the medical and developmental outcomes for infants and parents' competence when infants and their families are cared for in such a developmental framework are much improved. (16-27) Evidence also suggests that the NIDCAP model of care improves outcomes for healthy preterm infants. (27)

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The NIDCAP Federation International, NFI, is a nonprofit, incorporated international professional membership organization. The NFI is the certifying organization for all NIDCAP Training and Certification levels to safeguard the quality of all training and education within the NIDCAP model. The NFI promotes the advancement of the philosophy and science of the NIDCAP model of care and assures the quality of NIDCAP education, training, and certification for professionals and hospital systems. The NFI envisions a global society where all hospitalized newborns and their families receive care in the evidence-based NIDCAP model. The NIDCAP model supports development, enhances strengths, and minimizes stress for infants, families, and staff who care for them. It is individualized and uses a relationship-based, family-integrated approach that yields measurable outcomes. For more information, please go to https://nidcap.org.

The challenge confronting healthcare professionals who care for infants and families in hospital settings is to ensure the infants' survival and optimize neurodevelopmental trajectories. Through assessment and documentation of infants' competencies and behavioral thresholds of disorganization, healthcare professionals may gain a better understanding of the infant's developing nervous system. (14-15) This, in turn, supports providing individualized and developmentally appropriate experiences creating opportunities for developing relationships with infants and their families in the hospital setting. Structuring a physical and social environment supportive and nurturant of the individual infant's immature or dysmature nervous system and the family's sense of competence becomes a critical component of care in the nursery and of follow-up care in the home and the community. (15, 21, 30)

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NIDCAP NURSERY PROGRAM

The NIDCAP Nursery Program is based on the goal of complete emotional and physical integration of infants and families within the nursery (16-27). Research has documented the synchronous factors that influence preterm infant health between parents and infants. (10) Early parent-infant contact is fundamental to the infant's developmental trajectory. It is a dynamic process focused on enhancing and supporting the parent-infant experience, explicitly targeting the acquisition of skills for parent problem-solving and providing appropriate infant care based on the infant's needs at a particular time. (10-12) Through a parent's involvement and self-motivation to set goals and utilize informational resources about the unique care necessary for their infant, they can increase their engagement while simultaneously improving their infant's health progression. (11, 12) Translating research on individualized developmental care into clinical practice provides opportunities to improve infant outcomes through increasing mother-infant contact, monitoring infant physiologic regulation, and understanding the resiliency of the mother-infant dyad. (13) The evolution of the NIDCAP model of care implemented through systems change efforts utilizing the NIDCAP Nursery Program enhances early parent-infant interactions as an essential step in developing therapeutic modalities to improve health outcomes.

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The NIDCAP Nursery Program supports infant health and development and relates parents' engagement and participation as their infant's primary caregivers and lifelong advocates. (12, 21, 30) The NIDCAP Nursery Program provides a framework for healthcare teams to understand how infant and family care is delivered in their nursery. Further, it offers a guide with detailed

recommendations for incorporating NIDCAP, individualized developmentally supportive care, into all aspects of the nursery and experience of care for infants and families and the healthcare professional team. The NIDCAP Nursery Program provides a dynamic environment for the full integration of expert medical, nursing, and therapy (OT, PT, SLP, SW, Psychology) care securely embedded within the active pursuit of mutual respect, caring, nurturance of and collaboration with infants and families, and among all healthcare professionals on the team. The *Model of the NIDCAP Nursery: From Self-Assessment to NIDCAP Nursery Certification* elegantly demonstrates consistently well-integrated NIDCAP care and Nursery Certification (https://nidcap.org/nidcap-nursery-program-overview/).

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Measures

The NIDCAP Nursery Program's key resource is the Nursery Assessment Manual**.** This instrument is used in support of nursery self-evaluation and the process of NIDCAP Nursery Certification. (31) It consists of 121 scales grouped into four major categories of a nursery's characteristics and functioning, four Category Summary Scales, and one Overall Nursery Summary Scale. (31) The individual and the summary scales address the level of individualization, family-centeredness, and developmental support that a nursery provides for the infants and families in its care, along with the support provided to the healthcare professionals involved in delivering such care. (31) The individual scales are organized into the following four categories:

(1) Physical Environment of the Hospital and Nursery;
(2) Philosophy and Implementation of Care: Infant;
(3) Philosophy and Implementation of Care: Family; and
(4) Philosophy and Implementation of Care: Healthcare Professionals.

The five-point scale scores of the NNP Nursery Assessment Manual evaluate a nursery's philosophy and implementation of care about the NIDCAP model of care for infants and families requiring hospital care. Each of the five score points on the NIDCAP Nursery Program's ratings represents a level or degree of NIDCAP implementation as follows:

(1) Traditional, conventional care;
(2) The beginning of a minimal degree or level of NIDCAP implementation;
(3) An inconsistent, variable, or moderate degree or level of NIDCAP implementation;
(4) A consistent well-integrated level or degree of NIDCAP implementation; and
(5) A highly attuned, distinguished level or degree of NIDCAP implementation.

(NA) Not applicable is scored when care aspects do not apply to a specific nursery system.

One end of the continuum of nursery implementation describes *Traditional Care*. These include hospital and nursery practices that strive to meet the standards of safe care, with little to no attention to family-centered, individualized, developmentally supportive care for infants and families. *Infants* are considered patients. *Parents* are considered visitors. *Family Members* are considered bystanders and occasional visitors. *Healthcare Professionals* are schedule-driven, task and protocol-oriented. *Nursery and Hospital Environment & Culture* are focused on efficiency, occupancy, productivity, cost-effectiveness, and consumer/customer satisfaction.

"Integrating NIDCAP care into hospital and nursery care is an ongoing process that begins with Nursery healthcare teams, which includes parent participation, assessing and identifying current strengths and challenges. This nursery self-assessment is used for goal setting and planning."

The other end of the continuum of nursery implementation describes consistently well-integrated *NIDCAP care***.** This includes hospital and nursery practices that consistently promote the best short- and long-term health and developmental outcomes for all infants and families. *Infants* are considered individuals, persons, collaborators in care, supported, and nurtured by their parents. *Parents* are considered infants' key nurturers, advocates and caregivers, and collaborators in care decisions. *Family Members* are considered primary supporters of parents and infants. *Professionals and staff* are partners in care with infants, parents, and family members. *Nursery and Hospital Environment & Culture* are focused on supportive effectiveness, patient and family relationship orientation, and the promotion of individualized health, growth, strengths, and development. (31) Integrating NIDCAP care into hospital and nursery care is an ongoing process that begins with Nursery healthcare teams, which includes parent participation, assessing and identifying current strengths and challenges. This nursery self-assessment is used for goal setting and planning. Supports for nursery change may include introductory, foundational NIDCAP education.

Conclusions

The NIDCAP model of care was built from the seminal work of the Synactive Theory. (14-15) A priority of the NIDCAP program is the educational and consultative support to organizations towards effective infant care in a neuro-developmentally supportive, individualized, and family-centered framework. The evidence suggests that early experiences alter the premature and critically ill infant's brain structure and functioning. (8, 16) The NIDCAP Federation International (NFI) is a nonprofit, incorporated international professional membership organization. The NFI is the certifying organization for all levels of NIDCAP Training that safeguards the quality of all training and education within the NIDCAP model. For more information on NIDCAP, APIB, and the NIDCAP Nursery Program, please contact info@nidcap.org or use the website https://nidcap.org.

References:

1. Purisch SE, Gyamfi-Bannerman C. Epidemiology of preterm birth. Semin Perinatol. 2017; 41(7):387-391. https://doi:10.1053/j.semperi.2017.07.009

2. Retrieved August 1, 2023, from https://www.cdc.gov/nchs/nvss/births.htm.

3. McGowan EC, Hofheimer JA, O'Shea TM, Kilbride H, Carter BS, Check J, Helderman J, Neal CR, Pastyrnak S, Smith LM, Camerota M, Dansereau LM, Della Grotta SA, Lester BM. Analysis of neonatal neurobehavior and developmental outcomes among preterm infants. JAMA Pediatr. 2022; 5(7): e2222249. https://doi.org/10.1001/jamanetworkopen.2022.22249

4. McAnulty G, Duffy F, Kosta S, Weisenfeld N, Warfield S, Butler S, Als H. School age effects of the newborn individualized developmental care and assessment program for preterm infants with intrauterine growth restriction: preliminary findings. BMC Pediatr. 2013;13(25).

5. O'Reilly H, Johnson S, Ni Y, Wolke D, Marlow N. Neuropsychological outcomes at 19 years of age following extreme preterm birth. Pediatr. 2020; 145(2): e:20192087. https://doi.org/10.1542/peds.2019-2087

6. Bentley Waddoups A, Yoshikawa H, Strouf K. Developmental effects of parent–child separation. A Rev Dev Psyc. 2019; 1: 387–410.

7. Linsell L, Johnson S, Wolke D, Morris J, Kurinczuk J, Marlow N. Trajectories of behavior, attention, social and emotional problems from childhood to early adulthood following extremely preterm birth: a prospective cohort study. Eur Ch Adol Psyc. 2019; 28(4): 531-542. https://doi:org/10.1007/s00787-018-1219-8

8. Hodel A, Senich K, Jokinen C, Sasaon O, Morris A, Thomas K. Early executive function differences in infants born moderate to late preterm. E Hum Dev. 2017; 113: 23-30. https://doi.org/10.1016/j.earlhumdev.2017.07.007

9. Duncan AF, & Matthews MA. Neurodevelopmental outcomes in early childhood. Clin Perinatol, 2018; 45(3): 377–392. https://doi.org/10.1016/j.clp.2018.05.001

10. Feldman R. Sensitive periods in human social development: New insights from research on oxytocin, synchrony and high-risk parenting. Dev Psychopath. 2015;27:369-395. http://dx.doi.org/10.1017/S0954579415000048

11. Vittner D, McGrath J, Robinson J, Lawhon G, Eisenfeld L, Walsh S, Cong X. Increases in oxytocin from skin-to-skin contact enhances development of parent-infant relationships. Bio Res Nurs. 2018;20(1):54-62. https://doi.org/10.1177/1099800417735633

12. Vittner D, Butler S, Smith K, Makris N, Brownell E, Samra H, McGrath J. Parent Engagement correlates with Parent and Preterm Infant Oxytocin Release during Skin-to-Skin Contact, Adv Neo Car. 2019;19(1): 73-79. http://doi.org/10.1097/ANC.0000000000000558

13. Golds L, Gillespie-Smith K, Nimbley E, MacBeth A. What factors influence dyadic synchrony? A systematic review of the literature on predictors of mother-infant dyadic processes of shared behavior and affect. J Inf Ment Heal. 2022; 43: 808-830. https://doi.org/ 10.1002/imhj.22011

14. Als H. Toward a synactive theory of development: Promise for the assessment and support of infant individuality. J Inf Ment Heal. 1982; 3(4):229243.

15. 1Als H. A synactive model of neonatal behavioral organization: Framework for the assessment and support of the neurobehavioral development of the premature infant and his parents in the environment of the neonatal intensive care unit. In Sweeney JK (ed.), The HighRisk Neonate: Developmental Therapy Perspectives. Phys Occup Ther Pediatr. 1986; 6(3/4):355.

16. Als H, Duffy FH, McAnulty GB, Rivkin MJ, Vajapeyam S, Mulkern RV, et al. Early experience alters brain function and structure. Pediatr. 2004;113:846857.

17. Als H, Lawhon G, Brown E, Gibes R, Duffy FH, McAnulty G, Blickman JG. Individualized behavioral and environmental care for the VLBW preterm infant at high risk for bronchopulmonary dysplasia: NICU and developmental outcome. Pediatr. 1986; 78:ll2332.

18. Peters K, Rosychuk R, Hendson L, Cote J, MacPherson C, Tyebkhan J (2009).) Improvement of short- and long-term outcomes for very low birth weight infants: Edmonton NIDCAP trial. Pediatr.124, 1009-1020.

19. McAnulty GB, Duffy FH, Butler SC, Bernstein JH, Zurakowski D, & Als H (2010). Effects of the newborn individualized developmental care and assessment program (NIDCAP) at age 8 years: Preliminary data. Clin Pediatr. 49(3): 258-270.

20. Fleisher BE, VandenBerg K, Constantinou J, Heller C, Benitz WE, Johnson A, Rosenthal A, Stevenson DK. Individualized developmental care for very low birth weight premature infants. Clin Pediatr. 1995; 34:523529.

21. Kleberg A, Westrup B, Stjernqvist K. Developmental outcome, child behavior and motherchild interaction at 3 years of age following Newborn Individualized Developmental Care and Intervention Program (NIDCAP) intervention. E Hum Dev. 2000;60:123135.

22. Kleberg A, Westrup B, Stjernqvist K, Lagercrantz H. Indications of improved cognitive development at one year of age among infants born very prematurely who received care based on the Newborn Individualized Developmental Care and Assessment Program (NIDCAP). E Hum Dev. 2002;68:8391.

23. Ullenhag A, Persson K, Nyqvist KH (2009). Motor performance in very preterm infants before and after implementation of the newborn individualized developmental care and assessment programme in a neonatal intensive care unit. Acta Paediatrica. 98(6),947-52.

24. Wielenga JM, Smit BJ, Merkus MP, Wolf, MJ, van Sonderen L & Kok, JH (2009). Development and growth in very preterm infants in relation to nidcap in dutch nicu: Two years of follow-up. A Paediatr. 98, 291-297.

25. Als H, Lawhon G, Duffy FH, McAnulty GB, GibesGrossman R, Blickman JG. Individualized developmental care for the very lowbirthweight preterm infant: Medical and neurofunctional effects. JAMA Pediatric. 272: 853858, 1994. (Merenstein GB, Editorial, 890–91.)

26. Als H, Gilkerson L, Duffy FH, McAnulty GB, Buehler DM, VandenBerg KA, et al. A threecenter randomized controlled trial of individualized developmental care for very low birth weight preterm infants: Medical, neurodevelopmental, parenting and caregiving effects. J Dev Behav Pediatr. 2003;24:399408.

27. Buehler DM, Als H, Duffy FH, McAnulty GB, Liederman J. Effectiveness of individualized developmental care for low risk preterm infants: Behavioral and electrophysiological evidence. Pediatr. 1995; 96:923932.

28. Als H, Lester BM, Tronick E, Brazelton TB. Toward a research instrument for the assessment of preterm infants' behavior (APIB). In: Fitzgerald HE, Lester BM, Yogman MW (eds.), Theor Res Behav Pediatr. Vol. 1. New York: Plenum, 1982: 3563.

29. Als H, Butler S, Kosta S, McAnulty G. The assessment of preterm infants' behavior (APIB): Furthering the understanding and measurement of neurodevelopmental competence in preterm and fullterm infants. Ment Ret Dev Dis Res Rev. 2005; 11:94102.

30. Westrup B, Kleberg A, von Eichwald K, Stjernqvist K, Lagercrantz H: A randomized controlled trial to evaluate the effects of Newborn Individualized Developmental Care and Assessment Program in a Swedish setting. Pediatr. 2000; 105: 66\72.

31. Smith K, Buehler D, Hedlund R, Kosta S, Als H. NIDCAP Nursery Assessment and Certification Program (NNACP): A Guide to Preparation, Application and Implementation of NIDCAP Nursery Assessment and Certification. 2015. Boston, Mass: NIDCAP Federation International, Inc.

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Dorothy Vittner, PhD, RN, FAAN
Fairfield University, Egan School of Nursing and Health Studies
1073 North Benson Road
Fairfield, CT 06824
Email: dvittner@fairfield.edu
Phone: 860 306 0414

Deborah Buehler, PhD
West Coast NIDCAP & APIB Center, UCSF Benioff Children's Hospital
San Francisco, CA