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NICU Hospitalization: Long-Term Implications on Parenting and Child Behaviors

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Opinion statement

Purpose of review—Parents of infants admitted to the Neonatal Intensive Care Unit (NICU) experience psychological distress, loss of the parenting role, and disruptions to parent-infant bonding. The inclusion of evidence-based practices to address these challenges in the NICU has largely been based upon short-term improvements in parent and infant functioning. However, less is known regarding the extent to which family-based interventions may also be associated with longer-term parenting behaviors and children's neurobehavioral outcomes.

Recent findings—Comprehensive family-based NICU interventions demonstrate consistent links with later parental mental wellbeing, sensitive parenting behaviors, and children's cognitive and socioemotional development. Dyadic co-regulation activities implemented inconsistently and/or in isolation to other components of NICU interventions show mixed associations with outcomes, highlighting the need for multifaceted wrap-around care. Further research is needed to delineate associations between NICU interventions and children's neurological and language development, with follow-up beyond very early childhood in larger samples.

Summary—Long-term associations may reflect the stability of early parental responses to NICU interventions and the extent to which parents continue to implement mental health and sensitive

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parenting techniques in the home. However, the transition of parental psychiatric care from hospital to community-based services upon NICU discharge remains a pertinent need for high-risk families. Remaining issues also concern the extent to which NICU interventions incorporate sociodemographic differences across families, and whether interventions are generalizable or feasible across hospitals. Despite variation across interventions and NICUs; supporting, educating, and partnering with parents is crucial to strengthen longer-term family functioning and alter the developmental trajectories of high-risk infants.

Keywords

Neonatal intensive care unit; family-centered care; parenting; child development; follow-up

Introduction

The Neonatal Intensive Care Unit (NICU) is a specialized level-III/IV treatment setting for high-risk infants. From 2007 to 2012, American NICU admissions rose from 6.4% to 7.8% of all live births (1). Parents of hospitalized infants experience psychological distress, loss of the parental role, and disrupted parent-infant bonding (2,3). The inclusion of evidence-based practices to address these challenges has largely been based upon improvements in parental functioning reported during the NICU stay. However, less is known regarding longer-term family outcomes post-NICU discharge. This review examines links between family-based NICU interventions and longer-term parenting behaviors and children's neurobehavioral outcomes.

Mental Health in the NICU

Maternal depression before and during pregnancy increases the likelihood that an infant will be admitted to the NICU and compounds the risk for postpartum depression (4–7). Up to 20% of mothers of hospitalized infants experience depression, with more severe symptoms than mothers of healthy infants (7–9). Anxiety and post-traumatic stress disorder (PTSD) are also common among parents of hospitalized infants (4,8). Approximately 35% of mothers and 24% of fathers experience Acute Stress Disorder days after infant hospitalization, with 15% of these mothers and 8% of these fathers having ongoing PTSD symptoms (6). Importantly, poor parental mental health disrupts parent-infant bonding in the NICU (10).

Having an infant in the NICU is a stressful experience for parents, with sources of psychological distress reported across a number of domains. For example, the health of the hospitalized infant is a key source of distress as parents feel helpless to protect their baby from medical procedures (11,12). Parents also report witnessing near-death and resuscitation events as overwhelming and frightening (13). Findings from multiple cohorts indicate that the perceived loss of the parental role is a prominent NICU-related stressor (11,12,14). A recent study (n=211) found that parents experienced greater levels of stress relating to parent-infant separation, the inability to provide care and disrupted parent-infant bonding relative to stress concerning their infant's appearance and the NICU environment (12). Wider sources of stress reflect the practical challenges that parents encounter as they attempt to visit their infant in the NICU, spanning difficulties with time management, organizing child care, and family finances (15).

Social Circumstances

Mothers from socially disadvantaged backgrounds are more likely to have a hospitalized infant and longer NICU stays as a result of exposure to poverty, high stress levels, and poor prenatal care coupled with obstetric complications (16–18). Social adversity also places families at increased risk of stress and psychopathology in the NICU (8,14). Key predictors include low education, single parenthood, and prior stressful life events (8,11,14). Worryingly, families facing socio-economic hardships have more limited means to facilitate NICU visitation, which in turn, hinders early parental adjustment and engagement (3,19). Parental engagement, defined as participation in clinical decision making and caregiving in the NICU, improves infant health and family outcomes (3). Enhancing parental engagement, however, is relies upon the development and implementation of interventions that support parents during the NICU stay (20).

Family-Based NICU Interventions

Family-based interventions advocate that optimal family outcomes are achieved when parents are supported, educated, and included in the healthcare team (20–22). Key components of family-based care span the physical NICU environment and addressing the psychosocial needs of parents (Figure 1). Comprehensive interventions include Family-Centered Care (20,21,23), Family Integrative Care (24), Compassionate Family Care (25), Family Support (2,20,21) and Neonatal Integrative Developmental Care (26). These interventions support parents via collaborative partnerships; access to psychosocial care; restoration of the parenting role; and supporting the transition to home (Table 1) (23,27).

Design of the NICU

The NICU consists of open-bay wards, and more recently, single family rooms (28). Open-bay wards contain multiple infant isolettes and small family areas in close proximity, which some parents find overwhelming (29). Single family rooms were therefore introduced to protect the family unit (28). Infants placed in single family rooms show better clinical progress and experience greater parental caregiving (29,30). Family benefits include increased parental visitation, privacy, and family cohesion (29,31). However, one study found that after accounting for wider social support, mothers in single family rooms reported greater stress compared to mothers in open-bay wards, potentially due to their perceived isolation and/or obligation to provide care (31). This highlights the importance of balancing NICU design features such that parents in open-bay wards have access to private spaces, and parents in single rooms are connected with peer-support groups (20).

Parents as Partners

An important cornerstone of NICU access concerns welcoming families as partners in the healthcare team (32). Unrestricted visiting hours and the ability to bring support persons to the NICU is associated with positive parental perceptions of the NICU (33). There has also been some effort to provide access to supervised hospital playrooms for parents with additional children (2,34). However, as some playrooms do not supervise infant siblings and/or have specific hours, parents still report challenges with childcare (15). Nonetheless, an expanding NICU practice concerns parental presence at the infant's bedside during

clinical rounds (35). Parental presence at the bedside encourages knowledge exchange such that staff can ascertain the needs of each family and discuss infant clinical progress (25) while parents participate in shared decision making (24,34,35). Parental presence increases confidence in the healthcare team, reduces anxiety and stress, and is linked to improved neonatal outcomes (36–38).

Psychosocial Interventions

To promote parental wellbeing during the parent's earliest experiences with their infant (39), many NICU interventions integrate psychosocial services as part of wrap-around care (22,26,40). Embedding mental health professionals is important to contextualize parent's negative emotions and screen for current or emerging psychopathology (41). Effective interventions span educational-behavioral programs (42), psychological interventions (43,44), and trauma-focused care (45,46).

Both educational- and cognitive-based interventions reduce depressive symptoms in the perinatal period, with less consistent effects found for anxiety. For example, the Creating Opportunities for Parental Empowerment (COPE) program is an educational-behavioral intervention administered from NICU admission to 1-week post-hospital discharge (42). The COPE provides parents with information and behavioral activities that reinforce topics related to high-risk infants and sensitive parenting. Study findings indicated that COPE mothers (n=138) had reduced NICU-related stress (d=.27) than control mothers (n=109), although effects on depression and anxiety were not evident until 2-months post-NICU discharge (42). The efficacy of the COPE has also been examined as part of a meta-analysis reporting NICU intervention effects on depression and anxiety (44). Compared to educational programs (including the COPE) and dyadic mother-infant interventions, the meta-analysis showed that Cognitive Behavioral Therapy was the most effective type of intervention to treat depression in the NICU (44). While the meta-analysis was not able to detect pooled intervention effects for anxiety, improvements in anxiety have been reported following the completion of an individualized intervention that addressed parental grief and coping, integrating the infant into the family, and hospital discharge planning (43).

Trauma-focused interventions show promise for treating perinatal-specific PTSD. For example, a 6-session PSTD intervention utilized therapeutic activities to address birth trauma through psychoeducation, cognitive restructuring, and muscle relaxation (46). By 1-month postpartum, mothers (n=62) who received trauma-focused NICU care had lower PTSD (d=0.41) and depressive (d=0.59) symptoms compared to control mothers (n=43). Furthermore, mothers with high stress levels pre-intervention demonstrated greater gains in wellbeing post-intervention, highlighting benefits of trauma-focused care in high-risk parents (46).

Peer-to-peer support is a widely utilized psychosocial intervention, connecting current NICU parents with veteran parents through meetings in the NICU or through telecommunication services (20,47). Support provided by peer groups is valuable for NICU parents who do not have or do not use existing support systems, or who do not respond to clinician-led programs. However, the success of peer-support depends upon how well families are

matched on sociodemographic and infant characteristics; length of NICU stay; and how willing parents are to leave their infant's bedside (41,47).

The Parental Role

To mitigate the loss of the parenting role, family-based interventions optimize parental engagement through educational and guided caregiving activities (20,26,34). Parenting interventions include Family Integrated Care (24), the Neonatal Behavioral Observations (NBO) system (48), the Newborn Individualized Developmental Care Program (NIDCAP) (49), and the Family Nurture Intervention (FNI) (50). The core philosophy of Family Integrated Care is to include parents as healthcare team members (51). Parents attend clinical rounds, complete basic charting, and perform caregiving tasks and skin-to-skin care (also known as kangaroo care). Family Integrated Care has been piloted in a sample (n=42) of mothers of very preterm (VPT, <32 weeks gestation) infants (51) and is being evaluated in a large trial spanning 27 NICUs (24). Pilot results suggest that Family Integrated Care is associated with improvements in infant weight gain, parental stress, and incidence of breastfeeding by hospital discharge (51).

Neuro-protective developmental interventions encourage sensitive caregiving in the context of the parent-infant relationship (52,53). In the NBO, the clinician demonstrates handling and caregiving techniques that parents can use in the home (48). Similarly, the NIDCAP invites parents to observe the clinician as they develop an individualized caregiving plan tailored to the infant's neurobehavioral sensory and regulatory capacities (49,54). A small study found that NBO mothers (n=10) gained knowledge regarding their infant's capabilities and how to sensitively interact with their infant (55). Gains in parenting confidence and knowledge (d=.25–.54), as well as positive parent-infant interactions in the NICU (d=.26), have also been linked to the COPE program (42).

Dyadic co-regulation interventions target parent-infant bonding in the NICU (21,56–58). The FNI has parents participate in tactile, visual, and vocal activities at the bedside, and skin-to-skin contact during holding and feeding (50). The FNI promotes higher-quality caregiving in the NICU (59) and reduces depression and anxiety from term to 4-months post-intervention (60). Skin-to-skin care encourages bonding because it unites parent and infant, and activates the release of oxytocin and reduction of cortisol during contact (61). However, positive correlations have been reported between hours of skin-to-skin care and parental stress (62), potentially highlighting the need to consider parenting readiness in the NICU.

The Transition to Home

The continuum of parental needs extends beyond the NICU stay (63,64). Discharge planning should begin early and provide incremental education about the discharge process (20). The Train-To-Home program delivers information on neonatal health and key NICU-to-home milestones to increase parental understanding of infant clinical progress and subsequent readiness for discharge (65). Overnight transition rooms also facilitate discharge readiness as parents provide independent care within the monitored environment (66,67). Importantly,

systematic discharge planning is associated with reduced outpatient healthcare utilization and fewer re-hospitalizations (68–70).

As part of the transition of care, Family-Centered Care recommends appointing a NICU team member to coordinate follow-up appointments with a primary care provider and/or pediatric specialist to meet the infant's ongoing medical needs (64,69,71). Parental referral to community-based psychiatric services, however, remains a pertinent need for high-risk families. Mothers with psychiatric disorders perceive themselves as having poor emotional readiness for NICU discharge (72), with ongoing risks for postpartum depression (73). In-home follow-up visits may, to some extent, facilitate continued nursing care and psychosocial support (64).

Longer-Term Parenting Outcomes

Family-based NICU interventions directly restore the parental role and support the foundation of sensitive parenting behaviors (20). Longer-term parenting domains that have been evaluated thus far include parental mental wellbeing, the quality of the home environment, and parenting behaviors in the context of the parent-child relationship.

Parental Mental Wellbeing

Longitudinal findings highlight the role of NICU-based psychiatric treatments and dyadic interventions on parental mental wellbeing within 12-months of discharge (42,46,57,74). For example, after covariate adjustment, mothers who completed COPE had reduced anxiety (d=.24) and depressive (d=.30) symptoms compared to control mothers at 2-months follow-up (42). Similarly, Shaw et al. found that their trauma-focused intervention (46) had increasing benefits for depression, anxiety, and PTSD symptoms from 1- to 6-months post-intervention (75). This might suggest that trauma-focused interventions have delayed effects and/or that responses to trauma-focused interventions continue to emerge as mothers use learned cognitive-behavioral techniques in the home.

In terms of dyadic interventions, Holditch et al. examined whether skin-to-skin contact and a multisensory auditory-tactile-visual-vestibular (ATVV) intervention improved parental psychological wellbeing at 12-months post-intervention (74). Compared to mothers who did not complete any NICU intervention, mothers who performed infant massage (including ATVV) showed improvements in depressive symptoms, whereas skin-to-skin care reduced infant-related worries (74). When taken together, findings suggest that psychiatric interventions have targeted effects on parental wellbeing due to shared underlying mental health constructs, whereas dyadic interventions may have more general effects on parental wellbeing.

The Home Environment

Follow-up studies have examined the quality of the home environment using the Home Observation for Measurement of the Environment (HOME) inventory (57,74,76). Feldman et al. found that preterm infants of mothers who provided consistent skin-to-skin care obtained higher Emotional and Verbal Responsiveness (d=.48), Organization of the Physical Environment (d=.48), and Opportunities for Variety in Daily Life (d=.40) HOME scores

than demographically-matched control mothers of preterm infants at the 3-month follow-up (57). Similar associations between dyadic co-regulation interventions and total HOME scores have also been reported at 6-months post-intervention (74). In contrast, the parent training Parent Baby Interaction Program (PBIP) was not associated with stimulation and support provided to the child in home (76). The PBIP was, however, a low-dose intervention administered in a stressed sample of mothers, coupled with low rates of skin-to-skin care. Thus, dyadic interventions that reduce mother-infant separation need to be implemented often and consistently to engender maternal bonding, emotional closeness, and supportive behavior that generalizes beyond the NICU (77).

The Parent-Child Relationship

Surprisingly, mixed outcomes have been reported between dyadic co-regulation interventions and the longer-term quality of the parent-child relationship (57,58,74,76). For example, a modified version of the Mother-Infant Transaction Program (MITP) that included skin-to-skin care, was associated with higher observational ratings of parent-infant reciprocity and synchrony at 3-months follow-up (58). Skin-to-skin care is also linked to longer-term sensitive parenting behaviors characterized by positive affect, timely and appropriate responses, and adapting behavior to suit the changing needs of the infant (57). Findings likely reflect homotypic continuity in terms of parents continuing to implement sensitive parenting techniques in the home (42,55,57,59). Infants who are better regulated as a result of NICU family-based interventions may also be easier to parent, thereby contributing to the reciprocal parent-infant relationship (78,79). On the other hand, Holditch et al. did not report any dyadic co-regulation intervention effects on observational ratings of parental involvement at 2- and 6-months follow-up (74). However, discrepancies between study findings may be explained by differences in sample characteristics, parenting variables examined, and the extent to which mothers participated in other non-assigned NICU interventions. Compared to follow-up studies of dyadic interventions, few studies have examined links between educational or psychiatric interventions and longer term parenting behaviors despite initial evidence linking the COPE with more positive mother-infant interactions in the NICU (42). There is also a paucity of findings beyond 12-months follow-up. However, registered protocols indicate that studies investigating parenting outcomes by 5-years post-intervention are forthcoming (80,81).

Longer-Term Child Outcomes

Family-based NICU interventions support children’s neurobehavioral outcomes through early contributions to neural and neurophysiological organization, and through early and continued parental involvement (49,54,57,79). Reported outcomes include brain development, cognitive ability, language skills, and socioemotional behaviors. Fewer studies have examined neuromotor outcomes (30,54,82). However, as family-based interventions do not typically target infant motor development (83), these findings will not be discussed.

Brain Development

Studies linking family-based interventions with structural and functional brain development have focused on the neonate (54,84–86). Just two studies have examined associations

between the NIDCAP and structural and functional connectivity in school-age preterm children (29–33 weeks gestation) born birthweight appropriate for gestational age (87) or intrauterine growth restricted (88). Compared to preterm children who received standard care as infants, the non-growth restricted NIDCAP cohort had more mature frontal and parietal brain connectivity and more mature fiber tracts in the internal capsule and cingulum bundle at age 8-years (87). Similarly, the growth restricted NIDCAP cohort had increased connectivity between frontal, occipital and parietal regions, and larger cerebellums than control preterm children at age 9-years (88). These collective findings advocate for neuroprotective developmental care in the NICU. However, both of studies included small samples (n<25) and thus study replication with larger cohorts is warranted.

Cognition

Follow-up studies have examined a wide range of NICU interventions on cognitive outcomes from age 6-months to school-age. Findings from two preterm cohorts suggest that infants cared for in single family rooms obtain higher cognitive scale scores on the Bayley Scales of Infant Development-III (BSID-III) at age 18–24 months than infants cared for in open-bay rooms (89,90). However, the extent to which these findings reflect higher levels of parental caregiving and/or other NICU interventions implemented in single family rooms remains unclear (29).

In terms of links between isolated parenting activities in the NICU and cognitive outcomes, findings are mixed. One prospective study found that preterm infants (25–34 weeks gestation) who received skin-to-skin care in the NICU obtained higher BSID-II cognitive scores at age 6-months compared to infants who received standard care (57). A more recent retrospective study, however, reported non-significant associations between hours of skin-to-skin care in the NICU and cognitive outcomes of extremely preterm infants (<27 weeks gestation) at ages 6- and 12-months (91). Discrepancy in findings may be attributed to differences in infant clinical characteristics, and the fact that one study (91) analyzed hours of skin-to-skin care using a median split which potentially masked linear associations with cognitive scores (92).

In comparison, comprehensive parenting interventions show consistent associations with cognitive outcomes (54,87,93,94). For example, the COPE program was associated with higher cognitive scores in low birthweight preterm infants at ages 3-months (d=.60) and 6-months (d=.72) (94). COPE mothers were likely better prepared to parent a high-risk infant, having gained parenting confidence and knowledge in the NICU (42). While the NIDCAP is not effective in reducing global neurodevelopmental impairment (82), the NIDCAP is associated with improved general cognitive ability at age 9-months (54) and performance on tasks drawing upon planning, decision-making, executive function, and visual-spatial processing at age 8-years (87). Taking findings together, the context in which neuroprotective care, dyadic co-regulation activities, and holistic parenting programs are implemented in the NICU appear to support general cognitive development in very early childhood, and components of executive function at school age.

Language

Follow-up studies are now linking single family NICU rooms with language outcomes in childhood, however, the findings have been mixed (85,89,90,91). For example, one study found that compared to VPT infants placed in an open-bay wards (n=40), VPT infants placed in single family rooms (n=46) obtained lower BSID-III language scores (d=.61) at age 2-years (85). Findings persisted after adjusting for family background, parental visitation, and holding in the NICU; potentially highlighting the role of sensory deprivation among disadvantaged samples with low visitation rates. In contrast, Vohr et al. found that low birthweight infants placed in single family rooms (n=161) had higher total and expressive BSID-III language scores at age 18–24 months (90). While other studies suggest that single family rooms are associated with increased visitation and enhance the effects of parental involvement on language outcomes (28,31,89), Vohr et al. did not adjust findings for NICU visitation rates which may have indirectly contributed to language outcomes.

Socioemotional Development

Few follow-up studies have assessed internalizing and externalizing outcomes. Pineda and colleagues reported that after adjusting for clinical, social, and family factors; VPT infants placed in single parent rooms received higher parent-report ratings on the externalizing problems scale of the Infant Toddler Social Emotional Assessment at age 2-years, than infants in open-bay wards (85). This finding potentially reflects the longer-term sequelae of low parental involvement during a sensitive period of infant brain development, or the heritability of externalizing problems as parents with psychopathology may be less likely to engage in NICU care. Other indirect factors, including the quality of care and mental health support provided in the NICU, predict internalizing problems in early childhood (95).

Comprehensive NICU interventions show reliable associations with both parent-report and observational ratings of socioemotional outcomes (54,58,93). For example, mothers who completed the MITP, which included skin-to-skin care, were more likely to rate their infants as having easier temperament, more approach behaviors, and fewer regulatory problems at age 3-months compared to preterm infants who received standard care (58). The NIDCAP has also been associated with observational ratings of emotion regulation skills (54), whereas the FNI has demonstrated positive associations with parent-report ratings of social-relatedness and attention in very early childhood (93). Dyadic co-regulation activities implemented in isolation to other parenting practices, however, do not appear to be effective (57). Supporting children’s socioemotional development may, therefore, depend upon comprehensive NICU interventions that target ways in which parents can sensitively interact with and support their infants in the NICU and provide the foundation for later positive parenting behaviors (96).

Directions for Future Research

In light of associations between family-based NICU interventions and longer-term parent and child outcomes, a number of research gaps remain. First, most follow-up studies have focused on preterm populations. Less is known about the utility of NICU interventions in parents of infants with specific high-risk medical complications who may need

individualized support. Second, as family-centered care is multifaceted, it is difficult to pinpoint independent and/or additive effects attributable to components of an intervention (30,74,76). Thus, the need for large prospective RCTs remains. Third, as recent studies highlight gaps in service provision for mothers with psychopathology (72,97), investigation of NICU discharge planning that incorporates referral to community-based mental health programs is desperately needed for mothers with perinatal mental health disorders.

Remaining Clinical Considerations

A remaining challenge of NICU intervention implementation is to accommodate differences across sociodemographic groups. High-risk mothers are more likely to have an infant admitted to the NICU (7,16) but have low visitation rates due to their sociofamilial circumstances (19). Furthermore, the ability to take extended maternity or family medical leave undeniably impacts the extent to which parents are able to engage in NICU interventions (58,98). Although some social factors may not be modifiable, NICU access and interventions may need to be tailored for parents who are willing to provide care but lack the mobility to do so. Careful consideration should also be given to intervention timing and duration (40,76). Intervening when parents are less traumatized may improve engagement in parenting interventions, and therefore, longer-term parental wellbeing and family functioning (45,62).

In the application of family-based NICU interventions, the extent to which interventions are generalizable or feasible across hospitals remains unclear. Variation in NICU practices may reflect the fact that family-based interventions are heterogeneous; differing in focus, duration, and the resources needed to implement the program. Disparities in service provision may also exist due to NICU differences in administrative organization, staff culture and/or expertise, and NICU design or resources (99). Some NICUs may also be situated in adult hospitals (likely adjacent to an obstetric service) and are attempting to implement family-centered care in a hospital that typically serves adult patient populations. For a small service to implement family-focused care within an adult hospital, it requires overcoming numerous barriers that may not be encountered in pediatric hospitals. Thus, some NICUs implement all components family-care while others offer isolated components or are at varying stages of implementation (21,97,99). In addition, there are no standardized recommendations for providing psychosocial support in the NICU, underscoring the importance of embedding evidence-based guidelines for psychiatric and trauma-focused care (97).

Conclusions

Comprehensive family-based NICU interventions address parental psychological distress, the loss of the parenting role, and disruptions to parent-infant bonding. Extending short-term outcomes, improvements in parental mental wellbeing, sensitive parenting behaviors, and children’s cognitive and socioemotional development are relatively consistent. Long-term associations may reflect the stability of early parental responses to NICU interventions and the extent to which parents continue to implement mental health and sensitive parenting techniques in the home. Remaining issues concern the extent to which NICU interventions

incorporate sociodemographic differences across families, and whether effective interventions are generalizable or feasible across hospitals. Despite variation across interventions and NICUs; supporting, educating, and partnering with parents is crucial to strengthen longer-term family functioning and alter the developmental trajectories of high-risk infants.

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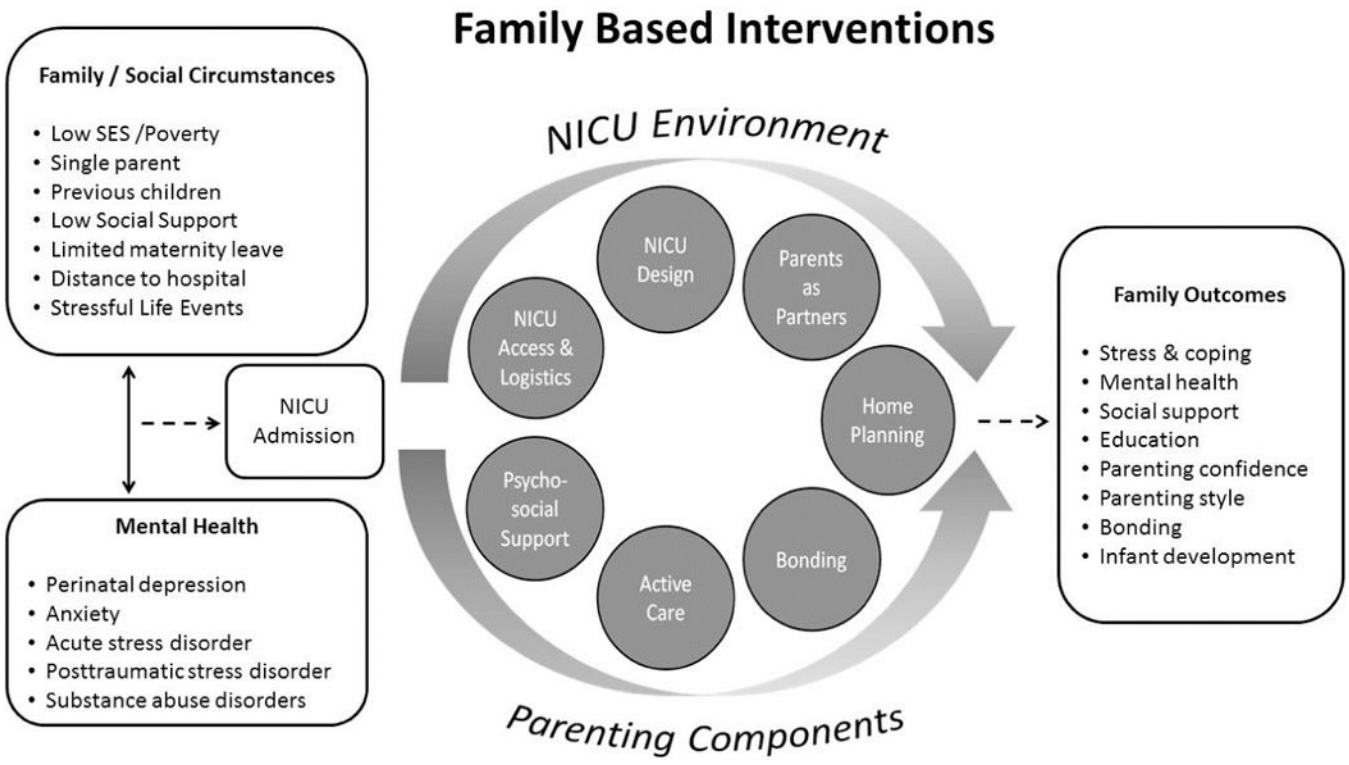

Figure 1.

A Conceptual Overview of Family-Based NICU Interventions. This figure provides a conceptual overview of links between family social circumstances leading to NICU admission; core components of family-centered care implemented in the NICU; and targeted longer-term family outcomes.

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Table 1

Summary of Family-Based Interventions Used in the Neonatal Intensive Care Unit (NICU)

	Model	Description	Core components	Program Implementation	Duration	Populations	Outcomes
Parent Centered Interventions	Family-Centered Care (20,21,23)	Mutually beneficial partnerships between NICU staff & parents	- Parents as partners - Participation in caregiving - Information sharing - Respect & dignity for families	- Open NICU access - Care for all family members - Education sessions - Active caregiving - Peer-to-peer support groups - Sibling education - Home transition planning	NICU admission to transition to home	- Preterm infants - Infants with birth defects	↑ Psychological wellbeing ↑ Social Support ↑ Confidence ↑ Knowledge transformation ↑ Engagement ↑ Attachment/ bonding
	Family Integrated Care (24,51)	Parents are completely integrated into the NICU care team	- Support, educate & empower parents - Restoration of parenta role	- Education sessions - Peer-to-peer support groups - Bedside parental presence - Attend clinical rounds - Active caregiving - Perform basic charting	NICU admission	- Preterm infants - Infants with no/low respiratory support	↑ Parenting efficacy ↑ Attachment/ bonding
	Compassionate Family Care (25)	Compassionate partnerships between NICU staff & parents	- Parents as partners - Communication - Compassionate relationships	- Active listening - Addressing parental concerns/needs - Positive communication	NICU admission to transition to home	- Preterm infants - Critically ill term infants	↑ Parenting efficacy ↑ Empowerment ↑ Attachment/ bonding ↑ Developing identity
	Parental Presence at the Bedside (37)	Parental presence as part of family-centered care	- Parents as partners - Communication - Create learning opportunities	- Attend clinical rounds - Bedside parental presence - Parents encouraged to ask questions	Variable: During NICU stay, rounds approx. 2 hours long	- Preterm infants admitted for 5 consecutive days	↑ Psychological wellbeing ↑Confidence in healthcare providers
Neonatal-Family Interventions	Neonatal Integrative Developmental Care (26)	Holistic neuroprotective, family-centered, developmental care	- Healing environment - Parents as partners - Protect infant brain development - Support infant neurobehavioral & neurosensory development	- Open NICU access - Single family NICU rooms - Education sessions - Interactive workshops - Psychosocial support - Skin-to-skin contact - Active caregiving - Home transition planning	NICU admission to transition to home	- Preterm infants	↑ Knowledge transformation ↑ Social Support ↑ Confidence ↑ Engagement ↑ Attachment/ bonding ↓Hospital stays

	Model	Description	Core components	Program Implementation	Duration	Populations	Outcomes
Psychosocial Interventions	NIDCAP Individualized Care Program (49)	Individualized, developmentally supportive, family-centered care	- Parents as partners - Attachment/ bonding - Co-regulation - Infant development	- Developmentally sensitive care - Assess infant's capabilities - Reading infant behavioral cues - Skin-to-skin contact	NICU admission to transition to home	- Preterm infants - Critically ill term infants	↑ Self-regulation ↑ Competence ↑ Psychological wellbeing ↑ Parent-infant interaction ↑ Attachment/ bonding
	Modified Mother-Infant Transaction Program (58)	Parental sensitively and stimulation activities	- Mother as the interventionist - Recognize and support infant needs - Initiate positive stimulation	- Education sessions - Verbal instruction - Infant observation - Handling infants - Skin-to-skin contact - Infant massage - Infant bath session	NICU admission and in-home follow-up visits	- Preterm infants	X Depression ↓ Stress ↑ Sensitive parenting ↑Parent-infant synchrony
	Newborn Behavioral Observations System (48)	Assess infant capabilities in the context of parent-infant dyad	- Infant behavior as communication - Caregiver awareness & responsiveness - Quality of parent-infant interaction	- Structured observations - Education sessions - Active caregiving	Variable: Delivery to 3 postpartum	- Term infants - Preterm infants	↑ Knowledge transformation ↑ Competence ↑ Parental role ↑ Attachment/ bonding ↑ Parent-infant interaction
	Family Nurture Intervention (50)	Dyadic co-regulatory activities	- Attachment/ bonding - Infant development - Maternal wellbeing	- Isolette odor exchange, sustained touch, vocal soothing, eye contact - Active caregiving - Family sessions	NICU admission to transition to home	- Preterm infants	↑ Social support ↑ Psychological wellbeing ↑ Parent-infant interaction
	Creating Opportunities for Parent Empowerment (42)	Three phase educational-behavioral program	- Parental education - Parental engagement - Restoration of parental role	- Education sessions - Audiotapes - Written materials - Activity workbook - Active caregiving	NICU admission to transition to home	- Preterm infants	↓ Stress ↑ Psychological wellbeing ↑ Competency ↑ Knowledge transformation
	Individualized Support (43)	Five phase individualized intervention	- Strategies for coping - Dealing with grief - Restoration of parental role	- Education sessions - Workshops - Guided activities with baby - Home transition planning	NICU admission to transition to home	- Congenital heart defect - Perinatal HIE - At least 4 weeks in NICU	↓ Anxiety ↓ Depression X Stress

	Model	Description	Core components	Program Implementation	Duration	Populations	Outcomes
			- Family dynamics				
	Counseling Model for Postpartum Women (45)	Counselling intervention	- Expression of feelings - Perceptions of birth trauma - Strategies for coping	- Brief counselling sessions	Variable: Within 72 hours of delivery to 4 – 6 weeks postpartum	- Traumatic birth - Has not been evaluated in context of preterm birth	↑ Social support ↑ Psychological wellbeing
	Prevention of Traumatic Stress in Mothers with Preterm Infants (46)	Intervention for posttraumatic stress, depression & anxiety	- Trama focused treatment - Psychoeducation - Cognitive restructuring - Redefining negative perceptions	- Highly manualized therapeutic sessions - Once or twice weekly - 44 – 45 minutes per session	Variable: 3 – 4 weeks during the NICU stay	- Preterm infants	↑ Psychological wellbeing ↓ PTSD
	Peer-to-Peer Support (20)	Connecting current NICU parents with veteran NICU parents	- Parents as partners - Parent education	- Education sessions - Peer-to-peer support groups - Bedside support - Telephone support	NICU admission to transition to home	- Not defined	↑ Knowledge transformation ↑ Social support ↑ Parent-staff communication ↑ Coping

Note. Preterm infants <33 weeks gestational age. ↑ indicates increase in positive outcome; ↓ indicates reduction in adverse outcome; X indicates no effect. NIDCAP: The Newborn Individualized Developmental Care & Assessment Program. HIE: hypoxic-ischemic encephalopathy.

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