

Abstract

Breastfeeding in neonatal care is facilitated by a general positive attitude to breastfeeding in society, mothers' right to leave of absence from work and maternal allowance after childbirth, guidelines for early introduction of breastfeeding, and knowledge among professionals about preterm infants' breastfeeding capacity. Models of care relevant for breastfeeding support are Kangaroo Mother Care, the Humane Neonatal Care Initiative, and developmentally supportive family-centered care using the Newborn Individualized Developmental Care and Assessment Program (NIDCAP). Hospital policies and practices should include unrestricted parental visiting, care-by-parent guidelines, early frequent breast milk expression, breastfeeding observation and individualized breastfeeding support, cup instead of bottle feeding, the use of a nipple shield when indicated, and early introduction of semi-demand feeding. Test weighing may facilitate early attainment of exclusive breastfeeding. Early discharge is recommended provided there is an adequate follow-up program.

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Breastfeeding Support in Neonatal Care: An Example of the Integration of International Evidence and Experience

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Considerable differences in breastfeeding incidence among preterm (born at a gestation of <37 weeks) and low-birth-weight (LBW, <2500 grams) infants are obvious when reports from various countries are compared. In an American study of infants born weighing 1500 grams or less, 60% of mothers initiated expressed milk feedings whereas only 27% of the mothers breastfed their infants directly.¹ An Australian study found a 64% breast milk-feeding rate and a 38% breastfeeding rate.² The breastfeeding rate at discharge in Italian preterm singletons was 63%, with 49% being breastfed exclusively and 14% partially.³ In the United Kingdom, 83% of a sample of preterm infants received breast milk at discharge and 75% were feeding at the breast.⁴ In a Swedish survey, the proportion of LBW infants in one county who were fed breast milk at discharge approached the rate found in a control group composed of the whole county population (ie, 93% vs 97%).⁵ Although there may be many explanations for these differences, examination of a successful breastfeeding program will provide support for neonatal intensive care units wishing to improve the provision of breast milk or breastfeeding for these high-risk infants. The purpose of this paper is to describe a successful, evidence-based Swedish program for breastfeeding of high-risk neonates. The paper will describe the evidence that supports components of the program and how the program was implemented and maintained.

International Goals and Policies for Breastfeeding

World Health Organization Goal for Breastfeeding

The World Health Organization's current goals for breastfeeding are defined as follows: "infants should be exclusively breastfed for 6 months of life to

achieve optimal growth, development and health. Thereafter, . . . infants should receive nutritionally adequate and safe complementary foods while breastfeeding continues to up to 2 years of age or beyond.”⁶ In addition to the health benefits of breast milk feeding that apply to all children, there are particular benefits for children born preterm or LBW, including reduced risk for neonatal sepsis and necrotizing enterocolitis, lower incidence and severity of problems with vision, and more favorable cognitive development.^{7–9}

Baby-friendly Hospitals Initiative

Although the baby-friendly hospitals initiative (BFHI) is formally targeted at mothers of healthy full-term infants, it also appears to contribute to increasing breastfeeding incidence and duration among preterm/LBW infants. It can be assumed that personnel of a neonatal unit in a baby-friendly hospital adapt their guidelines to approach the intentions of the BFHI. This assumption was supported by the observation of a “spillover effect” of the BFHI in an American hospital, with an increase in the proportion of preterm infants in the neonatal intensive care unit receiving any breast milk at the age of 2 weeks from 28% to 66%.¹⁰ In Sweden, where all hospitals were certified as baby friendly between 1992 and 1995, a process of recertification is going on.

Factors That Act as Support or Obstacles to Breastfeeding in Neonatal Care

Breastfeeding Culture

The general attitude to breastfeeding in society at large probably provides the major explanation of breastfeeding outcome for full-term as well as preterm infants. In settings where breastfeeding is considered the norm for infant and young child feeding, health personnel take it for granted that mothers intend to breastfeed. Mothers of preterm infants and personnel share a common positive attitude to breastfeeding and strive at approaching “normalcy.” Sweden can be defined as a breastfeeding culture, wherein the majority embraces the opinion that all women can breastfeed and regard breastfeeding as a distinctive feature of a good mother. Postdischarge breastfeeding support is available free of charge at neighborhood child health centers (CHCs). According to the latest national annual breastfeeding statistics for children born in 2002, including nearly 100% of all children born during 1 year, the overall/full breastfeeding rates at the age of 1 week were 98.1% vs 91.0% and the corresponding rates at 2, 4, and

6 months were 91.9% vs 79.3%, 83.2% vs 68.0%, and 72.6% vs 31.5%, respectively.¹¹ A Swedish experimental study of early discharge versus standard neonatal care illustrated that this breastfeeding culture also pervades neonatal care.¹² Children in an early discharge group and children in a control group were breastfed to the same extent up to the age of 6 months as those in the national breastfeeding statistics.

Insurance Systems

The issue of breastfeeding outcome cannot be discussed without recognizing huge differences between countries in mothers’ right to leave of absence from work in connection with childbirth and the extent to which insurance systems—national and private—provide any maternal allowance after childbirth. Swedish mothers’ opportunity to establish successful breastfeeding and to continue breastfeeding for a prolonged period is facilitated by a generous legislation and a national health insurance that entitles mothers a leave of absence from work with 80% of their salary for about 1 year after their child’s birth and during their child’s hospitalization.

Restrictive Guidelines

Restrictive criteria for the introduction of breastfeeding preterm infants still appear in some settings. A common criterion is that infants must attain a certain maturational level such as a postmenstrual age (PMA, gestational weeks from the first day of the last menstrual period) of 34 weeks or 32 weeks.^{13–16} It has also been suggested that infants at a PMA of less than 32 weeks should only be allowed to suck at their mother’s emptied breast, whereas mothers of infants at a higher PMA can be allowed to breastfeed without any such restriction.¹⁷

Lack of Knowledge About Preterm Infants’ Breastfeeding Capacity

Restrictive approaches to the introduction and advancement of breastfeeding may partly be attributed to the lack of sufficient evidence for the development of preterm infants’ breastfeeding capacity. In the absence of such knowledge, data on infants’ sucking response to nipple (bottle) feeding appear to have been inferred to breastfeeding. The conclusion in a study of bottle feeding, in which apnea, bradycardia, and oxygen desaturation were noted during sucking, was that “in most preterm infants respiratory control during feeding is still immature at 35–36 weeks.”¹⁸ Comparisons of infants’ physiological responses

to breastfeeding and bottle feeding have confirmed these results. Negative effects observed in connection with bottle feeding are uncoordinated sucking and swallowing, reduced breathing, higher incidence of apnea (breath pause >20 seconds), higher incidence of oxygen desaturation and lower oxygen saturation, progressive postfeed decline of transcutaneous oxygen pressure, bradycardia, and lower temperature.^{19–22} However, whereas sucking distress was observed during bottle feeding, physiological stability was noted when the same infants sucked their mother's breast from a PMA of 32 weeks.²¹

The first detailed description of preterm infants' sucking pattern at the breast appeared in 1987, when Meier and Anderson²¹ reported a burst-pause pattern in infants at 32 to 36 weeks, initially with short sucking bursts of three to seven sucks or isolated sucks. A few days later, some infants managed bursts of 10 to 15 consecutive sucks. A different approach in the description of preterm infants' sucking competence was taken by Martell et al,²³ who defined "efficient sucking" in terms of milk intake. A mean intake of 12 milliliters per kilogram body weight at each feeding was observed between 32 and 36 weeks. Some authors have recommended that an infant's readiness to feed should be tested by assessing the infant's capacity for active sucking (eg, by evaluation of sucking vigor during pacifier or finger sucking).¹⁴ A common opinion is that efficient oral feeding requires a mature sucking pattern with coordination of sucking, swallowing, and breathing. It may be assumed that the interpretation of preterm infants' oral motor behavior as either an inability to cope with oral feeding because of the risk of physiological compromise or a behavior that lacks the characteristics of a mature sucking pattern observed during bottle feeding has contributed to restrictive guidelines for breastfeeding in neonatal units.

Models of Care That Support Breastfeeding

Kangaroo Mother Care

At the same time, as practices that evolved in many industrialized countries stipulated assessment of preterm infants' readiness to feed and caution in the introduction of breastfeeding, the Kangaroo Mother Care (KMC) method was launched in Colombia in 1978, with mother-infant skin-to-skin (STS) contact and breast milk feeding/breastfeeding as key components.²⁴ The KMC method rapidly received increasing attention, both in industrialized and low-income countries. In a multicenter study of KMC, the breastfeeding/breast milk feeding rates at discharge were 83%, 98%, and 80%.²⁵

Whereas the original KMC model was implemented in low-income countries, the approach in the Western world took a somewhat different course. The terms *skin-to-skin care* and *kangaroo care* (excluding "mother") became common. Infants' physiological response to the method^{26–28} and psychological effects on parents were investigated.^{29–31} Although a major part of research emphasized safety aspects, some authors also described improved lactation and breastfeeding.^{32,33} Bier et al³⁴ noted that 90% of mothers with STS contact continued breastfeeding during their infants' hospitalization versus 61% in a control group with "standard contact." After the appearance of extensive evidence of the benefits of KMC, the International Network on Kangaroo Mother Care published recommendations for application of the model.³⁵ For settings with ample resources, the network recommended that "KMC can be applied to LBW infants of any post-conceptual age from 28 weeks and onward, of any gestational age (GA), of any weight (as low as 600 g), . . . as tolerated by the mother-infant dyad, by the family and by the health care system. . . and can also be continued after discharge." In 2003, the World Health Organization included KMC among methods that are recommended for the provision of high-quality neonatal care and published guidelines for practical implementation.³⁶

Evaluation of early discharge of LBW/preterm infants and follow-up programs has shown that the KMC model of care results in shorter duration of hospital stay and higher breastfeeding rates. For instance, overall breastfeeding and exclusive breastfeeding were more common in Mexican KMC infants with early discharge as compared with infants from a control group (88% vs 70% and 80% vs 16%, respectively).²⁵ However, no significant differences were found in a Swedish study in the incidence of overall and full breastfeeding between infants with early discharge and those with standard neonatal care.¹² This lack of difference was attributed to adequate nursing support after discharge in both groups.

Humane Neonatal Care

At approximately the same time as the KMC was established, another innovative model of neonatal care was launched in Tallin, Estonia, *Humane Neonatal Care*.³⁷ The key concept of this model is that a newborn infant and the mother form a closed psychosocial unit that should not be separated. A nurse's main task is to serve as a facilitator of the maternal role, with strictly defined functions related to procedures that require professional education. Parent rooms should be available in the neonatal intermediate care unit in which the mother (and father when permitted by the circumstances) rooms in with her baby throughout

her baby's hospitalization and breastfeeding is established before the baby's discharge from the hospital.

Convention on the Rights of the Child

In 1992, the Nordic Association for Sick Children launched a Nordic standard for children in hospital and medical care³⁸ based on the United Nations Children's Fund Convention on the Rights of the Child.³⁹ This standard includes children's right to have their parents together with them at all times and parents' right to accommodation without costs and to participation in their child's care as core components. It goes without saying that these changes have exercised considerable influence on breastfeeding outcome in infants who require neonatal care.

Developmentally Supportive Family-centered Care

A list of possible reasons for differences in breastfeeding outcome in infants requiring neonatal care would be incomplete without including developmentally supportive family-centered care. The basic concept behind this model is that infant development is enhanced by modification of care and the caregiving environment according to an infant's current maturational stage of central nervous system development, which is made possible by means of strategies for support of the infant's own activities for self-regulation. A clinical model for structured infant assessment and a program for providing neonatal care in harmony with the infant's current developmental stage and medical condition were developed by Als et al,⁴⁰ the *Newborn Individual Developmental Care and Assessment Program* (NIDCAP). According to the NIDCAP, an infant's response can be observed in autonomic signs, motor behavior, behavioral states, and activities related to interaction with the social and physical environment and self-regulation. The interaction between an infant and a parent or professional is conceptualized as a dialogue in which both participants exert a mutual influence on each other. The sensitive caregiver modifies his or her behavior and the environment according to the infant's ongoing responses. In contrast, when the caregiver acts mainly according to his or her own agenda, the infant responds by increasing incidence and severity of signs of sensitivity. The application of developmentally supportive care facilitates decisions about the introduction, timing, and progression of oral feeding based on an infant's threshold of tolerance.⁴¹ Very preterm infants who received care structured according to regular NIDCAP observations attained full oral feeding earlier than infants given conventional care.⁴⁰

The NIDCAP program particularly emphasizes the parents' unique role in their infant's life. In the feeding context this means (a) enabling parents to be present in the unit, to participate in the decision-making process regarding their infant's feeding on equal terms with the hospital professionals, and to take over the responsibility for their infant's care and feeding as soon as possible and (b) giving the highest priority to breastfeeding.

Hospital Feeding Practices That Support Breastfeeding for High-risk Infants

Early Frequent Breast Milk Expression

Initiation as soon as possible such as beginning before 6 hours postdelivery³³ of regular and frequent milk expression (eg, seven times per 24 hours)⁴² has shown significant effects on milk production. In settings with ample resources, lactation is initiated and maintained by the use of an electric breast pump, preferably with a double-pumping system.⁴³ Breast massage in connection with pumping has also been proven to increase milk production.⁴⁴ Early attainment of a milk production that exceeds infants' current needs should be supported.⁴⁵ In settings with limited resources, manual expression is used successfully by mothers of LBW infants.⁴⁶ In industrialized countries, manual expression is mainly used as a complement to breast pumps. Swedish mothers of infants admitted for neonatal care usually borrow an electric breast pump free of charge from the hospital for use at home during their infant's hospitalization and most mothers are offered instructions in manual expression.

Avoiding Bottle Feeding

Different strategies for the transition from full enteral feeding to breastfeeding have been suggested. The exclusion of bottle feeding is a recommendation that has been included in several reported strategies. Compared with preterm infants who received bottle supplements, infants who received supplementation by nasogastric tube were more likely to be breastfeeding at discharge.⁴⁷

Cup Feeding

Another type of feeding program for preterm infants based on the use of cup feeding and the exclusion of bottles was described in Kenya in 1987.^{48,49} A similar protocol was presented in the United States in 1990, which



Fig 1. Mother cup feeding her preterm baby (34 weeks).

included initiation of breastfeeding in stable preterm infants from 30 weeks.⁴⁶ In the United Kingdom, Lang⁵⁰ recommended using cups as an alternative oral feeding method for preterm infants from 30 weeks and for infants with uncoordinated suck and neurological conditions. In an Indian study, cup feeding was readily accepted by stable preterm infants from 29 weeks.⁵¹ Cup-fed infants rapidly increased their volume of intake, and nurses did not find the method time consuming.⁵² Comparisons between preterm infants' response to bottle feeding and to cup feeding have demonstrated lower heart rates, higher oxygen saturations, and a lower incidence of desaturations during cup feeding.^{53,54} Dowling et al,⁵⁵ who also found adequate breathing during cup feeding, noted considerable spillage of milk. In an evaluation of cup feeding, Swedish neonatal nurses shared the opinion that the method was easy to use but recommended that spillage is measured to ensure intake of the prescribed milk volume.⁵⁶ They also emphasized that it is important to make sure that parents receive adequate practical instructions about the method (Fig 1).

Nipple Shield

Mothers' use of a nipple shield when breastfeeding their preterm babies was associated with longer sucking bursts, longer periods of wakefulness, and higher milk consumption.⁵⁷ Indications for nipple shield use by these mothers were that the infant had difficulties in latching on to or in staying fixed at the breast and when infants needed a reminder of sucking when they kept falling asleep at the breast.

Test Weighing

Mothers' primary concerns after hospital discharge were worries about their milk production and milk transfer to their infants and as to whether the baby consumed an adequate volume of milk by breastfeeding alone.^{58,59} The use of test weighing in this situation was supported by Kavanaugh et al.⁵⁹ Lemons and Lemons⁶⁰ suggested that test weighing supports breastfeeding because it is helpful for planning appropriate supplementation. In a study of test weighing in the hospital, no differences in breastfeeding confidence and competence were found between mothers of preterm infants who used test weighing and those who did not.⁶¹ An alternative to test weighing is to reduce supplementation gradually according to a schedule. A third approach is to base decisions about volume of supplementation on the assessment of an infant's sucking vigor and pattern and sounds of audible swallowing, so-called *clinical indices* of milk intake. However, an investigation of mothers' and nurses' observations of clinical indices revealed that it is not a reliable method for the evaluation of milk intake.⁶² In Swedish neonatal units, practices diverge regarding the optimal strategy for transition from enteral feeding to breastfeeding.

The Development of Breastfeeding Capacity in Preterm Infants: A Swedish Study

Policies for breastfeeding of preterm infants are based on health professionals' perception of what can be expected from these infants and what is beneficial for them and their mothers. The lack of sufficient evidence in this field was the impetus for research performed at the neonatal unit of the University Children's Hospital, Uppsala, Sweden, one of seven regional/university hospitals. The unit has 26 beds, with 14 beds for intensive care, including neonatal surgery. The aim of the research carried out in this unit was to provide data that could guide the establishment of a culturally congruent program for feeding practices and breastfeeding in this setting.

Preterm Infant Breastfeeding Behavior Scale

To capture infants' optimal breastfeeding performance in a prospective, descriptive study, a method for direct observation by professionals and mothers, the Preterm Infant Breastfeeding Behavior Scale (PIBBS), was developed in collaboration by researchers and mothers.⁶³ The scale provides operational definitions and measurements of levels of competence in rooting, how much of

the breast was inside the baby's mouth, how long the infant latched on and stayed fixed to the nipple (longest episode in minutes), sucking bursts, longest sucking burst, and swallowing.

Developmentally Supportive Breastfeeding Guidance

Items relevant for the provision of developmentally supportive breastfeeding guidance were formulated on the basis of NIDCAP observations of very preterm infants during breastfeeding.⁶⁴ These items related to modification of the physical environment and mother-infant interaction and are included in a checklist practical for developmentally supportive breastfeeding. The other items in this checklist were based on relevant research and clinical experience in the study unit (Appendix A).

Evidence of Early Breastfeeding Competence in Preterm Infants

A convenience sample of 71 mothers used the PIBBS as a breastfeeding diary throughout their baby's hospital stay. The infants, without serious illness, were singletons, born at a GA between 26 and 35 weeks.⁶⁵ Breastfeeding was initiated as soon as the infants were able to breathe without ventilator or continuous positive airway pressure (CPAP), irrespective of current maturational level, age, or weight. The mothers received breastfeeding counseling in connection with weekly PIBBS observations. As soon as there was any sign of milk intake, test weighing was performed before and after each breastfeed.

The first breastfeed occurred at a PMA of 27 weeks (Table 1). Regardless of PMA on the first day with breastfeeding, all infants with data ($n = 36$) showed rooting and latched on, half of them efficiently with part



Fig 2. Mother breastfeeding her preterm baby (32 weeks).

of the areola inside the mouth. Nearly all infants showed occasional sucks or sucking bursts. Obvious rooting, efficient areolar grasp, and long periods of staying fixed were observed as early as at 28 weeks. Some infants attained repeated long sucking bursts (≥ 10 consecutive sucks) and very long bursts of 30 sucks or more at 32 weeks. Nutritive sucking, defined as intake of 5 milliliters or more, verified by test weighing, was observed at 30 weeks, whereas repeated audible swallowing was observed at 31 weeks. Intake of more than 80% of the prescribed daily volume was observed at 32 weeks.⁶⁶ Ninety-four percent of the infants were breastfed at the time of their discharge from the hospital, 80% fully and 14% partly. Full breastfeeding was achieved at a median of 36 (range, 33–40) weeks. On the first day with full breastfeeding, some infants showed very long sucking bursts, whereas other infants did not show any repeated long sucking bursts at all. The conclusions of this study were that guidelines for initiation of breastfeeding in preterm infants be based on cardiorespiratory stability, regardless of current PMA or postnatal age or weight and that a mature sucking pattern is not necessary for achievement of full breastfeeding (Fig 2). Less-efficient feeding performance in these infants was explained by lower birth weight, duration of ventilator and oxygen treatment, medical treatment of apnea, infections, and exposure to bottle feeding.⁶⁷ A shorter gestation was associated with higher performance during postmenstrual weeks 32 to 37. A maternal characteristic

Table 1. Developmental Milestones in the Progress of Breastfeeding in Preterm Infants

Events	n	PMA [median (range)]	PNA [median (range)]
Initiation of breastfeeding	71	33.7 (27.9–35.9)	1 (0–20)
Nutritive sucking (≥ 5 mL)	71	34.3 (30.6–37.7)	8 (1–46)
Full breastfeeding	57	36.0 (33.4–40.0)	19 (2–68)

PNA indicates postnatal age.

associated with higher infant competence was previous breastfeeding experience.

Another study, in which surface electromyography was used for investigation of sucking activities in 26 infants at 32 to 37 weeks, illustrated the variability in preterm infants' activities when positioned at their mother's breast. The proportion of time spent sucking ranged between 10% and 60% of a breastfeeding episode.⁶⁸ The corresponding range in the ratio of mouthing was 2% to 35% and that for pauses between bursts was 12% to 67%. The longest sucking burst ranged from 5 to 96 sucks (this long sucking burst was noted in an infant at 34 weeks). These results indicated that restrictions in the duration of breastfeeds (motivated by a perceived risk of exhausting the baby) are unnecessary because many infants spend a lot of time at the breast resting.

Feeding Policy : A Swedish Example

A feeding policy based on the research described earlier was developed in the study unit in connection with the study. The core of the policy is a conceptualization of the parent as an infant's primary caregiver. Since then, some components in the policy have been revised in response to new research findings and ongoing clinical experience. The main contents of the current policy are described below. The aims of the feeding policy are described in [Table 2](#).

Information Before the Delivery

When there is enough time, mothers (and fathers) admitted for impending preterm delivery are given information about how the infant will be fed, the lactation process, and the benefits of breast milk and the value of

initiating breast milk expression as early as possible. They are also told about STS holding and when the mother can commence breastfeeding.

Breast Milk Expression

Mothers of infants who cannot be fully breastfed immediately after birth are advised to initiate breast milk expression as soon as possible (if possible within 2 hours) of birth and to express their milk regularly, with the goal of expressing milk for a minimum of eight times per day, including that at night. Double pumping, combined with gentle breast massage, is recommended. An electric breast pump for use at home is provided without charge during an infant's hospitalization. Mothers in the neonatal unit can express their milk in a separate "pumping room" or at the infant's bedside.

Skin-to-skin Contact

Physical contact between the parents and the infant is encouraged. Infants who are ventilated are provided STS contact as soon as they show adequate physiological stability in connection with transfer out of and back into the incubator. For infants born at a GA of less than 28 weeks or with a birth weight of less than 1000 grams, STS contact is usually avoided during the first week of life as a means of preventing hypothermia. Other than signs of severe infant physiological instability (severe bradycardia, apnea, or desaturation), there are no restrictions for STS contact in frequency or duration.

Tube Feeding

Tube feeding is used when an infant cannot be fed at the breast or by cup because of prematurity, medical problems, or exhaustion. Infants who are fed every 2 hours and infants who cannot be fed orally because of serious illness have an indwelling oral tube. (A nasal tube is generally only used in infants who will require tube feeding for a prolonged period after discharge.) Infants who are fed every 3 hours and infants who only require occasional tube feeding usually have a new tube inserted and removed in connection with each feed. All infants not held at their mother's breast during tube feeding are offered the opportunity to suck a pacifier during each tube feed and are offered a small portion of breast milk (a maximum of 0.5 milliliter at the beginning of each tube feed) by gentle administration via a syringe on one side of the tongue. This also covers infants with ventilator or CPAP treatment ([Fig 3](#)).

Table 2. Aims of a Feeding Policy

Aims of the Feeding Policy in the Study Unit
To support optimal infant growth
To satisfy the infant's need for sucking
To achieve a feeding situation that is as normal as possible concerning parent-infant contact and the physical environment
To entrust parents with the normal parental task of feeding as soon as possible
To enable mothers to breastfeed
To terminate a regulated feeding schedule with fixed times and volumes as soon as possible
To support exclusive breastfeeding



Fig 3. Intraoral administration of breast milk to infant with CPAP.

Initiation of Breastfeeding

Breastfeeding is the first oral feeding method to be introduced and is initiated as soon as an infant (*a*) has been weaned off the ventilator and CPAP and (*b*) does not show any sign of severe instability, regardless of current PMA, age, or weight. (Exceptions can be made for infants given CPAP treatment who are sufficiently stable and show interest in sucking.) If possible, the mother is offered practical breastfeeding guidance the first time she positions her infant at the breast. Suggestions are given regarding alternative breastfeeding positions, and a breastfeeding observation is made.

Breastfeeding sessions are not restricted in frequency or duration. Breastfeeding mothers in the maternity unit are encouraged to come for breastfeeding at night as well and, upon agreement, the nurse in charge calls her on the telephone when her infant wakes up. When the mother leaves the neonatal unit, she is asked to inform the nurse in charge about when she plans to visit the next time and how she can be reached (eg, by telephone or cellular phone).

Transition From a Regulated Feeding Schedule to Demand Breastfeeding

Initially, a regulated feeding schedule is used and the milk volumes per feed are prescribed by a neonatologist. With the exception of infants who demonstrate milk intake during breastfeeding, infants are fed every 2 or 3 hours,

depending on current weight and tolerance of milk volumes (infants with a weight of around 1500 grams or less are usually fed every 2 hours).

Test weighing is introduced at the first sign of milk intake at the breast, verified by audible swallowing or by the appearance of fresh milk in connection with assessment of feeding tube location. Breastfed infants with a regulated feeding schedule (fixed times and volumes) are weighed before and after each feed. The goal of test weighing is to reduce the number of tube feeds and the duration of an infant's exposure to a tube and to facilitate the earliest possible attainment of exclusive breastfeeding. The assessment of an infant's need of supplementation (including the timing and volume of supplementation) and feeding method is made jointly by the mother and nurse in charge.

When the infant achieves an intake of about half of the volume of milk prescribed for a feed (once is enough), the regulated feeding schedule is terminated. Instead, a semi-demand feeding schedule is introduced. A total daily volume of milk is prescribed, whereby the infants feed whenever they want to suck. Thus, the feeding frequency of a breastfed baby is highly individual. To reach the daily target intake, test weighing is continued, the volumes of milk taken at the breast are accumulated, and supplementary feeds are given by cup or tube when required. The mother is encouraged to place the infant at the breast (*a*) whenever the infant shows any sign of rooting according to the PIBBS and (*b*) when a maximum of about 3 hours has passed since the last breastfeed. She is reminded that a variable intake pattern is normal for a breastfed infant. Test weighing is usually discontinued when the infant has reached full breastfeeding or full oral feeding (mixed breastfeeding and bottle feeding). However, exceptions to this rule can be made depending on the mother's perception of this practice as helpful or stressful. Thereafter, the infant is only weighed once a day or every second day initially to ensure adequate weight gain. A demand feeding schedule can be introduced when the infant wakes up spontaneously for a sufficient number of feeds per day, which normally occurs when he or she reaches term age.

Alternative Oral Feeding Methods

Cup feeding is the first choice as a viable alternative oral feeding method when full oral feeding cannot be achieved wholly by breastfeeding. Cup feeding is normally introduced from a PMA of 32 weeks or earlier, depending on infant stability. A cup is used in the mother's absence and in a situation when an infant is awake after a breastfeed has not taken enough milk and does not want to continue sucking. In (unusual) situations when a mother

Table 3. Observations Based on the PIBBS With Related Practical Support to the Mother

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1. Rooting

Signs of rooting: mouth opening, lip movements, directing lips forward, tongue extension, sucking movements, head turning, hand-to-face/mouth movements.

Obvious rooting: simultaneous mouth opening and head turning.

Support. Suggestions to the mother: touch the infant's lips with your nipple or finger to stimulate rooting. Express some milk on the infant's lip or pour some milk on the nipple from a medicine cup to give stimulation by taste. Touch the infant's cheek. Preterm infants initially respond to this stimulus with restless motor activity, whereas full-term infants show head turning as part of the rooting reflex. Inform the mother that crying is a late hunger cue: the infant has been awake and rooting for some time and has lost his temper. Preterm infants do not necessarily cry in this situation and fall asleep instead.
 2. Areolar grasp. What is inside the infant's mouth when he or she latches on?

Nipple (whole or part): mouth not wide open.

Nipple and part of areola: mouth wide open, chin pressed into the breast, tip of nose in contact with the breast (this facilitates contact between the nipple and the hard palate, which elicits the sucking reflex).

Support. Observe the position of the mother and infant: need of improvement? Suggestions to the mother: stimulate the rooting reflex (touch the infant's lips), touch the infant's palm, and then wait until the infant shows a wide open mouth with the tongue down; pull the infant closer, pressing the infant's bottom closer to your trunk.
 3. Longest duration of staying fixed at the breast.

Does the infant latch on and then lets go or slides off immediately?

Does the infant stay fixed?—If so, for how long (assessed from <1 minute up to several minutes; can be specified as an exact number of minutes or 5-10 minutes, 15 minutes, or longer)?

Support. Observe the mother's and infant's positions: do they need any improvement? Give the mother suggestions about how she can encourage her infant to root and latch on more efficiently (see above). Discuss the infant's response to touch, sounds, and visual input and how these stimuli can be adapted to the infant's current threshold of tolerance.
 4. Sucking. Observations of movements of the infant's mouth, cheek, jaw, temple, and under the chin. The mother feels these movements.

Licking and tasting: these behavioral components are observed more or less in all infants during breastfeeding, regardless of maturational level or age.

Single sucks, occasional short sucking bursts (two to nine consecutive sucks).

Repeated (two consecutive bursts or more) short sucking bursts, occasional long sucking bursts (10 consecutive sucks or more).

Repeated long sucking bursts.
 5. Longest sucking burst: maximum number of consecutive sucks before a pause.

Support. Suggestions to the mother: talk to the infant in a soft voice. Depress the breast gently in front of the infant's nose; this makes the nipple touch the hard palate and may elicit the sucking reflex. Touch the infant's palm. Change the infant's position. If the infant does not suck at all despite being awake, provide the infant with a period of nonnutritive sucking before placing him at the breast by inserting the tip of a finger into the infant's mouth being sure to touch the hard palate.
 6. Swallowing. Discrete sound when the airways close; appears as a gulping sound in case of a rapid milk flow.

Occasional sounds of swallowing.

Repeated sounds of swallowing: rhythmic pattern of sucking and swallowing.

Support. Tell the mother that it is difficult to perceive this sound, especially in a noisy environment. Inform her that it is impossible to estimate the ingested volume accurately by mere assessment of duration and vigor of sucking and sounds of swallowing. Finally, you need to tell the mother that the only way to make an accurate assessment of volume of milk intake is to test weigh.

Nipple shield. A nipple shield is a practical tool for the solution of certain problems, but only as an absolute last resort after the mother has tried all other possible interventions without any improvement despite repeated trials. For preterm/sick infants, a nipple shield has several functions. Because it is firmer than the mother's nipple tissue, it provides more distinct stimulation of lips, tongue, and hard palate than the maternal nipple. This enhances the elicitation of rooting behavior and sucking. Other effects include helping the infant to latch on to a large, firm, or engorged breast or to a flat or retracted nipple as well as preventing the infant from sliding off the breast during pauses. In addition, it may contribute to increased milk intake because it serves the function of a container that holds milk that flows during pauses in sucking.

Support. Tell the mother about the indication for use of a nipple shield and the expected effect and then ask her whether she would like to use it. Inform her of the special importance of verifying that the infant latches on correctly. The choice of nipple shield size (small or large) is based on the infant's mouth size, breastfeeding behavior, response to the shield, and the size of the maternal nipple.

Recommend trying to breastfeed without the nipple shield sometimes to evaluate the infant's capacity for managing without it and to discontinue use once she has reached sufficient confidence in breastfeeding.
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cannot breastfeed or does not intend to breastfeed, cup feeding is the first choice as an oral feeding method in preterm infants.

Bottle feeding is used in exceptional situations such as when the mother (*a*) is unable to breastfeed for medical reasons, (*b*) does not intend to breastfeed, or (*c*) explicitly demands to use a bottle. The bottle is introduced when the infant approaches term age or when the time of discharge is approaching. Mothers who intend to breastfeed are informed of the advantages of cup feeding and the reasons for a restrictive attitude toward the use of bottles.

Parental Participation in Feeding

Parents are offered the opportunity to learn how to tube feed as soon as the infant shows sufficient physiological stability during feeding. Preferably, the infant is held by a parent while he or she is fed. Infants who have commenced breastfeeding can be tube fed at the mother's breast. Before parents cup feed the first time, a nurse

demonstrates how to hold the baby in an upright position and how to hold the cup.

Parental Presence in the Unit

Mothers of infants in intensive care are offered the opportunity to stay in a reclining chair at the infant's bedside or in a parent room inside or near the neonatal unit. Parent rooms in the intermediate care nursery are available and mothers are encouraged to live in and eventually room in at least during the concluding part of their infant's hospital stay. Mothers who spend the day in the unit but prefer to sleep at home are offered a bed in a parent room for rest and relaxation during daytime (depending on availability).

Early Discharge and Home Care

Criteria for transfer to home care are medical stability, absence of apneic episodes, ability to maintain normal

Table 4. An Example of a Preterm Infant's Breastfeeding Progress

Age (days)	PMA	Weight (grams)	Tube	Breast	Events
0	30 + 5	1525	2 ^{a,b}		Infant tube fed every 3 hours from the age of 1 hour: donor breast milk and colostrum
1	30 + 6	1525	7 ^b	1	Initiation of breastfeeding
2	31 + 0	1495	8	2	Nurses' report sheet: "Sucks very well, hungry"; introduction of test weighing
4	31 + 2	1425	8	4	Lowest weight, 6.6% weight loss; mother transfers from maternity unit to parent room in the neonatal unit
5	31 + 3	1455	4	9	Milk intake nine times: 1-25 milliliters; infant begins to gain weight
6	31 + 4	1445	4	8	
7	31 + 5	1475	2	6	
8	31 + 6	1495	4	7	
9	32 + 0	1530	3	7	Infant regains birth weight
10	32 + 1	1555	1	9	Infant transferred from incubator to water bed in an open crib; discontinuation of regulated feeding schedule
11	32 + 2	1555	0	8	Exclusive breastfeeding; volumes, 20-50 milliliters; nurses' report sheet: "Infant spent the night in her mother's bed"
12	32 + 3	1595			Test weighing is discontinued
13	32 + 4	1605			
14	32 + 5	1645			The water bed is removed from the crib and physiological monitoring is terminated
15	32 + 6	1650			Early discharge for care at home by the parents
16	33 + 0	1690			
17	33 + 1	—			
18	33 + 2	1749			Formal discharge from the hospital; responsibility for follow-up is taken over by child health services and the hospital neonatal follow-up outpatient clinic

Infant: GA at birth, 30 weeks + 5 days; birth weight, 1525 grams; length, 41 centimeters; female. Duration of ventilator treatment, 8 hours; CPAP, 12 hours. Age (PMA) is expressed as weeks + days.

^aBorn in the evening.

^bFasting 6 hours after extubation.

body temperature in an open crib (with clothes, cap, and adequate bedding), some oral intake (breast, cup, or bottle), and adequate weight gain. Parental criteria are readiness to take the infant home, ability to feed by tube or cup, and reported confidence in taking over care of the infant. Scales are provided free of charge for test weighing and monitoring the infant's weight gain. Communication about the infant's growth and planning of the infant's feeding occur over the telephone. The infant's care plan is discussed during daily rounds in the nursery. In addition, the nurse in charge has daily contact with the parents over the telephone. The parents also have access to telephone counseling by a nurse and a neonatologist round the clock and can return to the hospital with their baby whenever they wish. A minimum period of 1 or 2 days at home (with telephone support) before the infant's formal discharge from the hospital is generally required as a trial period. Home visits by a nurse are provided in case of a prolonged period of home care. Relevant information about the infant including breastfeeding status are given to the district health nurse at the neighborhood CHC before discharge.

Follow-up After Discharge

After formal discharge from the hospital, strict monitoring of an infant's growth, nutrition, health, and development is provided by the CHC and the hospital neonatal follow-up clinic according to a scheduled program. The nurse at the CHC makes a home visit within a few days after the infant's discharge. The mother has access to telephone counseling and can visit the CHC on weekdays for weighing her baby and for advice.

Observations Based on the PIBBS With Related Practical Support to the Mother

The PIBBS items with operational definitions and information and recommendations that may be relevant depending on observed infant behavior are presented in Table 3.

The application of the feeding policy and the model for breastfeeding support to a very preterm infant and her mother is illustrated by the case report of a girl born at a GA of 30 weeks plus 5 days as shown in Table 4. This infant had a fairly smooth adaptation to extrauterine life and commenced breastfeeding 2 days after birth. She and her mother were allowed optimal opportunities to be together and breastfeed. The mother's feeding plan aimed at giving breastfeeding the highest priority. This enabled her to reach full breastfeeding 11 days after the delivery and to take her baby home—initially with the assistance

of the home care program—at the age of 15 days, 3 days before the infant was formally discharged.

Discussion

The generalizability of breastfeeding outcome in infants requiring neonatal care (especially preterm infants) in different settings must be assessed with caution. Innumerable factors covary as support or obstacles to breastfeeding. Because of this, a strategy that is successful in one setting may be difficult to import into or even be totally unsuitable for another setting. Swedish mothers' right to maternal leave after childbirth, parental allowance, and availability of parent rooms in hospital reduces the period of mother-infant separation and facilitates the establishment and continuation of breastfeeding. Social, financial, and legal circumstances require political measures for achieving change and necessitate diverging strategies in different settings. It is essential that health care and hospital professionals join forces with other "good" forces to bring about change in this type of political barrier to breastfeeding. It may be easier to modify structural factors (eg, the design of hospital facilities) for enabling mothers to be present. The development of a breastfeeding culture such as that in Nordic countries can be expected to take decades to stabilize and pervade a population.

The feeding policy presented here is an attempt to integrate research data obtained in the study setting and practices developed in other parts of the world—after careful evaluation of their practical applicability. The contents constitute an attempt to modify the BFHI to clinical reality in the study unit. It should be regarded as an example and not as a model to be copied. To provide consistent care, each neonatal unit should involve all professionals in discussions about the philosophy underlying its feeding policy and in concrete definitions of practices. Equal attention should be paid to (a) the establishment of a research-based feeding policy, (b) the provision of a developmentally supportive family-centered environment, (c) individual guidance to mothers with the aim of supporting a sensitive "dialogue" with the infant, and (d) empowerment of mothers and fathers in their roles.

A holistic model for clinical breastfeeding observation of preterm and infants should include infants' reactions to all types of stimuli in physiological response, movements, facial expressions, and behavioral states, the mothers' and infant's positions, and environmental factors—in addition to items related to infants' behavior directed at the breast. A similar model of structured feeding assessment in the neonatal intensive care unit, with a focus on bottle feeding, was suggested by Glass.⁶⁹

Some of the components in the feeding policy may seem controversial. It still appears to be common practice to base decisions about initiation of breastfeeding on such defined criteria as current PMA or weight. The only criterion in the study setting is physiological stability in connection with handling. Some units advocate a systematic assessment of readiness to feed. In the study setting, this is considered unnecessary because the development of an infant's capacity for rooting, sucking, and swallowing commences very early during gestation. According to the dynamic motor theory suggested by Thelen and Vogel,⁷⁰ functional behavior may be observed long before the consistent appearance of a mature behavior and appropriate contextual support can "unmask" a behavioral pattern that could not otherwise emerge. Consequently, oral motor development occurs and is boosted as an infant is exposed to new stimuli provided by the maternal breast and breast milk touching the mouth and inside the mouth.

In the provision of contextual support, developmentally supportive care has a crucial function. Despite this, the NIDCAP model does not seem to receive the attention it deserves in the field of breastfeeding support to mothers of preterm and sick infants. The professional nurse's basic knowledge about infants' behavioral repertoire and strategies to help them in maintaining optimal physiological and behavioral stability is sufficient to make a difference in their breastfeeding capacity. In the optimal situation, certified NIDCAP observers contribute to the advancement of an infant's feeding progress by recommendations derived from structured observations.

A practice that is a target of controversy among neonatal nurses in Sweden and elsewhere is test weighing. Opponents maintain that this practice acts as an obstacle to a mother's attainment of confidence in breastfeeding without worrying about feeding frequency and volumes, which may lead to earlier weaning. At the same time, the use of clinical indices or a schedule for the reduction of supplementation can be questioned in that these procedures may result in underestimation of the infant's actual capacity for sucking and milk intake and, consequently, the continuation of supplementation with large volumes, which may delay the attainment of full oral feeding. Scientific evaluations need to be made in different settings of the impact of different strategies for the transition to full breastfeeding on long-term breastfeeding outcome in preterm and sick infants as well as a mother's psychological reactions to those strategies.

Another issue under continued debate among neonatal professionals is bottle feeding of infants whose mothers intend to breastfeed. Anecdotal evidence from the United States and Europe demonstrate that it is not uncommon for professionals to regard bottle feeding as harmless as long as the mother is sufficiently motivated to establish breast-

feeding. An argument for this opinion is a perceived lack of difference in breastfeeding rates between infants who are bottle fed as compared with those who experience other alternative feeding methods. This argument needs to be studied by evaluating breastfeeding rates (exclusive and partial) in infants with and without exposure to bottle feeding, preferably in randomized controlled studies. In some settings, cup feeding has not reached acceptance as a sufficiently safe method. This is surprising because existing research evidence has presented consistent evidence of positive effects of cup feeding, whereas bottle feeding has shown consistent association with cardiorespiratory instability in preterm and sick infants.

Ventilator treatment during a period of 1 month or more has been associated with dysfunctional oral motor behavior, or aversive behavior, when oral feeding is introduced at a later time.⁷¹ The emergence of oral aversion has been explained by the infant's exposure to repeated unpleasant and painful stimuli in the mouth. Early introduction of breastfeeding can be regarded as an intervention that may prevent such feeding problems. The inclusion in the Uppsala feeding policy of intraoral breast milk during tube feeding was based on the hypothesis that positive intraoral stimuli might have a protective effect against feeding aversion. Clinical observations of preterm infants' capacity for swallowing saliva provided the argument for the safety of this practice. It should be noted that all infants should be observed carefully during the administration of intraoral milk for evaluation of their response. Infants with neurological problems or severe illness and infants treated with sedatives or drugs that cause muscle relaxation are exceptions to this practice.

The case report was presented for several reasons: (a) to provide arguments for the benefit of adopting support of mothers' presence round the clock in the unit as soon as possible, (b) to illustrate the value of test weighing as a means of enabling preterm infants to show their optimal performance at the breast, reducing the use of supplementation, and (c) to demonstrate that the period required for infants' transition from full enteral to full breastfeeding does not need to be prolonged. In the study setting, the implementation of the feeding policy has been accompanied by a decreasing duration of hospital stay in breastfed preterm infants. The infant described here should not be regarded as a "model" for what can be expected of an infant born at the same GA; what should be given credit is that her feeding progress illustrates the possibility of emergence of an early capacity. Therefore, professionals are recommended to introduce "early intensive breastfeeding support" for evaluation of feasibility, acceptability, and outcome in their respective settings. The reader is reminded that this baby was discharged with a semi-demand feeding schedule (ie, her mother saw to it that her baby had an ample number

of feeds per day) until she reached sufficient neurological maturity to demonstrate consistent hunger cues often enough for adequate feeding frequency and growth. It must also be pointed out that a careful individual assessment was made of safety aspects, that her parents received proper training in infant care, and that the infant was included in a program for adequate follow-up.

Numerous factors contribute to the explanation of the high breastfeeding rates among Swedish infants requiring neonatal care, and it would be extremely difficult to evaluate the respective impact of all components. Today, Sweden is one of the leading industrialized countries concerning breastfeeding in general, and breastfeeding in preterm infants in particular, probably because of political-economic reasons as well as of the existence of a breastfeeding culture in society at large. The suggestion directed to Swedish neonatal care by Charpak et al⁷² of the Kangaroo Foundation in Bogotá is to extend the implementation of the KMC model, both in duration of daily STS contact between parents and their child as continuously as possible and in earlier discharge, as a means of humanizing neonatal care. This suggestion serves as a challenge and as a shining example of the fruitful exchange of knowledge and experience between different regions of the world, which will help infants in need of neonatal care and their families to return to a normal family life as soon as possible.

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Appendix A. Checklist for Developmentally Supportive Breastfeeding Guidance

General Environmental Aspects

Supportive Physical Environment

In the nursery, the mother can be offered privacy by a curtain, screen, or a partitioning wall or by placing an armchair that allows her to sit with her back turned against the room. A separate breastfeeding room, a parent room, or a parent lounge can be used, provided that the infant is allowed to leave the nursery. It is essential that the environment is as quiet as possible, with conversations taking place only when necessary and in a subdued voice. Make an effort to shield the infant's eyes from light and activity in the visual field. (Noise and visual input cause distraction, irregular respiration, and restless movements and reduce the time available for the infant for success in activities directed at the breast.)

Prevention of Stressful Events

Plan the infant's care to avoid stressful events from occurring before a breastfeeding session. For preterm and sick infants, common caregiving activities such as diaper change, washing, and bathing may constitute stressful experiences and deplete the infant's reserve of energy.

Physiological Monitoring

For infants with tendencies for apnea, bradycardia, and desaturation, continuation of physiological monitoring of heart rate, respiration, and oxygen saturation at the mother's breast is advisable. Once the infant has shown adequate stability during breastfeeding, monitoring can be discontinued and replaced by the mother's assessment of her baby's breathing pattern and skin color.

Armchair, Foot Stool, Pillow

Provide the mother with an armchair in the right height. Assist her in finding a comfortable, upright position that allows adequate support for her back and arms. Offer her a pillow as a positioning aid and a foot stool to rest her feet and to facilitate the infant's position close to her body at the same height as the breast.

Specific Aspects of Support During Breastfeeding

Kangaroo Mother Care

Encouragement of early, prolonged mother-infant STS contact without restrictions on frequency or duration is a fundamental strategy for support of lactation and breastfeeding.

The Nurse's Presence

Offer your presence in connection with the first few breastfeeding sessions by sitting down close to the mother or staying in the vicinity. This is done to guide the mother in her interaction with the infant and to answer any question that she may have.

Breastfeeding Positions

To avoid heat loss, especially if the infant is preterm, encourage the mother to hold her infant STS under her clothes, covered by a blanket, and perhaps also wearing a cap. Describe options for positioning the infant at the breast. Assist her in holding the infant close to her trunk, with the infant's head directed forward, with straight neck and trunk and flexed arms and legs (with the lower arm tucked around the mother's body under the breast). Explain that a preterm infant needs head support to be able to stay at the breast. Encourage the mother to try various positions. The overhand hold is the most practical position for small infants, followed by the football hold, although there are several alternative ways of achieving a functional position. Tell her about the preterm infant's response to touch and recommend that the mother should hold the infant with still hands once a comfortable position has been achieved. (Caressing, patting, tickling, and rocking usually result in a

response that acts as an obstacle to a successful breastfeeding episode such as squirming, arm and leg extension, arching head and trunk, pulling away from the breast, and irregular respiration with pauses.)

Guidance of Mother-infant Interaction

The professional's main task in connection with breastfeeding support is to guide the mother in her perception of the infant's ongoing behavioral signs as a means to promote a mutually rewarding interaction between the mother and infant. This is a prerequisite for the mother's development of confidence in reaching independence in her infant's care. The professional needs to point out to the mother how her baby communicates alertness and robustness, indicating availability for stimulation at the breast. The mother must also be prepared for signs that the infant is tired and needs to rest, suggesting that stimulation should be withheld. Interpretation of infant behavior according to the NIDCAP model as the basis for individual recommendations is used to enhance the infant's capacity for reaching a quiet awake and alert state, maintaining physiological balance and a comfortable, flexed position without restless movements. This will create optimal opportunities for the infant's activities directed at the breast.

No Unfounded Restrictions

The infant's time at the breast should not be restricted unless there are definite reasons such as a medical procedure that must take place at a certain time. Instead, the mother should be encouraged to allow the infant plenty of time to suck and rest between periods of activity.

Realistic Expectations on the Infant's Performance

Both professionals and mothers need to consider the infant's individual "history" and make reasonable demands. Maturation level alone cannot be applied as a criterion for expectation on the infant's performance in incidence and duration of periods of alertness, in sucking behavior, or in milk intake. The infant's GA at birth, past and present medical problems, and the normal variation in developmental progress and in infant individuality all contribute to each infant's developmental pattern.