

Quiet, Please: We're Still Growing!

The effect of external stimuli on **PRETERM INFANTS** is a relatively new field of research, and it has already led to significant changes in the ways such infants are cared for.



The number of infants who are born prematurely in the U.S. has almost doubled in the past decade.

THE DEVELOPMENT of neonatal care for these “preemies” is already a success story, and there’s no end in sight. The great progress made in neonatology in recent decades, thanks to new medications and innovative technology, has enabled clinics to deal with many medical problems, increasing the odds that a preterm infant will survive dramatically.

For many decades, the number of infants born in the U.S. before the end of the 37th week of pregnancy had held steady at seven percent. But in the last 10 years neonatologists have observed an increase in the frequency of premature births, to approximately 12 to 13 percent of all pregnancies. In particular, the number of very small preterm infants (those weighing less than 1,000 grams) has increased from 0.7 percent to approximately 1 percent of all newborns (Epidemiology and causes of preterm birth; Goldenberg RL, Culhane JF, Iams JD, Romero R.; *The Lancet* 2008 Jan 5; 371(9606):75-84). “In the area of neonatology we’re seeing an increase in the number of smaller preterm infants,” says Prof. Johannes Pöschl, Medical Director of the Clinic for Neonatology in Heidelberg, Germany. “The causes include pregnancies late in life, an increase in the stressors affecting the mothers, and developments in reproductive medicine.”

Stimuli disturb development

Premature birth can mean that a tiny infant leaves the protection of the uterus as many as 16 weeks before the normal birth date. At that age the infant’s brain is still largely smooth—a tabula rasa, in effect. A significant phase of its brain development

has just begun. The stimuli to which it is now exposed are completely different from those it experienced while still inside its mother’s body. Many of the stimuli are not pleasant, and some can even disturb the infant’s maturation process. “Today it’s no longer merely a question of the infant surviving by every medically possible means,” says Sabina Bitter, the pediatric nurse who heads the neonatology ward at the University Clinic in Essen. “We want the preterm infants to develop optimally, not only at the motoric but also at the neurological level. Twenty years ago people were less concerned about negative stimuli such as too much noise or glaring lights. We would cover the incubators with towels to shield the newborns a little. From the early 1990s on, newborns were cared for in line with the concept of ‘gentle care.’ The focus was on minimal handling and infant care in accordance with kinesthetic criteria. The infants were provided with small positioning cushions that provided boundaries. But for about the past three years we’ve been seeing great changes in the direction of family-centered care that promotes child development. This process started when we >

ABSTRACT Twelve to thirteen percent of all babies in the U.S. are born before their calculated birthdate. These preterm infants require a special kind of care, because in many cases their brain development has only just begun. Disturbing external stimuli in the incubator can lead to deficits in the babies’ later development. Special care concepts take these latest research results into account.

Caregivers learn the “preemie language” in the NIDCAP program

> began to care for our tiny patients according to the NIDCAP principle.”

She’s referring to the Newborn Individualized Developmental Care and Assessment Program, which Dr. Heidelise Als began to develop at the Children’s Hospital in Boston, U.S., in the 1980s. Studies of brain development suggested that certain characteristics which frequently occurred in preterm infants as they grew older—attention deficit disorders, learning difficulties and weak self-regulation processes—are partly due to the overwhelming sensory input to which these infants’ immature nervous systems had been subjected. Als’ desire to structure these initial life experiences ex utero in a way that was more appropriate for preterm infants inspired her to develop the NIDCAP program.

Individual elements of this standardized observation program, which is known as “developmental care,” are implemented in many ways in a multitude of clinics. The concept is not strictly defined, and as a result it can include all of the measures that promote the child’s sense of well-being and take its needs into account when evaluating pleasant and unpleasant stimuli. For example, “kangarooing”—carrying the infant next to its parent’s skin—is a normal practice today in neonatology units.

Intensive care medical personnel are also increasingly taking into account non-technical factors in order to avoid causing negative stress to the infants. That means trying to minimize factors such as lighting conditions, noises inside and outside the incubator and painful procedures such as taking blood samples. “If the manual activities that the nurses perform during their

rounds are carried out just when the child is in a rest phase, that too can cause stress,” says Pöschl. Even though all preemies are similar in their need for conditions that resemble a mother’s womb as closely as possible, each is also a tiny but very individualistic human being that grows, matures and changes its degree of sensitivity to stimuli. This is the point where NIDCAP as an individualized program sets in. The medical personnel who complete the training program in one of the 17 training centers in the U.S. and Europe learn something that could be called the “preemie language,” because these infants communicate very differently from children born on schedule. The staff learn to interpret around 100 different signs of disorientation, stress, defense and withdrawal or, alternatively, organization, balance and well-being according to the “synactive theory” developed by Als.

Individual observations

This is what the program looks like in practice: “We observe the individual baby before, during and after our care procedures so that we can find out how it deals with different life situations,” says Agneta Kleberg, a Master Trainer in NIDCAP techniques in Europe and at the NIDCAP Centers in Lund and Stockholm in Sweden. “We describe its individual behavior and the efforts it’s making, and we make recommendations to the physicians, nurses and parents on how to interact with this particular baby. The most important things to watch for are the baby’s breathing patterns, skin color and any changes it shows, its motoric system, and states of excitement

and rest,” adds Kleberg, who is a nurse and has a Ph.D. in patient care. In the ideal case, a child is observed once a week for an hour by a nurse trained in the NIDCAP program. In many cases, medical monitors are slower to register changes than well-trained observers. The trained nurses can sometimes detect signs of disturbance in a child’s behavior long before there are measurable changes in heart frequency, breathing patterns or oxygen saturation.

This approach can potentially disrupt a ward’s schedule if care procedures may be carried out only when the individual child is ready for them. However, because the program results in babies that are less stressed and are in a more stable physical condition, it requires fewer care procedures. The additional time spent on individual procedures thus results in time savings overall. “For nurses and nursing aides who are used to being experts in preterm infant care, there’s been a paradigm shift to the view that they should regard the baby as an active, competent and sensitive partner and patient,” says Kleberg. “Care personnel and physicians usually do their work in a task-oriented way. By contrast, we are trying to transform this ‘adult perspective’ into a relationship concept.” Moreover, care personnel are not used to the fact that this approach also means doing everything possible to make the parents the child’s primary caregivers. “The initial costs of switching to NIDCAP principles, in terms of time and money, are balanced out by shorter periods of rest in the incubator, less frequent need for artificial ventilation, fewer cases of brain hemorrhage, less frequent use of feeding

tubes, fewer medical complications, and a better parent-child relationship over the long term.” According to an article by Als in the Encyclopedia on Early Childhood Development, the results of this program in the U.S. vary, but they indicate savings potential of at least 4,000 US dollars per child.

The pros and cons of NIDCAP

Nonetheless, not every practitioner believes that the effectiveness of NIDCAP has been convincingly demonstrated. It’s true that Kleberg et al. (Early Human Development 2002, 68, pp. 83–91) have shown that after one year, preterm infants cared for in line with the NIDCAP program registered better cognitive development according to the Bayley Scale of Infant Development than preemies in a comparison group. However, the authors point out that the number of infants in the sample was very small and that there had also been a certain amount of spillover, because the nurses in the comparison group also tried to care for “their” infants in ways that would promote their development. “It’s difficult to demonstrate the advantages of this kind of development-promoting care in a way that is statistically significant,” says Pöschl. “In the few studies we have in this area, there is often only a small number of infants in the sample. These studies show that the patients develop in very diverse ways. The advantages of the NIDCAP program have not yet been directly proved, but it seems that there is better motoric and mental development in the preterm infants that receive this kind of care.”

In the intensive care stations for new- >

Better growth with positioning aids

Positioning aids can help nursing staff avoid putting infants into negative positions in an incubator. In other words, these aids are not simply a way to make babies more comfortable—they are a medical necessity. The positioning of the baby can have a huge influence on its growth and development. Many preterm infants do not yet have enough strength to hold their arms and legs steady. Changing their position regularly in the incubator prevents them from lying in negative positions and promotes their further development. Dräger has developed a positioning cushion called “Nestchen” (Little Nest) that is specially shaped for “gentle care” requirements, and a positioning aid called “Hug it” that stabilizes the entire body of a baby weighing up to 1,500 grams.



Special positioning aids in the incubator can prevent negative positioning of the baby.

A little bit of stress can help promote development



Preterm infants need a special dose of attention.

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> borns in Sweden, it has long been standard procedure to ensure that about five percent of the staff have received a NIDCAP qualification. “The cost of this training, not including the loss of working time, is about 6,000 euros per trainee up to the first certificate, which takes about a year,” says Kleberg. Other countries in Europe have a scattering of NIDCAP centres. This year, Heidelberg will become the first NIDCAP application centre in Germany. It already offers much lower-cost training courses in a program it has created itself called EFIB—the Germany acronym for “development-promoting, family-centered individual care.” The EFIB approach is based on the conclusions reached by NIDCAP, the guiding principles of the German Federal Association for Preterm Infants and the Heidelberg Curriculum Medicinale. “Our approach to the care we provide to these children is based on NIDCAP. We’ve modified the assessment program to fit our needs and adopted the NIDCAP observation sheets with the approval of Heidelise Als as the creator of NIDCAP,” says Pöschl.

From a hushed underwater world

A further objective of the program is to enhance parenting skills. The primary focus of the care concept itself is to interfere with the infant’s brain development as little as possible. For infants born after a pregnancy of less than 33 weeks, there is still a great risk that the child will later develop partial vitality deficiencies. This was shown in the EPIPAGE survey published last May in *The Lancet* (Vol. 371, No. 9615, pp. 813–820). Common sense tells us that delicate creatures like these—a mere handful of hu-

manity—should be treated gently. It also sounds logical that we should reduce negative stimuli such as noise, light and pain and promote positive ones such as skin contact and the sound of a parent’s voice.

Infants require a small amount of eustress (beneficial stress) in order to develop properly. In other words, their surroundings should not be too dark or too quiet, because that’s not how it is in the womb either. The friendly orange glow shining through its mother’s abdominal wall, which turns lighter or darker depending on the time of day, is perceived by the tiny infant as a series of grey shadows—color perception becomes differentiated only at a later stage. The noise level decreases to a minimum of around 28 decibels. But if the mother, for example, loudly cheers on her favorite soccer team, her shouts vibrate through the uterus at a volume of over 83 decibels. However, even that is 25 decibels softer than the sound of a plastic milk bottle being set down on top of the incubator. For an infant coming from a hushed underwater world, not only the absolute noise level but also the unaccustomed frequencies of the noise cause stress. It’s much more difficult for preterm infants to settle down, fall asleep or attain a state of attentive wakefulness. The top priority of human beings and technology should therefore be to reduce the level of disturbing noise whenever possible.

In a comparative study of the noise levels at three incubators (Effect of Environmental Changes on Noise in the NICU, *Neonatal Network* Vol. 26, No. 4, 2007), the Dräger Caleo was judged to be the friendliest acoustically. “The Caleo, which reg-

isters less than 47 decibels in its interior, is very quiet,” confirms Silke Bahr, Product Manager at the Neonatal Care & Thermoregulation unit at Dräger. “The routine noise in some intensive care stations could be a bigger problem than the incubator.” The sensitivity of the tiny patients should not be underestimated. Until a few decades ago, it was widely believed that because of their physiological immaturity premature babies could not feel stress or pain, but today we know that even an overly loud laugh can disturb a tiny infant.

“We actually have three sets of customers whose wishes we need to take into account simultaneously: the medical personnel, the small patients and their parents,” says Bahr. Previously, innovations in medical technology were the primary focus, but today people in this field are thinking more intensely about parallel issues: how to ideally promote the child’s growth and good health, how to ease the interaction between parent and child and, above all, how to satisfy the child’s desire for a sense of well-being. For example, x-ray examinations are a necessary medical measure that can be carried out in a very gentle way. Is there an integrated drawer into the incubator, the preterm infant can be x-rayed without having to be moved.

A closer relationship

“As product developers we continually ask ourselves to what extent we can support the concept of development-promoting care through our designs for basic medical equipment and accessories,” says Stefanie Wagner, Product Manager in the Lifecycle Solutions unit at Dräger. “With regard to

Instant detection of jaundice



Newborn jaundice is a potential risk for babies. It needs to be detected at the earliest possible stage in order to prevent later harm to the child. The bilirubin measuring system JM-103 Jaundice Meter determines the key element of the diagnosis—the baby’s total bilirubin concentration—in a noninvasive manner. The measuring head is simply held against the infant’s forehead or breastbone, and the bilirubin value can be immediately read.

our positioning aids, this means that we have to reproduce the infant’s position in utero as closely as possible. We therefore create the physical limits that the preterm infant is used to, and within this environment it can be comfortably positioned so that it can bring its hand to its mouth, brace its feet against something and snuggle down into its nest.” Appropriate covers for the incubators dampen light and noise, and the friendly rounded shapes of the Caleo plus the colorful textiles used transform a sober incubator into a cozy child’s room in miniature. The appearance of the Caleo should also make it easier for parents to realize that their child is well cared for in its temporary “home” without being overly distracted by the surrounding technology.

Everything that promotes early bonding between parent and child benefits the child’s development over the long term. For example, a study by Agneta Kleberg (*Early Human Development* 2007, 83, pp. 403–411) showed that mothers who had spent a lot of time with their preterm infants—as is usual in the NIDCAP centers—felt a closer bond with their children after 36 months than mothers whose children were cared for traditionally. “Of course, the better results achieved in language tests by toddlers cared for in NIDCAP programs could simply be due to increased parent-child interaction,” Kleberg admits. After all, in order to grow up healthy, children need not only calm and security but also lots of attention and physical closeness. **Dr. Sabine Wienand**

Further information online:
[Interview with Silke Mader, Chairwoman of EFCNI](#)
www.draeger.com/97/neonatal