CHAPTER 3

Health-Related Quality of Life of very preterm infants at 1 year of age after two Developmental Care based interventions

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Abstract

Background:
In the context of a growing interest in developmental care this study explores the effect of the basic elements of developmental care (DC) and the additional effect of the individual approach of the Newborn Individualized Developmental Care and Assessment Program (NIDCAP®) on health-related quality of life (HRQoL) of very preterm infants at 1 year of age. The basic elements of Developmental Care in this study were defined as the use of standardized nests and incubator covers, whose protective characteristics were hypothesized to have a positive effect on the infant’s health-related quality of life. The individualized approach of the NIDCAP was thought to further increase HRQoL.

Methods:
Very preterm (≤ 32 weeks) born infants in a Dutch Neonatal Intensive Care Unit at two locations were included in two consecutive randomized controlled trials (RCT) comparing controls (standard care) versus basic developmental care (standardized nests and covers) in the first RCT and basic developmental care versus NIDCAP in the second RCT. Parents completed a questionnaire (RCT1 n=136, RCT2 n=128) regarding their infant's HRQoL (TAPQoL) at 1 year of age, corrected for prematurity. Because of multiple testing a p-value of below 0.01 was chosen to indicate significance.

Results:
HRQoL scores were good to optimal for most infants. No significant differences were found between basic DC versus controls and NIDCAP versus basic DC on the child’s HRQoL at 1 year of age, as reported by parents.

Conclusion:
These two randomized controlled trials show that the basic elements of Developmental Care and the more individualized NIDCAP do not improve health-related quality of life of very preterm infants at 1 year of age.
Introduction

Advances in neonatology have decreased the mortality of infants born very preterm and neonatal caregiving in the Neonatal Intensive Care Unit (NICU) has shifted towards a more family-centered and individualized approach. In the 1980's Als introduced the Newborn Individualized Developmental Care and Assessment Program (NIDCAP) in the NICU. This program is based on the Synactive Theory of Development where the preterm infant’s individual behavior and efforts at self-regulation are observed through approach and avoidance behaviors by a trained developmental specialist. Recommendations to support the infant and family are made based on these observations and are discussed with parents and other caregivers.

A recent Cochrane review on Developmental Care concluded that positive effects of NIDCAP on short-term health outcomes during admission regarding moderate-severe lung disease and incidence of necrotizing enterocolitis. This review however also concluded that the significant effects were mainly based on studies with small sample sizes and several of these findings were not supported in other settings. Furthermore, the studies only reported on short-term health outcomes and there was no mention of studies done to evaluate the effect of NIDCAP on health outcomes after discharge.

Implementing NIDCAP by training nurses to administer the observational tool and implementing the individualized care is costly and time-consuming. As a result hospitals may primarily focus on the basic elements of developmental care programs. Basic elements of developmental care (DC) programs are, for example, the use of standardized incubator covers to reduce light and the use of standardized nests for positioning and to support motor development and physiological stability. These basic elements focus on protecting the infant from intense environmental stimuli and on promoting self-soothing behaviors, motor development, physical stability and health.

Quality of life has become an important outcome measure of neonatal care, in addition to mortality and morbidity. This has led to the development of
Developmental care and quality of life

questionnaires to monitor the infant’s health-related quality of life (HRQoL)
7. HRQoL is defined as the functioning of the child on four dimensions:
physical functioning, social functioning, cognitive functioning and emotional
functioning, weighted by the emotional evaluation of the problems 8,9. In
previous studies very preterm children showed lower scores compared to
reference groups of children born at term on several scales of HRQoL
questionnaires 10-13.

The current study was designed to measure whether the use of the basic
elements of developmental care would improve health-related quality of life
of very preterm infants. The additional effect of the more intensive and
individualized NIDCAP program compared to basic developmental care, on
health-related quality of life, was explored in a second randomized controlled
trial. The effect of developmental care on HRQoL has, to our knowledge, not
yet been studied. Our hypothesis was that application of the basic elements of
developmental care would increase health-related quality of life after 1 year
because of the protective properties of the covers from environmental stimuli
and the support of the standardized nests on the infant’s self-soothing
behaviors, motor development and physiological stability. Secondly, the
individual NIDCAP program was thought to further increase HRQoL because
this program is even more focused on creating opportunities for the infant to
rest and recover.

Methods

The first randomized controlled trial (inclusion April 2000 – May 2002)
measured the effect of basic Developmental Care (DC) versus standard
nursing care. The intervention was based on the reduction of light and sound
through the use of standardized incubator covers and on supporting motor
development and physiological stability by positioning the infant in ways that
encourage flexion and containment through the use of standardized nests. The
control (C) group received standard care prior to this study, when no
incubator covers or forms of nesting were used.
The second randomized controlled trial (inclusion July 2002 to August 2004) studied the additional effect of the individual approach of NIDCAP compared to the basic elements of developmental care. The intervention in the second trial consisted of basic developmental care and NIDCAP observations of the infant before, during and after caregiving every 7 to 10 days by a NIDCAP-trained developmental specialist. The trained developmental specialist wrote reports and discussed individualized recommendations with parents and other caregivers and supported them in giving care to the infant. The first observation was done within 48 hours after birth. A nursing team that received additional clinical lessons in the NIDCAP approach was assigned to the infants in the NIDCAP invention group. The control group in the second trial was given nests to support positioning and incubator covers (basic developmental care).

Subjects
In both trials, infants born with a gestational age below 32 weeks admitted to a NICU at two locations in the Netherlands, were randomly assigned (cards in sealed envelops) to a control group (first RCT: control standard care, second RCT: basic DC) or intervention group (first RCT: basic DC, second RCT: NIDCAP) within 48 hours after birth.

Exclusion criteria were: infants of drug-addicted mothers and infants with congenital heart disease or other major birth anomalies. According to protocol, infants in both groups who were admitted for less then 5 days were excluded from the follow-up of the current study because the duration of the basic DC intervention was hypothesized to be too short. After parental informed consent was obtained, 192 infants were included.

During outpatient clinic visits at 1 year of age, corrected for prematurity, the TNO-AZL Preschool Quality of Life Questionnaire (TAPQoL for infants under 18 months of age) was given to parents to complete at home. All ages mentioned hereafter are corrected for prematurity. The Medical Ethics Committees of both locations approved this study.
Developmental care and quality of life

Measures

Parent and child characteristics:
Demographic variables included parental age, educational level and country of birth (the Netherlands/other). Infant characteristics at birth were the infant’s gender, gestational age, birth weight and the Clinical Risk Index for Babies (CRIB) score. The CRIB score\(^{15}\) assesses initial neonatal risk by scoring birth weight, gestational age, congenital malformation, maximal base excess value (a measure of metabolic acidosis secondary to hypoxia) in the first 12 hours and minimum and maximal oxygen requirements in the first 12 hours after birth.

HRQoL (TAPQoL) questionnaire:
The TNO-AZL Preschool Quality of Life Questionnaire 35 item version (TAPQoL)\(^{14,16}\) was used. The TAPQoL is a multidimensional instrument for children 0-5 years of age with the following HRQoL scales; stomach, skin, lungs, sleeping, appetite, liveliness, positive mood, problem behavior, anxiety, motor functioning, social functioning and communication. An additional scale measuring eating problems for children born preterm was used as well. For children under 18 months of age the scales motor functioning, social functioning and communication do not apply.

The frequency of a specific complaint or limitation during the last three months was recorded first (for example: "In the last 3 months, has your child experienced any stomach or belly pain: never / occasionally / often"). If parents reported a problem, they were asked to rate the well-being of the child in relation to this problem (fine, not so good, quite bad or bad). Each item was encoded into one single score, ranging from 0 to 4 (4= no problem, 3= child has a problem (occasionally or often) but feels fine, 2= child has a problem and feels not so well, 1= child has a problem and feels quite bad, 0= child has a problem and feels bad). The scales measuring problem behavior, anxiety, positive mood and liveliness, did not ask how the child felt since the items already implied a positive or negative emotional state (for example: "my child was angry") and scores are 0 (often), 1 (occasionally) or 2 (never). All item scores were transformed to a scale score ranging from 0 to 100 with a higher score indicating a better HRQoL. In previous studies\(^{13,14,17}\) the
TAPQoL showed good validity and reliability with Cronbach’s alpha reliability scores ranging from respectively 0.66 to 0.88 for Dutch preterm infants. In the current study alpha reliability scores ranged from 0.50 to 0.91.

**Analysis**

SPSS 11.0 for Windows was used for statistical analysis. To test whether the infant and parent characteristics were comparable between groups, the Chi square test, the Chi-square test for trend, the two-sample t-test or the non-parametric Mann-Whitney test were applied where appropriate.

The TAPQoL scales were skewed, with most infants receiving an optimal HRQoL score of 100 (ceiling effect). Therefore, scores where divided into categories of <70 (non-optimal), 70-99 (sub-optimal) and 100 (optimal) and the percentage of infants scoring within a category was reported, as described in an earlier Dutch study using the TAPQoL.\(^{12}\) Chi-square tests for linear trend were performed to compare the percentages scoring in the categories on the HRQoL scales for both groups in both RCT’s. Because of multiple testing a p-value of below 0.01 was chosen to indicate significance. An overall main effect of the groups was calculated with a multivariate analysis with all TAPQoL scales scores as dependent variables.

**Results**

**Subjects**

During the first RCT 192 infants were included. At 1 year 143 parents received the questionnaire of which 136 (95%) were returned (Figure 1). The return rate of all 192 included children minus 25 infant deaths was 81%.

During the second RCT 168 infants were included. At 1 year 144 parents received the questionnaire of which 128 (89%) were returned (Figure 1). The return rate of all 168 included children minus 14 infant deaths was 83%. Loss to follow-up also included infants transferred within 5 days of admission.
The infant and parent characteristics of the parents who returned the questionnaire at 1 year were similar in both groups (Table 1), with the exception of maternal age (p=0.007), which was lower in the NIDCAP intervention group. However, mothers in both groups were on average in their thirties and their educational levels did not differ significantly and therefore maternal age was not expected to be a confounding variable.

**Basic developmental care and health-related quality of life**

In the first trial, no significant differences between the standard care control and basic DC intervention group were found on the TAPQoL scale scores (Table 2). For the scale ‘appetite’ HRQoL tended to be more often optimal in the DC group. However, for most scales (stomach, skin, lungs, eating disorders, and problem behavior) HRQoL more often tended to be optimal in the control group compared to the basic DC group. The main effect of basic DC on all scale scores was not significant (p=0.84).
Table 1. Comparison of infant and parent characteristics of completed questionnaires.

<table>
<thead>
<tr>
<th></th>
<th>Controls (N=68)</th>
<th>Basic DC (N=68)</th>
<th>Basic DC (N=65)</th>
<th>NIDCAP (N=63)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean(sd) or n(%)</td>
<td>Mean(sd) or n(%)</td>
<td>Mean(sd) or n(%)</td>
<td>Mean(sd) or n(%)</td>
</tr>
<tr>
<td>Completed by...</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>mother</td>
<td>47 (71%)</td>
<td>48 (72%)</td>
<td>57 (89%)</td>
<td>50 (79%)</td>
</tr>
<tr>
<td>father</td>
<td>9 (14%)</td>
<td>8 (12%)</td>
<td>5 (8%)</td>
<td>9 (14%)</td>
</tr>
<tr>
<td>both</td>
<td>10 (15%)</td>
<td>11 (16%)</td>
<td>2 (3%)</td>
<td>4 (6%)</td>
</tr>
<tr>
<td>Gender (male)</td>
<td>46 (68%)</td>
<td>37 (54%)</td>
<td>33 (51%)</td>
<td>38 (60%)</td>
</tr>
<tr>
<td>Gestational age at birth (weeks)</td>
<td>29.1 (1.9)</td>
<td>29.5 (1.6)</td>
<td>29.2 (1.6)</td>
<td>29.6 (1.5)</td>
</tr>
<tr>
<td>Birth weight (grams)</td>
<td>1231 (323)</td>
<td>1245 (345)</td>
<td>1244 (349)</td>
<td>1269 (318)</td>
</tr>
<tr>
<td>CRIB score ^</td>
<td>3.7 (3.0)</td>
<td>3.2 (3.0)</td>
<td>3.0 (3.1)</td>
<td>2.8 (2.8)</td>
</tr>
<tr>
<td>Maternal age when completing questionn. (yrs)</td>
<td>31.6 (4.8)</td>
<td>31.2 (5.1)</td>
<td>33.5 (4.9) *</td>
<td>31.1 (5.1) *</td>
</tr>
<tr>
<td>Maternal educational level ^</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>low</td>
<td>21 (31%)</td>
<td>29 (43%)</td>
<td>12 (19%)</td>
<td>17 (27)</td>
</tr>
<tr>
<td>interim</td>
<td>28 (42%)</td>
<td>23 (34%)</td>
<td>26 (41%)</td>
<td>24 (38)</td>
</tr>
<tr>
<td>high</td>
<td>18 (27%)</td>
<td>16 (24%)</td>
<td>26 (41%)</td>
<td>22 (35)</td>
</tr>
<tr>
<td>Country of birth mother (the Netherlands)</td>
<td>52 (76%)</td>
<td>46 (68%)</td>
<td>58 (91%)</td>
<td>51 (81%)</td>
</tr>
<tr>
<td>Paternal age when completing questionn. (yrs)</td>
<td>34.8 (5.6)</td>
<td>34.2 (5.4)</td>
<td>35.1 (5.5)</td>
<td>33.3 (5.8)</td>
</tr>
<tr>
<td>Paternal educational level ^</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>low</td>
<td>16 (24%)</td>
<td>27 (40%)</td>
<td>9 (15%)</td>
<td>12 (20%)</td>
</tr>
<tr>
<td>interim</td>
<td>30 (46%)</td>
<td>25 (37%)</td>
<td>32 (52%)</td>
<td>20 (34%)</td>
</tr>
<tr>
<td>high</td>
<td>20 (30%)</td>
<td>15 (22%)</td>
<td>21 (34%)</td>
<td>27 (40%)</td>
</tr>
<tr>
<td>Country of birth father (the Netherlands)</td>
<td>54 (79%)</td>
<td>50 (74%)</td>
<td>50 (78%)</td>
<td>48 (77%)</td>
</tr>
<tr>
<td>Completing day after age 1 year (days) #</td>
<td>9 (-11;117)</td>
<td>14 (-12;95)</td>
<td>15 (-42;101)</td>
<td>10 (-35;119)</td>
</tr>
<tr>
<td>Admission duration intervention NICU (days) #</td>
<td>35 (5;114)</td>
<td>41 (6;142)</td>
<td>36 (5;286)</td>
<td>38 (6;160)</td>
</tr>
</tbody>
</table>

* p < .01 ^ T-test / Chi square test (for trend) # Non parametric Mann-Whitney test
² Low = vocational education, intermediate = high school, high = college education/ university
¹ Clinical Risk Index for Babies (CRIB) ¹⁵
Table 2. Comparison of HRQoL scores RCT 1 (standard care – basic DC) and RCT 2 (basic DC – NIDCAP)

<table>
<thead>
<tr>
<th>TAPQoL scale score</th>
<th>RCT 1 (standard care – basic DC)</th>
<th>RCT 2 (basic DC – NIDCAP)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C (n)</td>
<td>DC (n)</td>
</tr>
<tr>
<td>Stomach</td>
<td>7 (10)</td>
<td>9 (13)</td>
</tr>
<tr>
<td>Skin</td>
<td>3 (5)</td>
<td>8 (12)</td>
</tr>
<tr>
<td>Lungs</td>
<td>19 (28)</td>
<td>21 (31)</td>
</tr>
<tr>
<td>Sleeping</td>
<td>21 (31)</td>
<td>20 (29)</td>
</tr>
<tr>
<td>Appetite</td>
<td>9 (13)</td>
<td>9 (13)</td>
</tr>
<tr>
<td>Eating problems</td>
<td>5 (7)</td>
<td>9 (13)</td>
</tr>
<tr>
<td>Liveliness</td>
<td>7 (10)</td>
<td>4 (6)</td>
</tr>
<tr>
<td>Positive mood</td>
<td>4 (6)</td>
<td>6 (9)</td>
</tr>
<tr>
<td>Problem behavior</td>
<td>8 (12)</td>
<td>14 (21)</td>
</tr>
<tr>
<td>Anxiety</td>
<td>22 (32)</td>
<td>19 (28)</td>
</tr>
</tbody>
</table>

Main effect HRQoL RCT 1 ~ .84

Main effect HRQoL RCT 2 ~ .48

^ Chi square test for trend for Controls (C) versus Intervention group (I)
~ Main effect: Multivariate analysis, Hotelling's trace
**NIDCAP and health-related quality of life**

In the second trial, no significant differences between the basic DC control and NIDCAP intervention group were found on the TAPQoL scale scores (Table 2) and the differences that were found were small. HRQoL scores tended to be more often optimal in the NIDCAP intervention group for most scales (stomach, skin, lungs, appetite, eating disorders and problem behavior). HRQoL tended to be less often optimal in the NIDCAP intervention group for the scales liveliness and positive mood. The main effect of NIDCAP on all HRQoL scales together was non-significant (p=0.48).

**Discussion**

This study found no significant effects of either a basic form of developmental care (the use of standardized nest and incubator covers) or the individualized NIDCAP intervention (with individual behavior observations and guidance) on health-related quality of life at 1 year of age during two consecutive RCT’s with a large sample of Dutch preterm infants. In the first RCT, the small differences of basic developmental care compared to standard care showed no pattern of effect. The hypothesis that the protection of covers and the positioning support of nests might give children more rest and support during admission and as a result might have led to improved health-related quality of life is therefore not supported by the results of this study. In the second RCT also only small non-significant differences were found which does not support the hypothesis that the more individualized care would further increase HRQoL in addition to basic DC.

The design of the current study, with two consecutive trials, made it possible to explore the effect of a basic DC intervention and the additional effect of a more individualized intervention. However, a side effect of this design is that it becomes difficult to compare the standard care controls in the first RCT with the infants receiving the individualized NIDCAP in the second RCT, which took place two years later. Furthermore, the average HRQoL scores of the infants in the two basic DC groups in both trials, who received the same intervention, often differed.
While a recent Cochrane review on Developmental Care \(^6\) reported some positive effects of NIDCAP on short term health outcomes during admission there was no mention of studies evaluating the effect of NIDCAP on health outcomes after discharge. A study regarding the effect of the Infant Health and Development Program, a longitudinal home visit intervention until 3 years of age, found no effects on serious health conditions and an increase in reported minor illnesses within the lower birth weight infants in their intervention group when the intervention ended at 3 years of age. The authors suggested that this might be due to reporting bias by mothers and the more intense health surveillance and education in the intervention group. They found no effect on health outcomes reported by parents at 5 and 8 years of age \(^18-20\).

Parents in our study were asked to give an impression of their child’s general health and health-related quality of life as proxy's who are not blinded for the study group their child is in. This might bias the amount of HRQoL they report. Blinding parents was impossible because of the visual aspects of the intervention and the involvement of parents during the intervention. In a review Hack \(^21\) warned that proxy HRQoL measurements can be influenced by parent’s cultural, social and educational background and their specific experience with children. Mothers and fathers who completed the questionnaire in the NIDCAP intervention group in the second RCT were younger but the parents’ educational level was comparable in the two groups. The response rate in this study was good and the sample seemed representative of the typical population of preterm infants with a gestational age < 32 weeks admitted to a Dutch NICU.

Most children received an optimal score of 100 on the TAPQoL scales. A recent study on the validity and reliability of the TAPQoL \(^17\) warns that this ‘ceiling effect’ may limit the use of the TAPQoL to measure change. In the current study HRQoL scores were divided into three groups to try to divide scores more evenly.

Previous studies \(^10-13\) have shown that very preterm born infants have less optimal HRQoL scores on some scales, compared to a reference group from
the normal population. A study by Eiser only found a difference between preterm and term infants on social HQoL but found no differences in the physical or emotional HQoL as reported by parents. A recent study on the HRQoL of Dutch preterm infants compared with term infants, using the TAPQoL at 1 year, showed significant lower HRQoL scores on the stomach, lungs and eating problems scales. However, on other domains HRQoL scores of the preterm infants often scored optimal and were comparable to term infants. The stomach, lungs and eating problems scales seem to represent typical problems that preterm infants encounter. Basic DC and NIDCAP did not significantly improve HRQoL on these scales.

Conclusion
These two consecutive randomized controlled trials showed that neither a basic form of Developmental Care nor the more individualized NIDCAP intervention improved health-related quality of life of very preterm infants at 1 year of age.

Acknowledgements
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References


