THE EFFECT OF FORMAL EXPOSURE TO DEVELOPMENTAL CARE PRINCIPLES ON THE IMPLEMENTATION OF DEVELOPMENTAL CARE POSITIONING AND HANDLING OF PRETERM INFANTS BY NEONATAL NURSES

Rachell Louw
BSocSc (UOFS), MCur (UP), Diploma Educ (UP)
Registered nurse (general, psychiatric, community nursing), Midwife, Neonatal nurse, Nurse educator
M Cur (Advanced Neonatal Nursing) student, University of Pretoria

Carin Maree
BCur (UP), Diploma Paediatric Nursing, BACur (UNISA), MCur (RAU), Diploma Neonatal Nursing (UP)
Registered nurse (general, psychiatric, community nursing), Midwife, Paediatric nurse, Nurse educator and administrator, Neonatal nurse
Lecturer, Department of Nursing Science, University of Pretoria
Corresponding author: cmaree@postillion.up.ac.za

Keywords: developmental care; developmental care positioning; developmental care handling; preterm infants; training exposure

ABSTRACT

The preterm infant requires developmental care that is designed to minimise the stress that the infant experiences within the neonatal intensive care unit (NICU). The aim of the study was to determine the effect of formal exposure to developmental care principles on the implementation of developmental care positioning and handling of the preterm infant by neonatal nurses. The first objective of the study was to compile an accurate scale for measuring the implementation of these principles with respect to the handling and positioning of the infant. Secondly, the study aimed at determining changes in the implementation of developmental care principles within a selected NICU after neonatal nurses were formally exposed to developmental care training. A quasi-experimental research design and a one-group pre-test-post-test approach were followed, and the Wilcoxon matched-pair signed-rank tests were used to examine the changes. Results were statistically significant and indicated improvement with respect to the developmental care components that were measured. The recommendation was that developmental care principles be integrated into formal neonatal courses. Follow-up studies should be conducted to determine the reliability of the instrument for possible inclusion in routine assessment of the quality of the implementation of developmental care in the NICU.

OPSOMMING

Die vroeggebore baba benodig ontwikkelingsorg wat ontwerp is om die stres wat die baba in die neonatale-intensiewesorgeenheid ervaar, te minimaliseer. Die doel van die studie was om die effek van formele blootstelling aan ontwikkelingsorgbeginsels op die implementering van ontwikkelingsorgposisionering en -hantering van die vroeggebore baba deur neonatale verpleegkundiges te bepaal. Die eerste doelwit van die studie was om ‘n akkurate metingskaal daar te stel vir die meting van die implementering van hierdie beginsels ten opsigte van die hantering en posisionering van die baba. Die tweede doelwit was om die veranderinge in die implementering van ontwikkelingsorgbeginsels binne ‘n geselekteerde neonataleorgeenheid te bepaal nadat neonatale verpleegkundiges funksie aan ontwikkelingsorgpleiding blootgestel is. ’n Kwasi-eksperimentele ontwerp en ’n een-groep pretoets-posttoetsbenadering is gevolg, en die Wicoxon vergelykbare toets van betekende range is gebruik om die veranderinge te meet. Die resultate was statisties beduidend en het verbetering aangedui ten opsigte van die komponente van ontwikkelingsorg wat gemeet is. Die aanbeveling was dat ontwikkelingsorgbeginsels geïntegreer word in formele neonatale kursusse. Opvolgstudies moet gedoen word om die betroubaarheid van die instrument vir
moontlike insluiting in roetine-assessering van die kwaliteit van die implementering van ontwikkelingsorg in die neonatalesorgeenheid te bepaal.

INTRODUCTION, RATIONALE AND LITERATURE REVIEW

A greater knowledge base and improved technological interventions had a profound effect on the survival rates of preterm infants who previously would have died (Lynch, 1991:79; Taquino & Lockridge, 1999:64). These babies have left the ideal, safe environment for neurological development provided by the womb and are subjected to loud noises, bright lights and frequent physical assaults to facilitate medical treatment in the neonatal intensive care unit (NICU). Time and longitudinal research indicated that the unfriendly environment of the NICU was not only unpleasant for tiny babies, but also enhanced their vulnerability to a variety of adverse neurodevelopment outcomes (Buehler, Als, Duffy, McAnulty & Liederman, 1995:930).

The primary goal of health care professionals caring for a critically ill individual is to provide the necessary therapeutic interventions, thereby maximising healthcare potential and minimising complications or morbidity (Lynch, 1991:78). It has been suggested that injury to the preterm developing brain resulting from the stressful intensive care environment is responsible for a portion of the overall morbidity suffered by these preterm infants (Young, 2000:preface). Buehler et al. (1995:923) suggest that premature experiences of the extra-uterine environment at a time of rapid brain development altered brain differentiation and influenced later development. As these consequences could be prevented, the challenge confronting the professional nurse in the NICU was not only to assure survival, but also to support the infant’s developmental progression (Als, Duffy & McAnulty, 1996:21). Thus, the provision of care in the NICU should be aimed at establishing a physical and social environment that was supportive of the infant’s rapidly developing nervous system.

According to these authors, interventions may include “… one or more elements such as control of external stimuli (vestibular, auditory, visual, tactile), clustering of nursery care activities, and positioning or swaddling of the preterm infant”. Taquino and Lockridge (1999:64) describe developmental care as individualised, behaviourally guided practice that bases interactions and interventions on the infant’s behavioural and physiological cues, and strives to reduce external stressors by modifying the environment.

Developmental care positioning is an important component of the developmental care of a preterm infant. It entails providing containment, supporting the infant’s hands in midline, flexion of the body, arms, legs and feet, and hip adduction (Lynch, 1991:81). Handling of the preterm infant also plays an important role in the implementation of developmental care, and includes gentle touch, skin-to-skin contact and slow positional changes (Jorgensen, 2000:1-4).

Since neonatal nurses are the primary caregivers in the NICU and it is the caregiver’s responsibility to enhance each infant’s strengths, neonatal nurses are in a key position to influence the environment of the developing neonate (Als, 1998:138; Young, 2000:3). Young (2000:3) explains this as follows: “To fulfil their role, neonatal nurses must take responsibility for identifying and reducing stimuli in the preterm infant’s environment which may damage the developing nervous system.” Lynch (1991:79) agrees, stating that neonatal nurses are in a key position to modify potential risks and prevent injuries associated with therapeutic interventions. To ensure that preterm infants derive maximum benefit from developmental care principles, these principles have to be implemented thoroughly.

Being a neonatal nurse, the researcher was concerned about the quality of developmental care practised in the NICU selected for this study. None of the neonatal nurses in the selected NICU had any formal exposure to developmental care training that included attendance of any seminar, conference, or workshop where these principles were explained. However, all the neonatal nurses working at the selected NICU had informal ex-
They obtained knowledge about this approach through observance.

The successful implementation of the positioning and handling of preterm infants according to developmental care principles is the sole responsibility of the individual neonatal nurse who is taking care of a particular infant. The successful implementation of most of the other aspects of developmental care such as environmental manipulation (light and noise reduction, or a positive smell) is dependent on the cooperation between all role players within the NICU.

The positioning and handling of the preterm infant according to developmental care principles by the neonatal intensive care professional nurse (neonatal nurse) were the focus of this study, because the individual neonatal nurse’s implementation of these principles could be observed and assessed.

The hypothesis was that formal exposure to the principles and practice of this new approach to infant care would result in improved implementation of developmental care positioning and handling of preterm infants by neonatal nurses, and the null hypothesis was that such exposure would produce no improvement. The study aimed at determining the effect of formal exposure to developmental care principles on the implementation of these principles by neonatal nurses, with specific reference to the positioning and handling of preterm infants.

**SECOND OBJECTIVE: DETERMINING THE EFFECT OF FORMAL EXPOSURE TO DEVELOPMENTAL CARE PRINCIPLES ON INFANT CARE BY NEONATAL NURSES**

During this phase of the study, a quasi-experimental design and an intra-subject or one-group pre-test-post-test approach were used to investigate the causal relationship between formal exposure of neonatal nurses to developmental care principles (independent variable) and the implementation of developmental care positioning and handling of preterm infants by these nurses (dependent variable) (De Vos, Strydom, Fouche & Delport, 2002:144; Polit & Hungler, 1993:18-9,136-41).

The research population (N=11) consisted of a single group of neonatal nurses who were working at the NICU of the hospital where the study was conducted. Since all the neonatal nurses working at the NICU were evaluated, the population constituted a non-probability convenience sample (Polit & Hungler, 1993:176). All the neonatal nurses in the NICU gave written informed consent to participate in the study. Over a three-week period, all these nurses were evaluated on their positioning and handling of preterm infants according to the developmental care principles. These evaluations (pre-testing and post-testing) took place while the partici-
Table 1: Instrument for evaluating developmental care positioning and handling

<table>
<thead>
<tr>
<th>Action to be evaluated</th>
<th>N/A</th>
<th>poor</th>
<th>satisf.</th>
<th>good</th>
<th>excel</th>
<th>For office use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment of the environment</td>
<td>V2</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assessment of physiological stress signals</td>
<td>V3</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assessment of behavioural stress signals</td>
<td>V4</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Provide adequate pain control, e.g. sucrose with non-nutritive suckling</td>
<td>V5</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Firm but gentle touch</td>
<td>V6</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slow movements to prevent vestibular disorganisation</td>
<td>V7</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maintenance of flexion throughout positional changes</td>
<td>V8</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consideration of electrodes, lines, etc.</td>
<td>V9</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consideration of special needs, e.g. oedema, surgery</td>
<td>V10</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Provision of three-dimensional containment</td>
<td>V11</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maintenance of flexion within boundaries (space for movement to feel boundaries &amp; return)</td>
<td>V12</td>
<td>13</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Provision of midline orientation with hands-to-mouth</td>
<td>V13</td>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maintenance of rounded shoulders</td>
<td>V14</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maintenance of back curvature</td>
<td>V15</td>
<td>16</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maintenance of head in neutral position with open airway</td>
<td>V16</td>
<td>17</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maintenance of leg flexion with knees together and hips adducted</td>
<td>V17</td>
<td>18</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maintenance of foot flexion and provision of effective boundary</td>
<td>V18</td>
<td>19</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hand-cupping to calm and reassure baby</td>
<td>V19</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not more than one or two sensoric stimulations at once</td>
<td>V20</td>
<td>21</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assessment of nurse’s actions and changes that were made if necessary</td>
<td>V21</td>
<td>22</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reassessment of the infant’s behavioural and physiological stress signals</td>
<td>V22</td>
<td>23</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
pant and the researcher were working together and the participant was busy with routine care of a preterm infant.

After completion of the pretest evaluations, all participants attended a workshop on developmental care principles and hands-on training presented by an expert (formal exposure). Thus, attendance of a workshop on the principles of developmental care that included hands-on training represented the independent variable. Within the next four weeks after participants had attended the workshop, the post-test evaluations were done, using the same instrument on the same subjects by the same person (researcher). It should be emphasised that this study was aimed at evaluating the effect of formal exposure to developmental care principles on the positioning and handling of preterm infants by neonatal nurses, and that it was never the intention to evaluate the nurses' ability to implement these principles. For this reason and to prevent the Hawthorne effect, neonatal nurses were unaware of the exact date on which they would be re-evaluated (although they did know that post-test evaluations would be done).

Validity and reliability

Measures taken to enhance the validity and reliability of the study included the steps taken to obtain a valid and reliable instrument for accurate measurement. The researcher collected all the data herself to enhance consistency in measurement, and the independent variable was introduced only after all the data of the pretests were collected. The collection of the post-test measurements took place after the independent variable was introduced, but the participants did not know the exact dates of the re-evaluations so that a true reflection of changes effected by the independent variable could be obtained.

Ethical considerations

The researcher obtained institutional and individual informed consent prior to the study, as well as ethical approval from the Ethics Committee of the Faculty of Health Sciences within the University of Pretoria. Participant confidentiality was upheld throughout the study. No harm was done to any preterm infant, as developmental care was the right of all neonatal patients. The expectation was that the consequences of the study would imply improvement in the implementation of developmental care principles to the benefit of preterm babies.

Data analysis

Once all the evaluations were done, the data were analysed by means of the software package, the Statistical Analysis System (SAS). The components of the dependent variable (implementation of developmental care positioning and handling) were identified and divided into four groups, namely:

- assessment of the environment and infant before handling of the infant;
- assessment of the neonatal nurse’s handling of the preterm infant;
- assessment of the neonatal nurse’s positioning of the preterm infant; and
- reassessment of the preterm infant and the neonatal nurse’s response.

The components of each group are set out in Table 2.

The Wilcoxon matched-pair signed-rank tests were used to examine the changes that occurred in the pre-test-post-test evaluations (matched pairs) (Burns & Grove, 1987:524-5; Polit & Hungler, 1993: 438-42).

Results

Group 1: Assessment before handling of the preterm infant

The t-value of the results of Group 1 as a whole was 0.002 that was statistically significant, and indicated improvement in the assessment of the environment and the preterm infant by the neonatal nurse before handling of the infant. See Figure 1.

Group 2: Assessment of the neonatal nurse’s handling of the preterm infant

Being 0.001, the t-value of the results of Group 2 as a whole was also statistically significant. It indicated improvement in the handling of the preterm infant by the neonatal nurse. See Figure 2.

Group 3: Assessment of the neonatal nurse’s positioning of the preterm infant

The neonatal nurses’ positioning of preterm infants
Table 2: Components of the dependent variable

<table>
<thead>
<tr>
<th>GROUP</th>
<th>COMPONENTS OF DEVELOPMENTAL CARE HANDLING AND POSITIONING</th>
</tr>
</thead>
</table>
| 1. Assessment before handling the preterm infant | a. Assessment of the environment  
| | b. Consideration of electrodes, lines, etc.  
| | c. Assessment of physiological stress signals  
| | d. Assessment of behavioural stress signals |
| 2. Assessment of the neonatal nurse’s handling of the preterm infant | a. Firm, but gentle touch  
| | b. Hand-cupping to calm and reassure the infant  
| | c. Not more than two sensory stimulations at once  
| | d. Slow movements to prevent vestibular disorganisation  
| | e. Consideration of special needs, e.g. oedema and surgery  
| | f. Maintenance of flexion throughout positional changes  
| | g. Provision of adequate pain control, e.g. sucrose with non-nutritive sucking |
| 3. Assessment of the neonatal nurse’s positioning of the preterm infant | a. Provision of three-dimensional containment  
| | b. Maintenance of flexion within boundaries, with space for movement for the infant to feel boundaries and return  
| | c. Maintenance of leg flexion with knees together and hips adducted  
| | d. Maintenance of foot flexion and provision of effective boundaries  
| | e. Provision of midline orientation with hands to mouth  
| | f. Maintenance of back curvature  
| | g. Maintenance of rounded shoulders  
| | h. Maintenance of the head in a neutral position with an open airway |
| 4. Reassessment of the preterm infant and the neonatal nurse’s response | a. Assessment of the nurse’s actions and changes that were made if necessary  
| | b. Reassessment of the infant’s behavioural and physiological stress signals |

showed improvement, as indicated by the statistically significant t-value (0.001) of the results of the components of Group 3.

**Group 4: Reassessment of the preterm infant and the neonatal nurse’s response**

The t-value (0.002) of the results regarding the reassessment of the preterm infant and the response of the neonatal nurse was statistically significant, and demonstrated improvement.

On the whole, the results of the study showed a statistically significant improvement in the neonatal nurses’ handling and positioning of preterm infants after formal exposure to developmental care principles and hands-on experience in the format of a workshop. The hypothesis was therefore found to be true, and the null hypothesis was rejected. Thus, formal exposure of neonatal nurses to developmental care principles resulted in a significant improvement in the implementation of developmental care positioning and handling of the preterm infant.
Figure 1: Assessment before handling a preterm infant

1.a Assessment of the environment  
1.b Consideration of electrodes, lines, etc.  
1.c Assessment of physiological stress signals  
1.d Assessment of behavioural stress signals

Figure 2: Assessment of the neonatal nurse’s handling of the preterm infant

2.a Firm but gentle touch  
2.b Hand-cupping to calm and reassure the infant  
2.c Not more than one or two sensory stimulations at the same time  
2.d Slow movements to prevent vestibular disorganisation  
2.f Maintenance of flexion throughout positional changes  
2.g Provision of adequate pain control, e.g. sucrose with non-nutritive suckling

CONCLUSIONS AND RECOMMENDATIONS

The purpose of the study was to make an inference that the formal exposure of neonatal nurses to developmental care principles and hands-on training was truly influencing the implementation of developmental care positioning and handling of preterm infants (De Vos et al. 2002:144; Polit & Hungler, 1993:156). As the results indicated that formal exposure of neonatal nurses to developmental care principles improved their implementation of developmental care positioning and handling of preterm infants, the hypothesis of the study could be accepted, and the null hypothesis be rejected.

Although this was a small study, results hinted at the
Figure 3: Assessment of the neonatal nurse’s positioning of the preterm infant

3.a Provision of three-dimensional containment
3.b Maintenance of flexion within boundaries, with space for movement for the infant to feel boundaries and return
3.c Maintenance of leg flexion with knees together and hips adducted
3.d Maintenance of foot flexion and provision of effective boundary
3.e Provision of midline orientation with hands-to-mouth
3.f Maintenance of back curvature
3.g Maintenance of rounded shoulders
3.h Maintenance of head in neutral position with open airway

Figure 4: Reassessment of the preterm infant and the neonatal nurse’s actions

4.a Assessment of the nurse’s actions and changes that were made if necessary
4.b Reassessment of the infant’s behavioural and physiological stress signals

Benefits of formal exposure of nurses to the principles of a new concept. It seems that formal introduction of a new concept by means of a workshop or formal courses, covering core literature, advantages and disadvantages, ethical and legal responsibilities, as well as hands-on training, has an advantage over informal exposure.

Thus, the following recommendations are made:

- Developmental care principles should be integrated into formal neonatal courses.
- As unit managers lead by example, also with respect to the acquisition of new knowledge and skills and professional-ethical conduct, they should be urged to take an active interest in the new approach to infant care, especially since this approach is evidence-based and justified.
- However, as acquisition of the necessary knowledge and skills does not guarantee implementation of developmental care principles, the recommendation is made that unit managers instil the right values and