THE EFFECT OF DEVELOPMENTALLY SUPPORTIVE POSITIONING (DSP) ON PRETERM INFANTS' STRESS LEVELS

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ABSTRACT

Research has proven that developmentally supportive care (DSC) improves the developmental outcomes for preterm infants. Available evidence regarding the similar effect of one of its principles, developmentally supportive position-ing (DSP), was inconclusive, which lead to this study. The study was conducted in two phases: firstly, the Hennessy Stress Scale for the Preterm Infant was developed and, secondly, using a within-subject design, the effects of DSP on the stress levels of preterm infants were measured. Using the Hennessy Stress Scale for the Preterm Infant, observed qualitative data could be quantified to reflect the infant's stress levels as a percentage. Nonprobability sampling was used to select twenty-two preterm infants of gestational age < 37 weeks. The stress levels of these infants, who were admitted to a specific neonatal intensive care unit and not sedated, were observed before and after the implementation of DSP, and were then quantified, and recorded. The pre-test (infants without DSP) and post-test (same infants with DSP) mean stress level scores were 29.07% vs. 16.87% (mean shift of 12.2% and standard deviation of 3.97%), which were significantly different (p < 0.0001; Student's paired t-test). The conclusion was that DSP significantly decreases premature infants' stress levels.

OPSOMMING

Navorsing het bewys dat ontwikkeling-ondersteunende sorg (OOS) die ontwikkelingsuitkomste van premature babas verbeter. Beskikbare bewyslewering van die soortgelyke effek van een van die beginsels daarvan, ontwikkeling-ondersteunende posisionering (OOP), was nie afdoende nie en het tot hierdie studie gelei. Die studie is in twee fases gedoen: eerstens is die Hennessy-stresskaal vir die Premature Baba ontwikkel en tweedens is die gevolge van OOP op die stresvlakke van premature babas gemeet deur van 'n binne-subjekontwerp gebruik te maak. Deur middel van die Hennessy-stresskaal vir die Premature Baba is waargenome kwalitatiewe data gekwantifiseer om die baba se stresvlakke as 'n persentasie weer te gee. 'n Nie-waarskynlikheidsteekproeftrekking is gebruik om twee-en-twintig premature babas van gestasie-ouderdom < 37 weke te selekteer. Die stresvlakke van hierdie babas, wat in 'n spesifieke neonatale-intensiewesorgeenheid opgeneem en nie gesedeer was nie, is vóór en ná die implementering van OOP waargeneem, en daarna gekwantifiseer en gedokumenteer. Die gemiddelde vooraftoets-(babas sonder OOP) en agternatoets- (dieselfde babas met OOP) stresvlaktellings was 29.07% versus 16.87% ('n gemiddelde verskuiwing van 12.2% en 'n standaardafwyking van 3.97%), wat betekenisvol verskillend was (p < 0.0001; "Student" se gepaarde t-toets). Die gevolgtrekking was dat OOP die stresvlakke van premature babas

betekenisvol verminder.

INTRODUCTION

In dealing with preterm infants, a vulnerable population, it is necessary to protect them as far as possible from the harmful effects of the unfamiliar extra-uterine environment. Because the preterm infant's central nervous system is immature, it is important to reduce the stress levels experienced by the infant in order to improve developmental sequelae.

The developmental care approach is known to reduce stress levels in the preterm and ill infant, and to improve developmental outcomes. Principles of developmental care include individualised infant care with the initiation of cluster care for nursing activities, family-centred care, appropriate handling and touching of the preterm infant, developmental positioning and swaddling, kangaroo mother care, non-nutritive sucking and manipulation of the external environment (reduction in negative stimuli, such as noise and light, and enhancement of positive smell stimuli) (Byers, 2003:174-179; Hennessy, 2004:29-34; Hennessy, 2003:1-52; Jorgensen, 2000:3; Taquino & Lockridge, 1999:64-79).

As part of the developmental care approach, developmentally supportive positioning (DSP), is described by Jorgensen (2000:1) to include midline orientation, hand-to-mouth activity and foetal flexor patterns. It is often not applied as such in the neonatal intensive care units. However, it was observed that preterm infants appeared less stressed when DSP was implemented. When searching for ways to improve sequelae in these infants, inter alia by encouraging the implementation of DSP, a lack of evidence regarding the effects of DSP on preterm infants was found in research literature. This study was conducted to contribute to scientific evidence of the effects of DSP on stress levels in preterm infants.

In order to reduce the preterm infant's stress levels, specific positioning aids, designed by Children's Medical Ventures (see www.childmed.com for more information), were used to position the infant as if in the intra-uterine environment, in a pre-test post-test situation. A reduction in the preterm infant's stress levels, as well as an improvement in the infant's short-term

and long-term developmental sequelae, was expected.

LITERATURE REVIEW

As technology in the medical field improves, patient mortality decreases. Although this seems to be an advance, short-term and long-term effects on the preterm infant are not as positive as could be expected. To the contrary, these infants experience a range of morbidity related to the immaturity of their organ systems and concurrent disease states (Symington & Pinelli, 2002:1).

Thus, in spite of improved technology, preterm infants tend to present with more stress than they can handle. According to Symington and Pinelli (2002:3) typical markers of stress are physiological parameters such as increased heart rate and decreased oxygen saturation. The preterm infant's growth is negatively affected by the increased energy expenditure that occurs as a result of the infant's reaction to routine care in the neonatal intensive care unit (NICU).

Short-term sequelae, such as changes in heart rate, respiration rate, colour, blood pressure and saturation levels, are specifically related to physiological instability and/or increased stress levels. Incorrect body positioning results in postural deformities, such as hip abduction and external rotation, ankle eversion, retracted and abducted shoulders, neck hyperextension, shoulder elevation and cranial moulding. These in turn impede achievement of developmental milestones, including head control, rolling, sitting, crawling and walking (Jorgensen, 2000:1).

Long-term problems for preterm infants, identified by Bohin, Draper and Field (1999:12), include cerebral palsy, developmental delays, visual impairment, hearing impairment, impaired growth, epilepsy, lung disease and hydrocephalus. It is common for these children to experience frequent re-admissions for health problems related to preterm delivery. They often require long-term developmental and functional rehabilitation in later years, including treatment by speech therapists, audiologists, occupational therapists and physiotherapists.

Negative sequelae can be reduced by applying developmentally supportive care (DSC), which is defined by Symington and Pinelli (2002:1-2) as a broad category of interventions designed to minimise the impact of the neonatal intensive care environment on preterm infants. These interventions may include control of one or more elements of the external environment, which influence tactile, vestibular, olfactory, auditory and visual systems. These different interventions have been designed to modify the extra-uterine environment so as to decrease a number of various stressors.

Principles of DSC include individualised infant care with initiation of cluster care for nursing activities, family-centred care, minimal and appropriate handling and touching of the preterm infant, developmentally supportive positioning (DSP), non-nutritive sucking, and manipulation of the external environment to reduce negative stimuli (noise and light reduction) and increase positive smell stimuli. These interventions lead to stress reduction and an increase in rest periods, and are therefore beneficial to the preterm infant (Bakewell-Sachs & Blackburn, 2003:688-689).

According to Jorgensen (2000:1), DSP includes midline orientation, hand-to-mouth activity and foetal flexor patterns. By promoting self-soothing and self-regulatory behaviours, DSP contributes to the preterm infant's neurobehavioural development. Thus, DSP is achieved when three principles are applied, namely containment, flexion and midline orientation.

Containment is provided through the use of linen rolls or positioning equipment to surround the infant with a three-dimensional boundary. The infant's head, sides and feet should be contained by this boundary. Flexion is achieved when the infant's positioned in the following manner: the shoulders rounded and the back curved, knees together with flexion toward the stomach, and the head and neck in a neutral position to facilitate an open airway. Midline orientation occurs when hands are near the face and limbs cross the midline of the body (Hennessy, 2004:29-32). These principles simulate the uterine environment.

Routine implementation of DSC principles in the NICU under study was observed to consist mainly of manipulation of the external environment with little or no attention given to correcting DSP, which provided the impetus for this study. Even with external environmental factors (light, touch and sound) optimally modified, the preterm infants were still prone to physiological instability and stress. The inference was that more than just environmental adaptation was needed to reduce negative sequelae. To the contrary, infants who were positioned according to DSP principles appeared to experience lower stress levels, associated with increased stability of vital data and reduced irritability. In addition, it appeared that, in these positions, infants experienced increased periods of sleep and rest (or quiet-alert states).

Based on the above observations, the assumption was made that DSP reduces stress levels of preterm infants and has a positive effect on sequelae. However, nursing science literature lacked evidence supporting this assumption. This study was aimed at determining the effects of DSP on the stress levels of preterm infants in an environment where other DSC principles are also maintained. If DSP results in less stressed, physiologically stable infants, then reduced developmental delays, reduced ventilation time, a reduced need for oxygen, faster weight gain, decreased use of sedation, reduced hospital costs, and shorter hospitalisation periods will typically follow. These results relate to more positive sequelae in the management of preterm infants.

PROBLEM STATEMENT, HYPOTHESIS AND OBJECTIVES

The problem statement, which was based on practical neonatal nursing experience, suggested that absence of or inadequate implementation of DSP (independent variable) has a negative effect on the stress levels of the preterm infant. The research question consequently addressed the effects of DSP on these stress levels. Therefore, in order to answer the research question, a stress scale was needed to measure the stress levels of preterm infants.

The null hypothesis stated DSP had no effect on the stress levels of the preterm infant, whereas the alternative hypothesis suggested DSP had a positive effect on the stress levels of the preterm infant.

Two research objectives made up the research purpose. These objectives were to find an appropriate stress scale to measure the stress levels of the preterm infant

and, using the stress scale, to determine the effects of DSP on the stress levels of the preterm infant. Since an appropriate stress scale could not be found, developing and validating such a scale became the study's first objective. Objective one and two were achieved during phase one and two of the research process respectively. Phase one addressed stress scale development and validation, while the difference between preterm infants' pre-DSP and post-DSP stress levels was measured during the second phase of the study.

METHODS AND PROCEDURES

In phase one (stress scale development and validation), observable qualitative data were converted into quantifiable measures that reflected the stress levels of preterm infants as percentages.

The stress scale can be defined as an instrument that converts the observable qualitative data of preterm infant behaviour and physiological stability into quantifiable measures that reflect the amount of stress experienced by each individual infant. Applicable evaluation instruments for stress assessment in this setting were not readily available, so an appropriate stress scale had to be compiled.

Stress scale development and data analysis were done under the supervision of a statistician at the Biostatistics Unit of the Medical Research Council (MRC). The scale was based on a framework that was derived from the qualitative analysis of relevant literature. As discussed by De Vos, Strudom, Fouché Poggenpoel and Schurink (1998:180), the extant literature in any discipline usually represents only a small section of the knowledge of the people involved in that field on a daily basis. For this reason, a panel of experts was requested to validate the contents of the stress scale and suggest adjustments. As the focus of the study was clinical, the expert panel consisted of specialists in the field of neonatology (Davis, 1992:194).

The research proposal and draft of the stress scale were circulated to expert panel members for feedback prior to scale finalisation. The five experts were given time to clarify concepts and provide input. Their comments were reviewed and necessary changes made. Based on the input received, stress scale content was eliminated, altered or added. After refinement, the sec-

ond draft of the stress scale consisted of fifteen items covering four main physiological systems; the stressor indicator consisted of ten observational factors.

During a workshop attended by the panel of experts, Human Judgement Modelling and the visual analogue scale were used to assign weights to items and categories of items on the stress scale (Hennessy, 2003:26; Hennessy, Becker, Wolfaardt & Maree, 2006). These weights provide a reliable method of calculating preterm infant stress levels (Hennessy, 2003:26-30). The third draft of the stress scale was then pilot tested to highlight any problems before data collection would commence. Areas of weakness were modified, the stress scale was finalised, and it was named the Hennessy Stress Scale for the Preterm Infant. This scale is included as Table 1.

After adding the Likert scores (between 0-4) obtained for each of the 15 items on the Hennessy scale, the total stress score ranges between 0 and 60. The implication is that the 15 scale items are equally important and the points (0-4) on the Likert scale equidistant, which in practice is not absolutely correct. However, the impact of any misrepresentation is minimised by the careful selection and weighting of items chosen for the scale by experienced expert panel members. Weighting was done using the general linear model framework to find item weights and the visual analogue scale to weigh Likert scores (Hennessy, 2003:26; Hennessy, *et al.* 2006).

A pilot study was conducted on eight preterm infants to facilitate power calculations. DSP reduced the mean stress score for preterm infants from 24.4% to 19.6%, and the expert panel agreed that the observable reduction of 20% would be clinically relevant. (Phase one of the study is discussed in more detail in a separate article that focuses on the methodology involved during the scale development by Hennessy, *et al.* 2006).

Phase two of the study consisted of quantitative empirical research. A within-subject design used a quasi-experimental approach to investigate the suspected causal relationship between DSP (independent variable) and preterm infants' stress levels (dependent variable). This type of research design is characterised by repeated measures of an observable behaviour, in this case preterm infants' stress levels, throughout at least

Table 1: Hennessy Stress Scale for the Preterm Infant

The Hennessy Stress Scale for the Preterm Infant

Observational Aspects		4	3	2	1	0	Likert Score	Converted Score
Neurological System	**Neck & back** $W_1 = 7.19$	severe jitteriness hyperextension hypertonia hypotonia $w_{1,4} = 1$	mild jitters $w_{1,3} = 0.78$	sensitivity to moro reflex stimulus fright $w_{1,2} = 0.57$	neck stiffness $w_{1,1} = 0.28$	reflexes correct for GA flexed head $w_{1,0} = 0$	3	$W_1 \times w_{1,3} =$ 5.60
	Extremities, fingers & toes $W_2 = 5.51$	flaccid flexor or extensor spasm hypertonic white knuckles $w_{2,4} = 1$	flying movements extension kicks frantically poor attempt at movement grasping hands poor grip $w_{2,3} = 0.78$	increased muscle tone in hands hands clasped together pushing with feet $w_{2,2} = 0.52$	lower than normal muscle tone attempts flexion holds on to object fists $w_{2,1} = 0.21$	relaxed midline flexion self-regulating behaviour hands to mouth co-ordination feet flexed $w_{2,0} = 0$	2	$W_2 \times w_{2,2} =$ 2.87
	Crying $W_3 = 5.56$	hysterical crying high pitched never cries $w_{3,4} = 1$	very upset crying constant moaning poor attempt to cry $w_{3,3} = 0.76$	upset crying irritability moaning $w_{3,2} = 0.47$	cries for attention $w_{3,1} = 0.17$	not crying and relaxed mouth $w_{3,0} = 0$	3	4.23
	Face $W_4 = 5.06$	gaping mouth drifting eyes half-open no focus no response $w_{4,4} = 1$	grimace frown tonguing continuously squeezes eyes closed $w_{4,3} = 0.76$	tonguing at times yawn sneeze blinks eyes tightly $w_{4,2} = 0.51$	pulls faces visual aversion $w_{4,1} = 0.23$	relaxed face relaxed mouth rooting reflex sucks pacifier eyes fixed on an object $w_{4,0} = 0$	4	5.06
	Sleep - wake Cycle $W_5 = 4.79$	no sleep $w_{5,4} = 1$	periods of light sleep no deep sleep $w_{5,3} = 0.74$	at times establishing $w_{5,2} = 0.44$	periods of deep sleep but wakes easily $w_{5,1} = 0.20$	> 30 min periods of deep sleep $w_{5,0} = 0$	3	3.54
Respiratory System	**Respiration Rate (/min)** $W_6 = 7.01$	< 20 > 120 $w_{6,4} = 1$	20 - 30 100 - 119 $w_{6,3} = 0.75$	30 - 35 81 - 99 $w_{6,2} = 0.47$	35 - 40 61 - 80 $w_{6,1} = 0.21$	40 - 60 $w_{6,0} = 0$	1	1.47
	Respiratory Sounds $W_7 = 6.86$	gasping $w_{7,4} = 1$	severe expiratory grunting $w_{7,3} = 0.75$	moderate expiratory grunting $w_{7,2} = 0.51$	mild expiratory grunting $w_{7,1} = 0.25$	no expiratory grunting $w_{7,0} = 0$	0	0
	SpO2 (%) $W_8 = 7.85$	< 85 $w_{8,4} = 1$	85 - 87 $w_{8,3} = 0.76$	88 - 90 $w_{8,2} = 0.51$	91 - 93 $w_{8,1} = 0.19$	94 - 100 or apnea monitor $w_{8,0} = 0$	0	0
Cardiovascular System	**Heart Rate (/min)** $W_9 = 9.69$	< 80 > 200 $w_{9,4} = 1$	80 - 89 181 - 200 $w_{9,3} = 0.78$	90 - 99 161 - 180 $w_{9,2} = 0.51$	100 - 119 141 - 160 $w_{9,1} = 0.23$	120 - 140 $w_{9,0} = 0$	1	2.28
	Heart Rhythm $W_{10} = 8.72$	irregular $w_{10,4} = 1$		irregular at times $w_{10,2} = 0.57$		regular $w_{10,0} = 0$	2	4.97
	Blood Pressure (mmHg) *Gestational age = GA* $W_{11} = 7.92$	BP mean 2 or more < GA or > 6 > GA $w_{11,4} = 1$	BP mean 1 < GA $w_{11,3} = 0.74$	BP mean equal to GA $w_{11,2} = 0.47$	BP mean 2 > GA $w_{11,1} = 0.23$	BP mean 2 - 6 > GA $w_{11,0} = 0$	4	7.92
	Skin Colour $W_{12} = 7.27$	blue or grey mottled purple $w_{12,4} = 1$	pale grey areas turns red when crying $w_{12,3} = 0.75$	ashen $w_{12,2} = 0.48$	pale pink $w_{12,1} = 0.22$	pink $w_{12,0} = 0$	4	7.27
	Perfusion $W_{13} = 6.90$	central and peripheral cyanosis $w_{13,4} = 1$	centrally pink peripheral cyanosis $w_{13,3} = 0.78$	cold extremities $w_{13,2} = 0.52$	cool extremities centrally pink peripherally pink $w_{13,1} = 0.24$	pink tongue no cyanosis warm extremities $w_{13,0} = 0$	1	1.66
GIT - System	**Nutrition per 3 hour period** $W_{14} = 4.58$	no absorption $w_{14,4} = 1$	absorbs < 25% $w_{14,3} = 0.74$	absorbs 25-50% $w_{14,2} = 0.49$	absorbs 50 - 75% $w_{14,1} = 0.24$	absorbs >75 % $w_{14,0} = 0$	0	0
	GIT Related Responses $W_{15} = 5.09$	abdominal distension vomiting $w_{15,4} = 1$	signs of nausea visible gag reflex $w_{15,3} = 0.73$	hiccups cramps (cries and pulls legs up) hungry $w_{15,2} = 0.43$	breaking winds $w_{15,1} = 0.16$	peaceful after feed $w_{15,0} = 0$	0	0
						Sum of converted scores	46.66%	46.87%

one baseline evaluation (pre-test) and an intervention phase (post-test). In this manner, the preterm infants formed their own control group. This approach is effective when evaluating a small group of subjects that also serve as their own control group (Backman & Harris, 1999:170).

The research population consisted of preterm infants with a gestational age of less than 37 weeks, who were admitted to a specific private NICU. Gestational age was determined, using the Ballard scale (Ballard, Khoury, Wedig, Wang, Eilers-Walsman & Lipp, 1991:418). This was done before the pre-test observation to limit additional stress factors for the infant. The study sample consisted of twenty-two (22) preterm infants, twelve male and ten female, between the gestational ages of 28 and 36 weeks, who were born in a specific private hospital and admitted to the NICU of

that hospital. As long as they were stable, preterm infants were not excluded because of illness. Sedated infants were excluded due to reduced observable behaviour.

Before data collection commenced, a compulsory educational session on DSC, including DSP, was presented to all NICU staff. This was done to ensure that the implementation of environmental manipulation was constant throughout the study in order to limit the influence of external variables. The researcher collected data over a four-week period during day-shift by evaluating the sample of 22 preterm infants according to the validated stress scale. The stress scale, which was accepted by the statistician and the panel of experts, was applied to assess the preterm infants' stress levels before (pre-test) and after (post-test) the implementation of DSP (intervention). The pre-test was done before routine care was delivered, and the post-test was conducted three hours after implementing DSP. With the exception of supine positioning, all positions were used. During the assessment period, DSC principles were implemented as far as possible. By observing the physiological stability and behaviour of the sample population, the effect of DSP on the stress levels of preterm infants could be measured.

The data analysis was done in collaboration with the Biostatistics unit of the MRC and under the supervision of a statistician. The analysis included the use of a one-sided Student's paired t-test, which compared the mean stress scores from pre-test and post-test data-collection results. Student's paired t-test indicated the suspected causal relationship of DSP (independent variable) and preterm infant stress levels (dependent variable).

Using the sample size software, nQuery V4.0, it was determined that a sample size of 22 infants will have 90% power to detect a clinically relevant reduction of 20% in the stress score when testing at 0.05 level of significance. A standard deviation of 7.33% was assumed from the pilot study.

RESULTS

Pre-test and post-test mean stress level scores, 29.07% versus 16.87% (mean shift of 12.2% and standard deviation of 3.97%), were significantly different (p < 0.0001; student's paired t-test) and the 95% confidence interval for the difference in mean stress level scores was 10.43% and 13.90%. Thus, DSP significantly improved preterm infant stress levels.

DISCUSSION

The expert panel agreed that, in order to be clinically significant, a shift of 20% was required in the mean stress score as a result of DSP. This meant that a reduction of not less than 5.81% was required in pre-test stress levels due to DSP. The results of this study surpassed the improvement required by the expert panel, as the shift from mean pre-test stress score to mean post-test stress score was 12.2%. This was a shift of 42% (as compared to the 20% required), and the lower 95% confidence limit of 10.43% suggested an improvement in the stress scale score of at least 36%.

The intervention, DSP, was seen to have dramatically improved the stress levels of the preterm infants, providing convincing evidence of the cause-effect relationship between DSP and preterm infant stress-level reduction (Backman & Harris, 1999:173).

To demonstrate the reduction in preterm infant stress levels as indicated by the difference in pre-test and post-test scores, one participant's pre-test post-test results are presented as a case study. Refer to Figure 1 and Table 2. In this case, the converted pre-test score recorded a stress level of 47%. Following the implementation of DSP, the infant was re-evaluated and a stress level of 34% recorded. Four of the five items on the Hennessy Stress Scale for the Preterm Infant, which indicated a reduction in stress, involved the neurological system.

ETHICAL CONSIDERATIONS

There was no control group in this study, as the non-implementation of DSP would result in negative sequelae. No harm or damage came to the research participants. The implementation of DSC, including DSP, could be regarded as only beneficial, as suggested in literature previously discussed. Participant confidentiality was upheld. Because the sample falls within the vulnerable population defined by the South African Nursing Council's Standards for Nursing Practice (Section
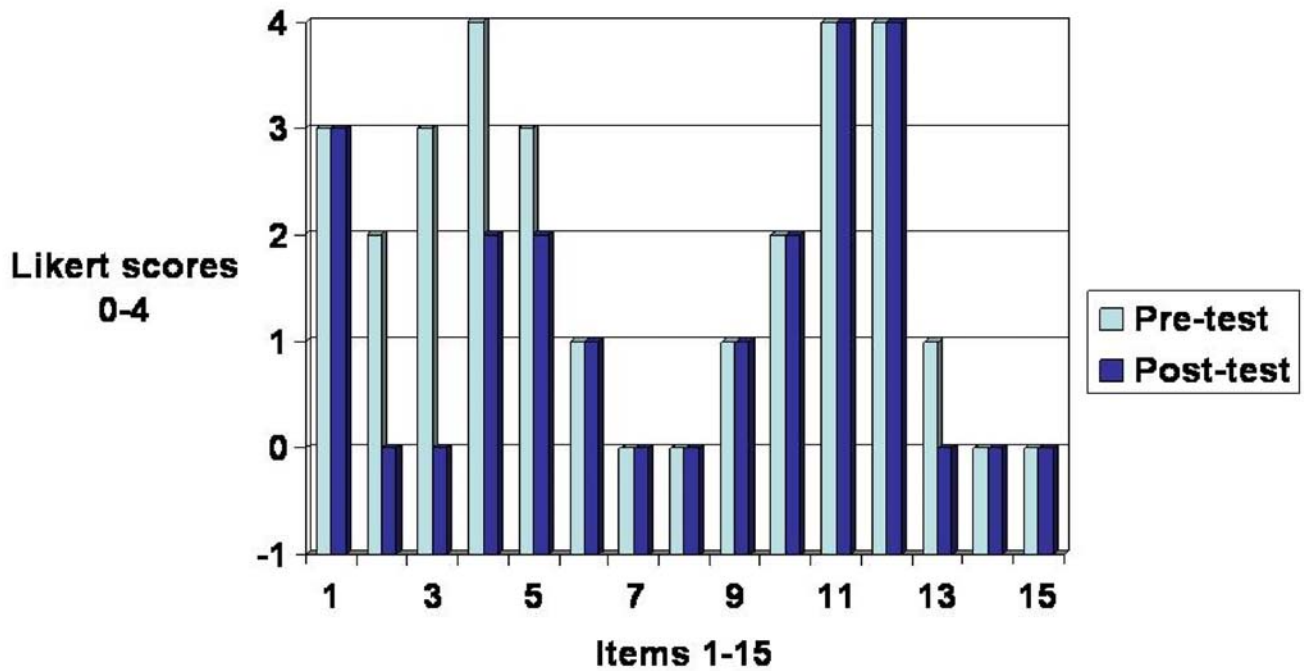
Case study of a participant

Figure 1: Case study of a participant

Table 2: Comparison of pre-test and post-test results of one case study

Observational aspects	Pre-test results	Post-test results
Extremities, fingers & toes	• Increased muscle tone in hands • Hands clasped together • Pushing with feet	• Relaxed • Midline flexion • Self-regulating behaviour • Hands to mouth • Co-ordinated • Feet flexed
Crying	• Very upset, crying / Poor attempt to cry • Constant moaning	• Not crying • Relaxed mouth
Face	• Gaping mouth • Drifting eyes • Half-open eyes • No focus • No response	• Tonguing at times • Yawn / sneeze • Blinking eyes close tightly
Sleep-wake cycle	• Periods of light sleep • No deep sleep	• Periods of deep sleep
Perfusion	• Centrally and peripherally pink • Cool extremities	• Centrally and peripherally pink • Warm extremities

3:4) (SANC, 1998), informed consent was obtained from parents. Consent to do research in the NICU of a specific private hospital was granted by hospital management. Ethical approval was obtained from the Ethics Committee of the University of Pretoria's Faculty of Health.

RELIABILITY AND VALIDITY

The researcher has specialised in neonatal nursing science, focussing on DSC, and has had prolonged engagement in the NICU environment. The statistician and the panel of experts approved the stress scale, ensuring both construct and content validity. The composition of the panel of experts, namely a wide selection of specialists comprising a multidisciplinary team, increased the reliability and validity of the study. Instrument development and data analysis were supervised and approved by a statistician. The sample size was adequate to satisfy the hypothesis. The research design allowed of subjects to serve as their own control group. The intensive training of staff ensured the manipulation of the external environment and prevented interference by extraneous variables. To enhance consistency, the researcher collected the data without the assistance of field workers.

WEAKNESSES OF THE STUDY

Due to the nature of a within-subject research design, which requires a small sample size, reducing the potential for generalisation of results, repeating the same study to confirm findings would be recommended. The study should be conducted over a 24-hour period, which the expert panel recommended. Sample stratification of research participants according to gestational age could also be included. An external reviewer of pre-test and post-test evaluations could increase the objectivity of assessments.

CONCLUSIONS AND RECOMMENDATIONS

The results of this study confirm the assumption that DSP is beneficial to preterm infants and should to be included as part of the developmental care approach. Previous studies have only suggested that stress reduction would occur as a logical (positive) sequelae resulting from other positive effects of the developmental care approach. Direct observation of the inverse cause-effect relationship between DSP and stress levels of the preterm infant can now be documented as significant.

The results of this study indicate that preterm infant stress levels are significantly reduced when DSP is implemented. The results, therefore, strongly support the notion that DSC, and particularly DSP, should be implemented in all NICUs in order to improve the short-term and long-term sequelae for preterm infants.

Further recommendations are that the research study should be repeated in other hospitals so that results can be generalised with greater reliability. The study should also be repeated over a longer time frame with a greater period between pre- and post-test stress scale assessment with the time frame being increased from a three to a 24-hour period. Stratification of the sample according to gestational age probably would reduce the limitation of the stress scale, making it more accurate and easier to generalise results. A longitudinal study could be conducted to determine the long-term sequelae of preterm infants exposed to DSP, in order to determine the long-term effects of DSP. DSP should be researched further, with specific focus on describing the relationship between DSP and reduction in hospital costs and period of hospitalisation.

The final conclusion is that DSP significantly reduces stress levels of preterm infants and should be implemented as part of neonatal care.

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