

Content validity of the developmental care scale for neonates with CHD

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Abstract

Purpose: Neuroprotective developmental care is paramount for neonates with CHD. Although several developmental care scales exist, either they have not been psychometrically tested or were not designed for the needs of neonates with CHD. The purpose of this study is to describe item development and content validity testing of the developmental care scale for neonates with CHD, which measures five domains of the developmental care provided by bedside nurses to neonates in the cardiac ICU: sleep, pain and stress management, activities of daily living, family-centred care, and environment. *Methods:* For this cross-sectional study, items were developed based on clinical expertise and the core measures for developmental care. In this study, seven experts provided content validity ratings of items for total scale and subscale fit and relevance. A content validity index was used to determine item retention. Item modifications and additions were based on expert feedback. *Results:* Expert ratings provided evidence of content validity on 24 of 53 items within the five domains of developmental care. A total of 24 items were deleted, and five items with low content validity ratings were retained, because of conceptual importance, and revised. An additional 11 items were added based on expert qualitative feedback. *Conclusions:* This study provided evidence of content validity of the developmental care scale for neonates with CHD by researchers and bedside nurses caring for these neonates. Further psychometric testing is warranted to provide evidence of internal consistency reliability, construct validity, and to identify variables that influence quality of the developmental care.

Introduction

Poor neurodevelopmental outcomes are the most common long-term morbidity associated with CHD and result from both biological and environmental risk factors.¹ Gaynor et al concluded that incidence of poor neurodevelopmental outcomes is rising in neonates as a result of higher risk in infants surviving cardiac surgery.² Length of hospital stay, in particular, has been recognised as a strong predictor of neurodevelopment.³ Evidence from other patient populations indicates that quality of caregiving in the hospital is associated with improved neurodevelopment.^{4–6} Long-term developmental outcomes of children with CHD appear to be similar to those of premature infants, who spent their early postnatal lives in the hospital.^{7–9} Given these findings, it is likely that interventions geared towards improving neurodevelopment of premature infants would be appropriate to use in CHD patients that require hospitalisation during the neonatal period as well.¹⁰ Developmental care is a widely used neuroprotective care intervention, which has exhibited a strong relationship with improved neurodevelopment in premature infants.^{4–6}

The developmental care for neonates has been systematically implemented in some cardiac ICUs as a method of neuroprotection. Although limited data about the developmental care practices in the cardiac ICU exist,^{10,11} most of what is currently known stems from a survey that was distributed to every dedicated paediatric cardiac ICU in the United States in 2015. The survey reported an 80% response rate and results indicated that 89% of units implemented some sort of developmental care.¹² Although the developmental care is reported to be widely used, the survey determined that the practices were inconsistent within and across cardiac ICUs.

Although measurement of developmental care has been in practice to hospitalised premature infants, no scale has been found in the literature that measures the developmental care delivered specifically to hospitalised neonates with CHD. Current consensus among experts is that developmental care for neonates with CHD will not look exactly like developmental care for premature infants because of different needs, acuties, and feasibility. However, the developmental care scales created for premature infants in the neonatal ICU may be modified to fit the needs of neonates with CHD.

The Newborn Individualized Developmental Care and Assessment Program is the most well-known and widely used developmental care scale. It was developed to certify neonatal ICUs demonstrating consistent promotion of short and long-term development of infants and families.¹³ Two other developmental care scales have been identified: The National Association of Neonatal Nurses, developmental care self-assessment¹⁴ and Core Measures for Developmental Care: Self-assessment.¹⁵ The National Association of Neonatal Nurses self-assessment scale was developed to assess an individual's incorporation of developmental care into daily practice in the neonatal ICU. Potential candidates for the National Association of Neonatal Nurses neonatal developmental care specialist designation must complete this self-assessment tool during the application process.¹⁴ The Core Measures for Developmental Care: Self-assessment was developed to identify the areas of strength and weakness of neonatal ICU nurses in delivering their developmental care. Items were created based on evidence from the literature and grounded in the Universe of Developmental Care theory.¹⁵ Although the existing scales provide a useful groundwork, none of them are specific to nursing care of full-term neonates with CHD and none of the self-assessment measurements found in the literature have been psychometrically tested.^{14,15} The focus of this paper is to describe the process by which items of the developmental care scale for neonates with CHD were developed or modified from an existing developmental care self-assessment scale used for bedside nurses caring for neonates with CHD, and to assess content validity of the scale by a panel of experts. Specifically, information was sought regarding which aspects of developmental care are appropriate, applicable, and measurable for neonates with CHD in the cardiac ICU setting.

Materials and methods

This cross-sectional study used quantitative and qualitative approaches to generate items, gather evidence of content validity, and refine the developmental care scale for neonates with CHD.

Item and item pool development

A pool of 53 potential items was organised according to the theoretical definition of developmental care by Gibbons, Coughlin, and Hoath.¹⁵ The developmental care was defined as age-appropriate care that focusses on the human needs of the patient population served independent of the presenting disease process and categorised into five domains.¹⁵ The five domains that reflect the recurring themes that have emerged from the literature related to quality developmental care practices are protected sleep, pain and stress assessment and management, age-appropriate activities of daily living, family-centred care, and the healing environment.¹⁶ Conceptual definitions of the five domains can be found in Table 1.

With permission from one of the authors,¹⁷ 32 items from the Core Measures for Developmental Care: Self-Assessment were modified and added to the developmental care scale for neonates with CHD item pool. Among the 32 items, eight were divided into a total of 16 items to ensure only one construct was measured per item. On the basis of one investigator's past experience as a cardiac ICU bedside nurse and another investigator's past experience as the parent of a hospitalised newborn, 13 items were generated. The suggested items based on investigators' past experiences included elements such as "The skin surface was

Table 1. Developmental care domain definitions.

Domain	Definition
Protected sleep	Infant sleep-wake states will be assessed, documented, and will guide all non-emergent care interactions; care strategies that support sleep are individualised for each infant and documented; and families are educated on the importance of sleep safety in the hospital and at home
Pain and stress assessment and management	Prevention of pain and stress is an expressed goal in the daily management of the hospitalised neonate; pain and stress are assessed and managed before, during, and after all procedures until the neonate returns to his/her baseline level of comfort; interventions and responses to stress-relieving and pain-management interventions are documented; family is involved and informed of the pain management plan of care; and family involvement and information sharing is documented
Age-appropriate activities of daily living	Age-appropriate postural alignment used to provide comfort and safety, physiologic stability, and support optimal neuro-motor development; age-appropriate alimentation that is infant-driven, nurturing, and preferred by the family; and age-appropriate skin integrity that is assessed, documented, and cared for in a manner that ensures protection
Family-centred care	Family has 24-hour unrestricted access to their infant and is supported in role-validating activities during the cardiac ICU stay; the family's level of emotional well-being and parental confidence and competence is assessed and documented weekly; and the family has access to resources and supports that assist them in short- and long-term parenting, decision-making, and mental well-being
The healing environment	A soothing and spacious environment conducive to rest, healing, and recovery; and a collaborative healthcare team that emanates teamwork, mindfulness, and caring

Source: Coughlin¹⁶

always protected from lines, tubes, drains, and airways" and "Mother's physical health and well-being was assessed."

Content validity

The item pool was reviewed by seven experts, including two paediatric developmental psychologists, one doctorally prepared nurse researcher, one neonatologist, and three cardiac ICU bedside nurses, all with expertise in neurodevelopment or care of neonates with CHD. To determine content validity, the experts were asked to determine the most appropriate developmental care domain for each item, indicate the relevance of the item to their assigned domain using a four-point response scale, suggest revisions for item improvement, and identify items or domains missing from the conceptual definition of developmental care.

Table 2. Developmental care scale for neonates with CHD item analysis

DCS-NCHD subscales	Items rated as content valid	Items retained with rating <0.86	Items added based on expert feedback	Current number of items
Environment	5	0	4	9
Protected sleep	3	1	2	6
Activities of daily living	8	1	0	9
Pain and stress management	4	2	0	6
Family-centred care	5	1	5	11

DCS-NCHD = Developmental care scale for neonates with CHD

Content validity was quantified for each item, domain, and total scale according to procedures outlined by Lynn.¹⁸ Item content validity index, or the proportion of experts endorsing an item compared with the total number of experts, was computed for relevance to the overall definition of developmental care. At least six experts were needed to endorse an item as “moderately relevant” or “very relevant” to achieve an acceptable content validity index of 0.86. Content validity of each developmental care domain was determined by the proportion of items rated as content valid – those items scored as “moderately relevant” or “very relevant” – to the total number of items in each subscale for each rater. All raters’ content validity indices were then summed and divided by the number of raters to calculate the mean subscale content validity index. Total scale content validity was defined by the number of items rated as content valid to the number of items in the total scale. A content validity index of 0.86 or greater is considered acceptable for subscale and total scale content validity as well. In addition to content validity indices, qualitative feedback from experts were used to guide item addition, revision, and removal. Experts were requested to add additional items or areas of the conceptual definition that were not represented by the items.

Results

Of the original 53 items, 24 items had a minimum content validity index of 0.86 for relevance to domain assignment. One item was divided into two separate items, and minor wording changes were made to the remaining items as suggested by experts. Five items with content validity indices lower than 0.86 were retained because of conceptual importance and reworded according to expert feedback. An additional 11 items were added based on recommendations from the experts resulting in a total of 41 items, consisting of nine environment items, six protected sleep items, nine activities of daily living items, six pain and stress management items, and 11 family-centred care items. Examples of items added based on expert feedback include “Family encouraged to participate in daily activities such as bathing and diaper changes; educated parents on upcoming developmental milestones; and developmental care plan created for each neonate.” A summary of the developmental care scale for neonates with CHD item analysis can be found in Table 2. Subscale and total scale content validity were determined after item deletion. All the subscale content validity ratings were acceptable, ranging from 0.86 to 0.89, except for the sleep subscale with a rating of 0.82. Despite the sleep subscale lacking adequate content validity,

sleep is an essential element of healthy brain development and maturation.¹⁹ So, further empirical evidence will be sought before considering sleep subscale elimination. A summary of the subscale content validity ratings can be found in Table 3. Total scale content validity was determined to be acceptable at 0.87. There were no suggestions for additional domains of developmental care. The resulting 41 items of the developmental care scale for neonates with CHD can be found in Table 4.

Discussion

This study is unique in that a group of seven content experts comprising nurse scientist, paediatric psychologists, neonatologist, and bedside nurses provided positive ratings for items, subscales, and total developmental care scale for neonates with CHD, which measures the quality of developmental care performed by bedside nurses for neonates with CHD in the cardiac ICU. The use of experts not only provided evidence of content validity for the developmental care scale for neonates with CHD but also revealed important items that needed to be considered for addition into the scale. For example, comments made by experts resulted in further refinement of all subscales and inclusion of new items pertaining to developmentally appropriate sensory stimulation, skin to skin contact, collaboration with families, and modelling safe sleep practices.

Two of the content experts had lower subscale content validity index ratings than the rest. This is important to note, as the low ratings made a significant impact on the number of items that were discarded or reworded. The discrepancy in ratings is likely due to differences in personal opinion and the experts’ differing professional backgrounds. Differing opinions seem to have always been an issue with developmental care. In a concept analysis, Aita and Snider indicated that developmental care has been conceptualised inconsistently since its inception.²⁰ Professional experience seemed to also play a role. The four clinically oriented experts, such as bedside nurses and neonatologist, provided the highest ratings, whereas the three research-oriented experts had more variability in their ratings, with one high rater and two lower raters. One of the lower rating experts had previous experience with developmental care scale development and her feedback primarily focussed on improving the wording of many of the items to ensure applicability in all situations. Recommendations were also made to include assessment of the infant’s state to some of the subscales. The second lower rating expert researches infant developmental outcomes and specific developmental care interventions. Her lower content validity ratings

Table 3. Content validity index ratings of the developmental care scale for neonates with CHD subscales

QDCS Subscales	No. of Items	Mean subscale content validity index ratings by individual experts ¹							Mean Rating All Expert ²
		Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	
Environment	5	1.0	1.0	1.0	0.4	1.0	1.0	0.8	0.89
Sleep	4	1.0	1.0	1.0	0	1.0	1.0	0.75	0.82
Activities of daily living	9	1.0	1.0	1.0	0.67	1.0	1.0	0.56	0.89
Pain and stress	6	1.0	1.0	1.0	0.33	1.0	1.0	0.67	0.86
Family-centred care	6	1.0	1.0	1.0	0.33	1.0	1.0	0.67	0.86

QDCS = Quality developmental care scale

¹Subscale content validity index ratings were calculated once 23 items with ratings <0.86 were removed

²Mean subscale ratings by individual experts equal to the number of items rated as "moderately relevant" or "very relevant" divided by the number of items in the subscale

³Mean ratings by all experts equal to the sum of individual expert ratings for each subscale divided by the number of experts

reflect disagreement over the appropriateness of including some of the items in a developmental care scale, such as documentation of nurse involvement in daily interdisciplinary rounds. As a result of this critical feedback, the developmental care scale for neonates with CHD has less items but should be more representative of developmental care applicable and feasible to neonates with CHD.

Sleep was the only subscale with an inadequate content validity rating. Likely, this either reflects items that do not represent the construct adequately or overlap between the multiple constructs that make up the domains of developmental care. Moreover, item distribution across the various domains is not proportional, again bringing dimensionality of the scale and potential overlap of constructs into question. Future research will include exploratory factor analysis in order to shed light on dimensionality of the scale. Family-centred care currently contains the largest number of items, which speaks to the primary importance of family collaboration with the healthcare team in providing developmental care. It also speaks to the importance of ensuring family needs are adequately met in order for family to be fully capable of caring for their neonate.

There are a number of similarities between the developmental care scale for neonates with CHD and developmental care self-assessment scales used with preterm infants already in existence. This is to be expected, as there will be overlap in developmental care interventions for all neonates, regardless of health condition or acuity. However, the main difference between the developmental care scale for neonates with CHD and others primarily lies with the focus on interventions that are within the control of the bedside nurse. Although collaboration with other disciplines certainly is important for providing the best care for patients, nurses are present at the patient's bedside around the clock. This puts them in a unique position to have control over oversight of consistent implementation of care that is independent from the disease-specific needs of the patient. Given the current limited knowledge about developmental care of neonates with CHD, similarities in developmental care interventions between different populations of neonates is to be expected. There is a possibility that interventions between neonatal populations will not be significantly different, but there could be barriers to interventions. For example, it is common for neonates with CHD to return to the cardiac ICU post-operation with an open sternum or with intracardiac lines. These present barriers to developmental care are unique to neonates with CHD. Another example is the neonate with complex CHD with such low cardiac output that some developmental care interventions may cause hemodynamic

instability. Future research is required to identify potential facilitators and barriers to developmental care, as well as interventions, which are vital to, and potentially specific to, neurodevelopment of the neonate with CHD.

Limitations

Findings from this study are limited by a small convenience sample of content experts and cannot be generalised beyond those individuals who participated. However, the study is a necessary first step, and current work is taking place to test the psychometric properties, including further validity testing, of the developmental care scale for neonates with CHD in a larger sample from multiple sites of cardiac ICU bedside nurses.

A total of 11 items were added based on expert qualitative feedback that were not assessed for content validity. However, experts had access to all conceptual definitions of developmental care and its domains, thereby retaining the chance that recommendations for new items were made within the theoretical dimensions of developmental care. Future testing will include item-to-total correlations, indicating some extent of content relevance, as it measures the degree to which any one item is correlated with the remaining items in each domain of developmental care.²¹

Nurses are extremely important and drive care; however, to truly integrate neuroprotective developmental care, all aspects of the environment and staff who have exposure to the patient are important for consideration. Moreover, focussing specifically on care provided by bedside nurses could be considered a limitation. In order to address this limitation, future research will include questionnaires based on the theory of planned behavior²² that will ask nurses about perceptions regarding developmental care norms, beliefs, and expectations of all cardiac ICU staff and about environmental barriers or facilitators to developmental care. It is important to also examine the developmental care practices of all disciplines in the cardiac ICU in order to implement the most effective, comprehensive developmental care programme in the future.

Summary

Establishing evidence of content validity is an important initial step in the process of developing the developmental care scale for neonates with CHD, which measures the quality of

Table 4. Developmental care scale for neonates with CHD items

Environment
Efforts were made to protect the neonate from light while sleeping
Muted, indirect light was provided when the neonate was awake
Room lighting was individualised based on the neonate's sleep-awake state
Quiet voices were used while in the neonate's room
Sounds from other unit-related activities were reduced
Calming sounds (e.g. music, voices, womb noises) were played at the bedside based on cues from the neonate
Visual stimuli were provided (e.g. mirror, black/white images, faces) based on the neonate's cues of interest
The nurse participated in daily interprofessional care rounds
Air temperature was stable, consistent, and appropriate for maintaining neonate's well-being
Protected sleep
Sleep-wake state was assessed before every interaction with the neonate
Family education on safe sleep (A.B.C. Alone, on their Backs, in a Crib) has been provided
Routine care was provided when the neonate was awake or emerging from sleep
Individualised activities that promote sleep were implemented
Safe sleep (A.B.C. Alone, on their Backs, in a Crib) was maintained
Care was clustered to minimise interruptions in sleep
Age-appropriate activities of daily living
The neonate was positioned with the neck and shoulders in alignment with the rest of the body
The neonate was positioned with extremities midline and semi-flexed
The neonate was contained without completely immobilising the extremities
Non-nutritive sucking was guided by cues of interest
The skin surface was protected from lines, tubes, drains, and airways
Bathing frequency was individualised to the neonate's needs and skin integrity
The skin surface was protected during use of adhesive products
Opportunities were created for the neonate to be held skin-to-skin
Opportunities were created for the neonate to be held based on cues from the neonate
Pain and stress management
The neonate's state of stress-guided routine care
Non-pharmacologic measures were used to minimise distress
Individualised pain-relieving interventions were added to plan of care
Families were involved in creating the pain management plan of care
Gentle, smooth, and supportive touch was used during care
Pharmacologic measures were used as needed to minimise distress
Family-centred care
Caregiving was provided in collaboration with family as appropriate
Opportunities were provided for family to provide comfort to the neonate
Mother's physical health and well-being was assessed

Table 4. (Continued)

Mother's emotional health and well-being was assessed
Referrals were made as needed based on assessment of mother's health and well-being
Family satisfaction with the neonate's care was assessed
Family resource needs were assessed
Referrals were made as needed based on the family resource assessment
Mother's feeding preference was included in the plan of care
Families were informed about available support groups
The daily plan of care was communicated to the family

developmental care provided by bedside nurses to neonates with CHD in the cardiac ICU. In this study, the developmental care scale for neonates with CHD demonstrated evidence of content validity. Qualitative feedback provided further improvements to the scale with addition or removal of items in each subscale. Further research is warranted to determine the evidence of construct validity, internal consistency reliability, and to identify variables that influence the quality of developmental care delivered. With evidence of validity and reliability, the developmental care scale for neonates with CHD has the potential to be a useful measure assessing developmental care standards and to drive education of staff who require more training on how these interventions should be performed.

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Conflicts of Interest. None.

Ethical Standards. This study was designated by the University of Cincinnati Institutional Review Board as Not Human Subjects Research (reference no. 2017-0931).

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