

Guidelines for the Institutional Implementation of Developmental Neuroprotective Care in the Neonatal Intensive Care Unit. Part A: Background and Rationale. A Joint Position Statement From the CANN, CAPWHN, NANN, and COINN

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Abstract

The use of age-appropriate care as an organized framework for care delivery in the neonatal intensive care unit is founded on the work of Heidelise Als, PhD, and her synactive theory of development. This theoretical construct has recently been advanced by the work of Gibbins and colleagues with the “universe of developmental care” conceptual model and developmental care core measures which were endorsed by the National Association of Neonatal Nurses in their age-appropriate care of premature infant guidelines as best-practice standards for the provision of high-quality care in the neonatal intensive care unit. These guidelines were recently revised and expanded. In alignment with the Joint Commission’s requirement for health-care professionals to provide age-specific care across the lifespan, the core measures for developmental care suggest the necessary competencies for those caring for the premature and critically ill hospitalized infant. Further supported by the Primer Standards of Accreditation and Health Canada, the institutional implementation of these core measures requires a strong framework for institutional operationalization, presented in these guidelines. Part A of this article will present the background and rationale behind the present guidelines and their condensed table of recommendations.

Keywords

guidelines, institutional implementation, development care, neuroprotective care, age-appropriate care, neonatal intensive care unit

Introduction

Over the last 30 years, advancement in the field of technology as well as new knowledge has improved survival and decreased the incidence of major long-term disabilities among premature infants (Wilson-Costello et al., 2007). However, neurodevelopmental outcomes for this

vulnerable patient population remain a major concern (Baron, Erickson, Ahronovich, Baker, & Litman, 2011; Hack et al., 1994, 2009) and are still heavily influenced

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by the environment of care which is more often than not intensive, stressful, and sometimes traumatic (Als et al., 1994; Altimier & Phillips, 2013; Chau et al., 2013; Coughlin, 2014). Based on Als' Synactive Theory (Als, 1986), developmental care (DC) has emerged as a neuroprotective care concept aimed at preventing the long-term consequences associated with the physical environment, promoting the optimal organization and neurological development of preterm infants in the neonatal intensive care unit (NICU) as well as integrating parents as care partners (Altimier, Kenner, & Damus, 2015; Coughlin, Gibbins, & Hoath, 2009; Kenner & McGrath, 2014). Neuroprotective care includes several strategies, such as family-centered developmental care, that promote normal development and prevent disabilities (McGrath, Cone, & Samra, 2011). Both terms, neuroprotective care and family-centered developmental care, are used in these guidelines to reinforce the importance and relevance of DC as a neuroprotective measure for premature infants admitted in the NICU while the ability to influence neural connectivity is at its greatest for potential long-term outcome-benefits (McGrath et al., 2011). Regardless of terminology, the objectives of these practice paradigms remain the same, and their results demonstrate a positive impact (Als et al., 2003, 2004; Buehler, Als, Duffy, McAnulty, & Liederman, 1995; Byers, 2003; Kleberg, Westrup, & Stjernqvist, 2000; Kleberg, Westrup, Stjernqvist, & Lagercrantz, 2002; Melnyk et al., 2005; Westrup, Kleberg, von Eichwald, Stjernqvist, & Lagercrantz, 2000). To further support DC, the Cochrane review states that

Developmental care interventions may help preterm infants cope better with the environment of the Neonatal Intensive Care Unit (NICU). There is concern that an unfavourable environment in the NICU can...negatively affect the infant's growth, with the brain being particularly vulnerable. DC refers to a range of strategies designed to reduce the stresses of the NICU. The review of trials suggests that these interventions may have some benefit...in enhancing neurodevelopmental outcomes. (Symington & Pinelli, 2006, p. 2)

Although numerous publications are available with regard to DC outcomes, the major-medical associations like the Canadian Pediatric Society and the American Academy of Pediatrics (AAP) are both silent in terms of DC, mentioning them only in their prevention of pain policy statement (AAP, 2006, 2010; Barrington, Batton, Finley, & Wallman, 2007). Improved recognition of infant mental health in neonatology (Coughlin, 2014; Zeanah, Bailey, & Berry, 2009) has been heightened by recent publications including the impact of early toxic stress and the environment on brain development. In a

recent position statement from the AAP (Garner & Shonkoff, 2012), the Academy proposes the adoption of an ecobiodevelopmental framework for pediatrics that promotes health and focuses on disease prevention impacting the health and wellness of the individual across the lifespan. Recommendations that support the development and implementation of new, evidenced-based DC interventions to reduce sources of toxic stress during critical and sensitive periods of development are essential (Garner & Shonkoff, 2012). However, little is published in terms of guidelines for their implementation and professional development (Altimier et al., 2015).

The only professional association worldwide to have guidelines in DC is the National Association of Neonatal Nurses (NANN). In 1995, they published their first content on the subject with their Infant and Family-Centered Developmental Care Guidelines, updated in 2000 (NANN, 1995). These evolved with their advance competency in DC (McGrath & Task force, 2008) as well as their DC specialist designation (McGrath & Task force, 2010) to be replaced in 2011 by their Age-Appropriate Care of the Premature and Critically Ill Hospitalized Infant – Guidelines for Practice (Coughlin, 2011). These guidelines were based on years of literature review, expert consultations, a conceptual model (The Universe of Developmental Care) (Gibbins, Hoath, Coughlin, Gibbins, & Franck, 2008) and Core Measures for Developmentally Supportive Care (Coughlin et al., 2009; Gibbins et al., 2008). This work culminates into the publication of the official professional association reference book on DC: *Developmental Care of Newborns and Infants—A guide for health-care professionals* (Kenner & McGrath, 2014). Like most publications available on DC, this precious and essential resource focuses mostly on individual practice guidelines, allowing only one chapter for implementation.

Many whom have criticized DC have mentioned the inconsistency in its implementation and the lack of institutional operationalization framework making outcomes very difficult to compare from one setting to another, and limiting research reproducibility (Carrier, 2002; Laudert et al., 2007; Wallin & Eriksson, 2009; Zhang, Lee, Chen, & Liu, 2016). The fact that this care model consists of multiple interventions with multiple outcomes also renders its evaluation and comparison more complex (Symington & Pinelli, 2006). Consequently, its implementation remains challenging, very sporadic, inconsistent, and variable from one setting as well as from one professional to the next, despite the presence of multiple recommendations, experts in the field, and the availability of training programs (Phillips, 2015; Zhang et al., 2016). In fact, despite the documented benefits, Coughlin et al. (2009) concluded that "...confusion about the existing theoretical construct and the

inability to identify and measure relevant clinical outcomes reliably has resulted in inconsistent adoption of developmental care and under-mined its potential as a revolutionary and transformative healthcare philosophy and practice paradigm” (p. 2240).

In order for implementation of DC to be successful and sustainable, it requires adoption at many different levels: individual practice changes (practice), institutional implementation (organizational), and national/international guidelines to be created and endorsed (system level) (Bertram, Blase, & Fixsen, 2015; Fixsen, Blase, Naom, & Wallace, 2009; Fixsen, Naom, Blase, Friedman, & Wallace, 2005). Therefore, institutional guidelines are essential.

Background and purpose

Individual practice guidelines in DC. Jacobs, Sokol, and Ohlsson (2002) as well as Altimier et al. (2015) emphasized that individual professional practices are key component of DC and standardizing their approaches with effective training programs improve infant and family outcomes. Adapting the US Joint Commission performance measurement model of core measures for quality hospital care, Coughlin developed five core measures in DC, which later led to the development of the NANN guidelines (Coughlin, 2011). The guideline is organized into five core measure sets; each core measure has three attributes and each attribute has three criteria to ensure optimal operationalization of evidence-based DC in NICUs (Coughlin et al., 2009) (Coughlin, 2011) (Table 1). The fifth core measure demonstrates the importance of policies and procedures at an institutional level but does not explain how to implement it. More recently, a DC model with seven neuroprotective core measures for family-centered developmental care was published (Altimier & Phillips, 2013). Although slightly different, these core measures resemble closely the ones from the NANN (Coughlin, 2011) but were developed to simplify

aspects and incorporate essential concepts from the original (Coughlin et al., 2009) core measures in DC as well as to provide more practical guidance for NICU staff in the delivery of DC. They are as follows: (1) healing environment, (2) partnering with families, (3) positioning and handling, (4) safeguarding sleep, (5) minimizing stress and pain, (6) protecting skin, and (7) optimizing nutrition. This model was implemented with success as the Wee Care Neuroprotective NICU program in a large number of NICUs in the United States (Altimier et al., 2015). However, it again provides guidelines for individual practices, but not for institutional or policy changes. It is on this last aspect that very little literature is available.

Institutional implementation guidelines in DC. Since institutional implementation and operationalization of DC is a priority in neonatology, some standardized guidelines for implementation should be available, as it would greatly help with the process of institutional operationalization but also in the field of comparative research. Some experts have presented recommendations for implementation that are extremely useful and necessary for the development of the present guidelines but incomplete for a consistent holistic institutional implementation of developmental neuroprotective care methodology. They will be presented below. Gilkerson and Als (1995) were the first ones to establish a process in the institutional implementation of developmentally supportive care in the NICU with reflective practice, known as the newborn individualized developmental care and intervention program (NIDCAP), which has demonstrated multiple clinical benefits to date (McAnulty et al., 2013; Ohlsson & Jacobs, 2013; Peters et al., 2009). This reflective practice was later put into a model for “Reflective practice in Developmental care – Individualized family-centered developmental care (IFDC) standards” by Carrier (2002). This model involved three general stages progressing from exploration/conceptualization of the new paradigm of DC through a mindful practice of IFDC principles, ending with the assimilation of the IFDC standards applied into practice but is difficult to operationalize.

In 1996, Als published the NIDCAP recommendations for the institutional implementation of DC which she called “component” of training and staff development at that time. To our knowledge, they have not yet been publicly updated. They included the following:

1. Training a DC specialist and nurse educator.
2. Training a multi-disciplinary leadership support team.
3. Training a core group of at least 10% of the nursing staff.
4. Creating a salaried position for the DC specialist and educator.

Table 1. Developmental care core measures and NANN age-appropriate care guidelines (Coughlin, 2011; Coughlin et al., 2009).

Core Measure (CM)	Practice recommended
CM1	Infant's sleep is protected
CM2	Infant's stress and pain are assessed and managed
CM3	Attention is given to ensuring the provision of age-appropriate activities of daily living (positioning, feeding, skin care, KMC)
CM4	Family-centered care is provided to the infant's family
CM5	A healing environment if provided

5. Creating a salaried position of a parent representative.

In the same publication, she also recommended several “specific components of unit development” in the following focus areas (p.133):

1. Development of a mission and vision statement.
2. Drawing up a unit plan.
3. Prioritizing changes.
4. Creating a task force on specific topics.
5. Increasing integration of family in care.
6. Developing strategies and resources to improve consistency.
7. Developing a format and training structure for staff.
8. Developing evaluation and reflexive process.

These recommendations might not have been publicly updated, but they are still used widely in many NIDCAP implementations. Furthermore, although their outcomes were not published in terms of implementation strategy and results, they still presented improved population outcomes. Bertram et al. (2015) mention that improved population outcomes depend upon changes made within the organization, thus supporting this program model in terms of implementation outcomes. Their recommendations were therefore largely used in the development of our institutional implementation of developmental neuroprotective care guidelines.

Evolving from these recommendations, Robison (2003) was one of the first to publish what she called an “Organizational guide for an effective developmental program in the NICU,” in which she presented six steps of implementation and four standards of care. She used this program in her establishment within the context of NIDCAP implementation in her unit (Table 2). These standards were widely used by different units and supported by the NANN (Carrier, 2010). Her insight was extremely valuable to the development of our developmental neuroprotective care guidelines to further develop the operationalization of her different steps.

Finally, very recently, Phillips (2015) presented steps in the implementation of the seven core measures of neuroprotective family-centered DC program, which are very similar to Robison’s. They were implemented in her unit with positive results. They included the following:

1. The identification of a champion.
2. The recruitment of a neuroprotective committee.
3. The creation of a neuroprotective steering committee.
4. The identification of select interventions with measurable outcomes.
5. The development of educational modalities for professionals and parents.

Table 2. Robison’s organizational guide for an effective developmental program in the NICU (Robison, 2003).

Step	Description
1	Assembling a leadership group
2	Establishing standards of care <ol style="list-style-type: none"> a. Caregiving is flexible, individualized, and responsive to the competencies, vulnerabilities, and thresholds of every infant. b. Parent–infant relationships are supported from birth. c. All caregivers practice collaboratively. d. A developmentally appropriate environment is provided.
3	Operationalizing developmental practices standards.
4	Structuring a program of individualized developmental and family-centered care.
5	Incorporating occupational, physical, and speech therapists into a preventive model of care.
6	Providing emotional support to NICU caregivers.

These steps are essential, but insufficient and incomplete for institutional implementation as they mostly focus on planning, but not operationalization. Part of the Wee Care implementation strategies were presented by Cardin et al. (2015), who mention that the transformational education program provides education, change management principles, resources, and consultation for full implementation. Their strategies, although very thorough, are not specific and clear enough for other units to replicate. The strategies used in their program included the following:

1. Pre-and post-program site assessment.
2. Unit champions preparation.
3. Medical grand rounds.
4. Onsite education session.
5. In unit consultation with care provider—DC rounds.
6. Plan-Do-Study-Act (PDSA) process.
7. Research and publication.

Based on Level II evidence (Johnson, Handberg, Dobalian, Gurol, & Pearson, 2005), DC operationalization is presented in one of the five NANN core measures, the healing environment (Coughlin, 2011; Coughlin et al., 2009) where one of the attributes of the core measure is related to evidence-based policies, procedures, and resources that should be available to sustain the healing environment over time. This attribute includes the following criteria:

1. Core measures of DC provide the standard of care for all patient care providers.

2. Resources to support the implementation of DC as defined by the core measures are always available.
3. A system for staff accountability in the practice of DC as outlined by the core measures is operational.

Recently published in a book, updated and expanded core measures for trauma-informed, age-appropriate care have been endorsed by the NANN (Coughlin, 2016). These new recommendations now include organizational implementation strategies in DC that were also operationalized in different phases and steps of the present guidelines (Coughlin, 2016). To integrate the core measure into practice, Coughlin (2016) suggests the following strategies:

- (a) Create a multi-disciplinary task force to review existing practice standards and guidelines.
- (b) Identify gaps between existing practice guidelines/standards and the core measures.
- (c) Draft a priority plan, include reasonable timelines, and identify responsible individuals.
- (d) Consider external expert consultation.
- (e) Initiate the P-D-S-A model for testing change—it will be described below.
- (f) Measure, evaluate, revise, implement.
- (g) Monitor progress, engage leaders, and establish performance metrics.
- (h) Measure and publish results.

Strategies to integrate practice expectations for age-appropriate care into the annual performance evaluation and ensure balanced accountability for the delivery of age-appropriate care are also suggested. These recommendations reinforce the current knowledge base in DC implementation but are not specific enough to use as guidelines for implementation. However, they were greatly valuable in the development and validation of our current guidelines.

Institutional implementation guidelines/strategies in health-care fields other than in DC

Few organizations have institutional or system implementation guidelines and even fewer focus their work on health-care priorities. The American *National Implementation Research Network's* (NIRN) mission is to contribute to the science of implementation and its best practices, organizational change, and system reinvention to improve outcomes across the spectrum of human services. A major goal of the NIRN is to help establish an evidence base for implementation processes and practices of evidence-based programs. NIRN guidelines were used to develop the general methodology of the implementation process of the present guidelines.

Their active implementation framework provides a mid-range theory to:

- organize current knowledge into useful frameworks,
- develop strategies to support implementation and scale up of evidence-based programs,
- establish relevant measures of implementation factors in practice, and
- develop a better laboratory in which imputed causal mechanisms can be studied, in order to improve the predictive validity of the theoretical frameworks and the precision of the measures.

In 2005, the NIRN published a monograph (meta-review) based on three decades of empirical implementation studies over a wide range of endeavors, for exploration, purposeful selection, clarification, improvement, and systematic implementation of a program model of any kind (Fixsen et al., 2005). To this day, their recommendations still stand (Bertram et al., 2015) and were supported by a multi-agency Consensus National Policy Paper (Bertram, Blase, Shern, Shea, & Fixsen, 2011). This Consensus was supported by the American Center for Mental Health Services, Mental Health America, the National Association of State Mental Health Program Directors, Vanguard Communications, as well as the NIRN. Although mostly about mental health prevention and promotion, these recommendations echo the AAP position statement on toxic stress and their ecobiodevelopmental framework as well as one of the main concerns of DC: infant mental health.

Of note, this model has been supported by European NIDCAP instructors and specialists (Ratynski, 2014). Their recommendations were thus endorsed by the present guideline.

A NIRN consensus brief (updated meta-review from 2005) outlined key components for effective implementation of prevention/promotion initiatives such as skill-based programs and offered a structural and procedural framework (Bertram et al., 2011). Looking at different practice models as well as their implementation and outcomes, the NIRN concluded that even with an effective program based on best-practices and core measures, ineffective implementation will lead to ineffective and unsustainable program and outcomes (Bertram et al., 2015) which is one of the major issues in DC implementation.

Consequently, the need to follow an implementation process with functional strategic stages is essential and can take up to 4 years to unfold. The NIRN's model includes four functional stages of implementation: exploration, installation, initial implementation, and full implementation.

The Institute for Healthcare Improvement (IHI, 2016a) in the USA is another organization that recommends the use of the P-D-S-A Model for Improvement.

The Model for Improvement, developed by Associates in Process Improvement, (Vasquez-Ruiz et al., 2014) is a simple, yet powerful tool for accelerating improvement. The PDSA cycle is shorthand for testing a change by developing a plan to test the change (Plan), carrying out the test (Do), observing and learning from the consequences (Study), and determining what modifications should be made to the test (Act) (IHI, 2016b). It is often the last two steps that are the most difficult to implement. Care should be taken to ensure the importance of adjusting the strategy to the response of the medium (study) to complete the PDSA and Act. This model is not meant to replace change models or implementation guidelines but rather to accelerate improvement.

This model is also supported by NANN (Carrier, 2002) as well as having been used in other DC implementation programs (Coughlin, 2016). It is our opinion that it should be used as an implementation strategy jointly with the current guidelines to reinforce implementation and accelerate success and improvement.

However, these recommendations, measures, and steps, though extremely useful, might not be specific enough to provide an operational framework on which different units can rely for institutional implementation of DC. The present guidelines answer that need and are presented in a condensed form in Table 3.

Methodology

The following methodology of research and presentation is based on the NANN Instructions for Writing Clinical Practice Guidelines (NANN, 2009).

Focus

These guidelines focus on institutional implementation of developmental neuroprotective care to improve the operationalization of the DC core measures which include protecting sleep, decreasing pain and stress, implementing age-appropriate activities of daily living, implementing family-centered care, and promoting a healing environment (Coughlin, 2011). A methodological framework of organizational changes and strategies are presented to maximize and implement clinical practice improvement at a unit/institutional level.

Objective

To improve the quality of care provided to the premature and critically ill hospitalized infant in NICUs or special care nurseries by the adoption and implementation of institutional developmentally supportive, neuroprotective care guidelines that align with the core measures for age-appropriate care (Coughlin et al., 2009).

Users and settings

Intended users of this guideline include all providers of direct and indirect care, clinical leaders, and agents of change as well as administrators of NICU and special care nursery settings.

Target population

Guideline recommendations apply to all providers of direct and indirect care, clinical leaders, and agents of change as well as administrators of NICU and special care nursery settings implementing a program of developmental neuroprotective care.

Evidence collection method

A comprehensive electronic search of articles published between 1980 and 2016 was conducted in Medline, Cumulative Index to Nursing and Allied Health Literature, the Cochrane Database, Psychology and Behavioral Sciences Collection, PsycINFO, and Google Scholar using the keywords: DC, trauma-informed care, age-appropriate care, neuroprotective care, infant, premature, implementation, institutional, organizational, guidelines, recommendations, and core measures. Articles were selected for inclusion if they identified specific interventions within the five core measures, NANN guidelines, implementation strategies or recommendations with evidence that improved short- or long-term outcomes for hospitalized infants as well as demonstrated efficacy towards implementation outcomes. Both French and English articles were included.

Recommendations grading criteria

The following grading system based on Melnyk and Fineout-Overholt (2010) was employed to rate the quality and strength of the evidence to support the practice recommendations as per the NANN Instructions for Writing Clinical Practice Guidelines (NANN, 2009) (Table 4).

Method for synthesizing evidence

The quality of evidence was evaluated by three independent reviewers using a predetermined structured format. Systematic reviews and randomized controlled trials were considered the strongest level of evidence. When these were not available, cohort studies, case-controlled studies, consensus statements, and studies using qualitative methods were considered the strongest level of evidence for a phenomenon of interest. However, when those were not available, single well-executed independent studies were considered. As well, research outside of

Table 3. Guidelines for institutional implementation of developmental neuroprotective care in the NICU—Condensed table of recommendations.

Steps	Recommendations	Strategies to support recommendations	Level of evidence	References
Phase I—Plan				
Rationale: The development of a vision of where, how, and when we want to make a change as well as who will be responsible of making it happen with clear objectives will improve the chances of success of its implementation				
Step 1	Gathering of an inter-professional developmental care leadership quality improvement team	<ol style="list-style-type: none"> 1. 6–7 leadership professionals 2. Inter-professional representatives 3. Multi-level representatives 4. 1 meeting/month × 1–2h/meeting 5. Clear mandate 	I V VI VII	Bertram et al. (NIRN) (2011, 2015); Fixen et al. (2005) Phillips (2015) Cardin et al. (2015) Als (1996); Milette et al., (2016); Robison (2003)
Step 2	Identification of a developmental care project manager/leader/specialist	<ol style="list-style-type: none"> 1. Two full-time salaried positions for a unit of 40 patients 2. DC nurse educator vs. specialist 3. Clear mandate 	I V VI VII	Bertram et al. (NIRN) (2011) (2015); Fixen et al. (2005) Phillips (2015) Cardin et al. (2015) Als (1996); Milette et al., (2016); Robison (2003); Als (1996); O'Brien et al. (2015)
Step 3	Inclusion of neonatal therapists in a preventive model of care Identification of a parent representative and endorsement of the FiCare approach	<ol style="list-style-type: none"> 1. Involving preventive interventions from birth 1. 1/2 time salaried position 2. Budget often comes from foundation 3. Clear mandate 	III IV VII	Macdonell et al. (2013); O'Brien et al. (2013) Als (1996) Coughlin (2016) Coughlin (2014) Sizun et al. (1999) Mambri et al. (2002); Phillips (2015)
Step 4	Literature review	<ol style="list-style-type: none"> 1. Literature review 2. Guidelines review 3. Training program and external resources review 	I IV VI	Bertram et al. (NIRN) (2011, 2015); Coughlin (2016); Fixen et al. (2005)
Step 6	Identification and endorsement of a developmental care vision/mission	<ol style="list-style-type: none"> 1. Endorsement of the NANN age-appropriate core measures and guidelines 	I	Bertram et al. (NIRN) (2011, 2015); Coughlin (2016); Fixen et al. (2005)
Step 7	Evaluation of the actual state and knowledge of the unit	<ol style="list-style-type: none"> 1. Individual professionals self-assessment tools 2. Unit self-assessment tools 3. Professionals knowledge evaluation 	I IV VII	Bertram et al. (NIRN) (2011, 2015); Coughlin (2016); Fixen et al. (2005) Gibbs et al. (2011); Mambri et al. (2002) Carrier (2002); Robison (2003)

(continued)

Table 3. Continued.

Steps	Recommendations	Strategies to support recommendations	Level of evidence	References
Step 8	Development of an implementation plan based on core measures recommendations and unit priorities	<ol style="list-style-type: none"> 1. Based on unit priorities/needs 2. Based on NANN guidelines and five core measures 3. Based on rapid small success vs. long endeavor 4. Identify deadlines and benchmark for success 	<p>I</p> <p>V</p> <p>VII</p>	<p>Coughlin et al. (2009); Coughlin (2016) Bareil (2004)</p> <p>Als (1996); Robison (2003)</p>
Step 9	Development of DC guidelines/neuro-protective protocol	<ol style="list-style-type: none"> 1. Endorsement of the NANN age-appropriate core measures and guidelines 2. Creation of unit unique protocol/policy/guidelines in DC 	<p>I</p> <p>VII</p>	<p>Bertram et al. (NIRN) (2011, 2015); Coughlin (2016); Fixen et al. (2005); Kenner and McGrath (2014) Robison (2003)</p>
Phase 2—Educate				
Rationale: Any change in practice begins with an improvement in knowledge related to it. Training and coaching professionals and the population under care ensure a better success of the implementation of that practice change				
Step 1	Initial training of 30% of the health-care professionals	<ol style="list-style-type: none"> 1. Identify a training program or develop one using 5 core measures 2. Choose the trainees: Inter-professionals and multi-level training 3. Choose the pre-requisite for the trainees to be trained: full-time position, leadership position . . . 	<p>I</p> <p>IV</p> <p>VII</p>	<p>Bertram et al. (NIRN) (2011, 2015); Fixen et al. (2005) Altimier et al. (2015) Als (1996)</p>
Step 2	Specialized training of a group of champions	<ol style="list-style-type: none"> 1. Identify a group of leaders/champions (10%) 2. Certification recommended: Advanced training through DC rounds as well as available programs (NANN DC Specialist CNE and Designation) 	<p>I</p> <p>VI</p> <p>VII</p>	<p>Bertram et al. (NIRN) (2015); Fixen et al. (2005) Altimier et al. (2015); Cardin et al. (2015); Mambri et al. (2002)</p> <p>Carrier (2002); Robison (2003); Ratynsky (2014)</p>
Step 3	Clinical integration through coaching	<ol style="list-style-type: none"> 1. Identify possible modalities of teaching/coaching: video-feedback, case study, hand-on coaching, DC rounds 	<p>I</p> <p>VII</p>	<p>Bertram et al. (NIRN) (2011, 2015); Fixen et al. (2005) Als (1996); Carrier (2002); McGrath and Valenzuela (1994); Mambri et al. (2002); Ratynski (2014)</p>

(continued)

Table 3. Continued.

Steps	Recommendations	Strategies to support recommendations	Level of evidence	References
Step 4	Development of continuous education program and resources	<ol style="list-style-type: none"> 1. Training of 100% of the unit professionals 2. Continuous training with multiples resources (e.g., Online training, online database) 3. Training of newly hired professionals 	I	Bertram et al. (NIRN) (2015); Fixen et al. (2005) Phillips (2015)
Step 5	Development of educational tools and resources for parents	<ol style="list-style-type: none"> 1. Family-integrated care approach recommended 2. Develop multiple modalities resources: online videos and modules, electronic application, pamphlets, coffee-conferences 3. Involve local or national premature infant or parents association in the process for support, visibility and sponsorship 	VI I V	Milette (2015a, 2015b, 2015) Bertram et al. (NIRN) (2011, 2015); Coughlin (2016); Fixen et al. (2005) Phillips (2015)
Phase 3—Prioritize				
Rationale: The identification of clinical practice priorities for changes based on units needs and recommended guidelines, with rapid success first, ensures a better potential of a success and professionals adherence to the change.				
Step 1	Changes in specific prioritized clinical practices based on DC core measures	<ol style="list-style-type: none"> 1. Based on unit priorities/needs 	I	Bertram et al. (NIRN) (2011, 2015); Coughlin (2011); Coughlin (2016); Fixen et al. (2005) Phillips (2015)
Step 2	Changes in unit protocols or guidelines to endorse DC core measures	<ol style="list-style-type: none"> 2. Based on NANN guidelines and five core measures 3. Based on rapid small success vs. long endeavor 4. Reinforce each clinical change with appropriate DC protocol/policy/guideline 	V VI VII	Altmier et al. (2015); Coughlin et al. (2009), Coughlin (2014) Altmier and Phillips (2013)
Step 3	Unit design and Purchase of different tools and resources to support DC	<ol style="list-style-type: none"> 1. Purchase of tools and/or resources related to each clinical practices prioritized to support implementation 2. Consider Recommendations of NICU Design Standards in any new renovation, unit or physical changes 	I	Bertram et al. (NIRN) (2011, 2015); Coughlin (2016); Fixen et al. (2005); White (2007)

(continued)

Table 3. Continued.

Steps	Recommendations	Strategies to support recommendations	Level of evidence	References
<p>Phase 4—Evaluate Rationale: process and outcome data must be collected, analyze and used to inform decision-making from initial to full implementation phase to insure efficiency, fidelity and sustainability of changes.</p>				
Step 1	Research grants and subvention acquisition	<ol style="list-style-type: none"> 1. Demonstrate beneficial outcomes (populational and financial) of DC implementation 2. Prioritize rapid success to demonstrate feasibility and efficiency 3. Look for funding everywhere 	I	Bertram et al. (NIRN) (2011, 2015); Fixen et al. (2005); Coughlin (2011); Coughlin (2016) Petryshen et al. (1997)
Step 2	Acquisition or development of evaluation tools	<ol style="list-style-type: none"> 1. Look for available evaluation tools 2. Create your own if none available or not appropriate 	IV	USAID (2008)
Step 3	Development and planning of audits	<ol style="list-style-type: none"> 1. Evaluation BEFORE and after implementation 2. Regular reevaluation to insure sustainability of practice changes 	I	Bertram et al. (NIRN) (2011, 2015); Fixen et al. (2005) USAID (2008)
<p>Phase 5—Ensure sustainability Rationale: Sustainability is not the end stage of implementation as significant changes may require reorganization over time. To do so, maintaining expertise and leadership amidst staff turn-over (P = program) is as essential as maintaining funding streams (F = financial)</p>				
Step 1	Staff selection and evaluation (P)	<ol style="list-style-type: none"> 1. Recruitment strategies linked to DC outcomes 2. Interview protocol includes DC philosophy 3. Staff selection include their fit and endorsement of DC 	I	Bertram et al. (NIRN) (2011, 2015); Coughlin (2016); Fixen et al. (2005)
Step 2	Performance evaluation/assessment (P)	<ol style="list-style-type: none"> 1. Evaluate if the organization provides clarity around individual and organizational responsibilities for accountability 2. Outline the steps necessary to realize individual accountability in your unit 3. Develop a test of change to evaluate the effectiveness of your ideas 4. Ensure cross disciplinary leadership support 5. Consider expert consultation 6. Audit and provide feedback to staff 	I	Bertram et al. (NIRN) (2011, 2015), Coughlin (2016); Fixen et al. (2005)
Step 3	Reflexive practice (P)	<ol style="list-style-type: none"> 1. Commitment to security and trust among staff and leaders 	I	Bertram et al. (NIRN) (2011, 2015); Fixen et al. (2005)
			VII	

(continued)

Table 3. Continued.

Steps	Recommendations	Strategies to support recommendations	Level of evidence	References
Step 4	Building collaborative health care teams (P)	<ol style="list-style-type: none"> 2. Consistent time to meet where discussion is safe 3. Activities that allow reflection on work towards DC 		Carrier (2002); Gilkerson and Als (1995)
Step 5	Professionals emotional support (P)	<ol style="list-style-type: none"> 1. Improve Communication 2. Improve Caring 3. Improve Collaboration 	VII	Coughlin (2014)
Step 6	Barriers to implementation (P)	<ol style="list-style-type: none"> 1. Focus group and discussion 2. Mental health professional and counselors availability for the staff 3. Mentoring and a DC specialist available to support them 	VII	Als (1996), Carrier (2002), Coughlin (2014), Robison (2003)
Step 7	Operational budget priorities (F)	<ol style="list-style-type: none"> 1. Considered and anticipated potential barriers 2. Plan to reduce their impact with the team 	VII	Carrier (2002)
Step 8	Data reports, publications of results (P)	<ol style="list-style-type: none"> 1. Demonstrate beneficial outcomes (populational and financial) of DC implementation 2. Prioritize rapid success to demonstrate feasibility and efficiency 3. Ensure salaried position for a DC specialist 4. Ensure a salaried position for a parent representative 5. Ensure operational budget funding for professionals continuous training 6. Ensure operational budget funding for continuous monitoring of competencies and outcomes (population and implementation) 	I	Bertram et al. (NIRN) (2011, 2015); Fixen et al. (2005)
		<ol style="list-style-type: none"> 1. Measure outcomes 2. Report outcomes to your team 3. Adjust implementation based on outcome if need be 4. Celebrate positive outcomes with your team 5. Publish outcomes 	IV	Petryshen et al. (1997)
			VII	Als (1996)
			I	Bertram et al. (NIRN) (2011, 2015); Fixen et al. (2005)
			VII	Coughlin (2014)

Table 4. Rating system for the hierarchy of evidence (Melnik & Fineout-Overholt, 2010).

Level	Description
I	Evidence from a systematic review or meta-analysis of all relevant randomized controlled trials (RCTs) or evidence-based clinical practice guidelines based on systematic reviews of RCTs
II	Evidence obtained from at least one well-designed RCT
III	Evidence obtained from well-designed controlled trials without randomization
IV	Evidence from well-designed case-control and cohort studies
V	Evidence from systematic reviews of descriptive and qualitative studies
VI	Evidence from a single descriptive or qualitative study
VII	Evidence from the opinion of authorities or reports of expert committees

the field of DC was included if their main contribution included implementation strategies and guidelines.

Prerelease review

Review was provided during presentations of the material in three settings: at the 29th Annual Gravens Conference on the Physical and Developmental Environment of the High-Risk Infant in Clearwater Beach, FL (Milette & Martel, 2015); at the 6^e congrès mondial des infirmières et infirmiers francophones (6th World Congress of francophone nurses), Montréal, Canada (Milette, 2015a), and at the 5th CAPWHN conference in Quebec, Canada (Milette, 2015b).

Discussion

The present guidelines provide a much-needed implementation framework to ensure consistency of care across settings, sustainability of a DC unit practice and institutional accountability for best practices. This step-by-step framework provides an implementation methodology and supporting strategies to improve health-care professional's competencies and accountability for DC best practices at both the unit and institutional levels.

Patients' preferences

These guidelines promote patients and their family, to be treated with dignity and respect and receive safe, quality

evidence-based care. The family is here defined by the parents of the neonate.

Potential benefits and harms

The anticipated benefits in the consistent implementation of this guideline by all care providers include an improved consistency in the implementation of DC practices in multiple units (implementation outcome), an enhanced level of health-care professional's competency and accountability for evidence-based DC best practices (implementation outcome), as well as an improved efficiency and quality in care delivery (patient outcome). We also anticipate a better sustainability of the practice change with the requirement for institutional involvement (implementation outcome). Potential harms are yet to be identified but they could relate to these guidelines being perceived as a strict protocol and prevent flexibility in their implementation. This could impede the input of the clinicians' experience and their clinical judgments. However, it is important to remember that these guidelines are meant as a flexible framework to be implemented to suit different contexts and needs.

Implementation considerations

The NANN age-appropriate guidelines (Coughlin, 2011) anticipated barriers to implementation including the absence of an effective process for practice improvement. Organizational commitment to a culture of safety and high-quality patient care is critical to achieve buy-in and subsequent consistent and reliable provision of care. Although the present institutional implementation guidelines answer that recommendation and consist in the ultimate goal evidence-based practice of developmental neuroprotective care implementation, they might require major changes in health-care delivery in many units and countries. For those units where DC is already present, these guidelines could guide further development by providing a step-by-step approach to future changes. As well, stepwise progress in countries where DC is a new concept can be initiated, and this guideline can help guide these changes. Part B of this article will present the recommendations and justification for the successful implementation of each steps of the present Guidelines (Milette, Martel, & Ribeiro da Silva, 2017). They are essential to the comprehension of this part.

Update plan

The guidelines for the institutional implementation of developmental neuroprotective care in the NICU are scheduled for review in 2020.

Author Note

Developers

Isabelle Milette, NNP, NICU, CHU Sainte-Justine Mother and child University Hospital Center. This guideline is based on early work (P.I.S.D.) done in partnership with Isabelle Milette (NNP, CHUSJ), Marie-Josée Martel (PhD, UQTR) and Margarida Ribeiro da Silva (NNP, MUHC) (Milette & Martel, 2014) as well as a CHU Saint-Justine Leading Practice in developmental care from Accreditation Canada (Milette et al., 2016). They were developed by an inter-professional team, reviewed by a board of experts in the field from different associations and is thus consist in a joint position statement from the CANN, CAPWHN, NANN, and COINN.

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Author Biographies

Isabelle Milette is a neonatal nurse practitioner and a Developmental care specialist (NANN certified) at the CHUSJ, Sainte-Justine University Hospital Center. She obtained her Bachelor in Nursing at McGill University (1997), her master's degree in Nursing from the University of Montreal (2000) and a post-master's certificate for neonatal nurse practitioner from Stony Brook University, New York (2007). In 2009, she became the first health care professional in Canada to obtain her certification of Advance Competency in Developmental Care offered by the National Association of Neonatal Nurses (NANN), which became, in 2010, the Neonatal Developmental Care Specialist Certification. Between 2012–2016, she trained and supervised Canada's largest cohort of champions in development care ever certified by the NANN. In 2016, Accreditation Canada certifies the CHU Sainte-Justine with the first Leading practice in Development Care, following its development by Ms. Milette. In 2017, she leads the publication of the Guidelines for the institutional implementation of developmental neuroprotective care in the NICU, a joint position statement of CANN, CAPWHN, NANN and COINN.

Her research interests are developmental care, noise and light reduction in NICUs and PICUs, and neonatal intensive care design. In 2011, she acted as advisor for the NICU design team within the new CHUSJ specialised units building. In 2015, she also joined the leadership group on change at the CHU Sainte-Justine to perfect her work with health professionals. In 2016, she joined the Canadian Neonatal Brain Platform (CNCP) with her participation in the project to transform the neonatal unit of CHU Sainte-Justine into a neuro-neonatal unit for the neuroprotection of newborns at risk for brain damage. To ensure the advancement of developmental care in research, she becomes an associate clinician member of the Quebec Network on Nursing Intervention Research (RRISIQ). She is the author of several research articles on these subjects, co-author of a book in development care with a second edition in progress, scientific director of a reference book on clinical examination of the newborn and a perinatal educational book (Chenelière Education). She is also a lecturer and invited speaker in many academic and professional presentations, participant in national and international

conferences, and clinical training of nurses and doctors in hospitals.

Marie-Josée Martel is a professor at the Department of Nursing Sciences of the Université du Québec à Trois-Rivières (UQTR) and Developmental care specialist (NANN Certified). She obtained her baccalaureate degree (1993) and her master's degree in nursing sciences (2000) from the Université de Montréal and completed her Doctorate degree in clinical sciences at Université de Sherbrooke in 2013. From 1993 to 2002, Marie-Josée worked as a nurse at the CHU Sainte-Justine in perinatal and pediatric nursing fields. Her last 5 years of practice in hospital were dedicated to neonatology where, as a Neonatal Nurse Practitioner, she introduced developmental care as the topic of her master's thesis. Since 2003, she teaches at the department of Nursing Sciences of the UQTR. She specializes in family, perinatal and pediatrics nursing & clinical placements as well as Primary Care Nurse Practitioner training. She is a regular researcher for the Centre d'Études interdisciplinaires sur le Développement de l'Enfant et de la Famille (CEIDEF) of the Université du Québec à Trois-Rivières and associate researcher at the Sainte Justine Hospital Research Center. Besides developmental care, her fields of interest include the establishment of the attachment relationship between premature infants and their parents.

Margarida Ribeiro da Silva graduated in 2003 from McGill University's School of Nursing. She started her practice at the Neonatal intensive care unit of the Royal Victoria Hospital where she discovered the developmental care philosophy. Wanting to care for her patients more holistically she decided to become a neonatal nurse practitioner in 2007. This led her to practice at

the Montreal's Children's Hospital while still spending half her time at the Royal Victoria Hospital. She implemented a developmental care in 2007 at her home hospital with the collaboration and based on the work of Isabelle Milette and Marie-Josée Martel. She continued to work with both these talented nurses and gave conferences, presented posters and provided training in Quebec and the United States.

Since 2008, she is also a member of the Quebec's order of nurses' neonatal practitioner exam committee where she develops with a team questions and scenarios to evaluate neonatal nurse practitioner candidates during their licensing exam.

Mary Coughlin McNeil is the founder and president of Caring Essentials Collaborative LLC and has over 30 years of professional nursing experience beginning with 7 years of active military duty in the United States Air Force Nurse Corp.

As the internationally recognized expert in the field of trauma-informed, age-appropriate care in the NICU, Mary presents globally on a wide range of topics related to the core measures for age-appropriate care, the trauma experience in the NICU, the implications of trauma-informed care for the hospitalized infant, family and professional, as well as implementation science and strategies that facilitate person-centered, biologically relevant cultural transformation.

Mary's coaching and mentoring strategies result in quantifiable outcomes, sustained adoption of evidence-based best practices, nursing scholarship, and frontline clinician engagement in transforming care at the bedside in the neonatal ICU! Mary lives in Boston, Massachusetts with her husband Dan and their dog George.