







BMJ Open Comprehensive mapping of NICU developmental care nursing interventions and related sensitive outcome indicators: a scoping review protocol

Marjolaine Héon ^{1,2}, Marilyn Aita ^{1,2,3}, Andréane Lavallée ^{1,3},
Gwenaëlle De Clifford-Faugère ^{1,3}, Geneviève Laporte ^{1,3}, Annie Boisvert,^{1,4}
Nancy Feeley ^{2,5,6}

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For numbered affiliations see end of article.

Correspondence to

Dr Marjolaine Héon;
marjolaine.heon@umontreal.ca and
Dr Marjolaine Héon;
marjolaine.heon@umontreal.ca

ABSTRACT

Introduction Neurodevelopmental outcomes of preterm infant are still a contemporary concern. To counter the detrimental effects resulting from the hospitalisation in the neonatal intensive care unit (NICU), developmental care (DC) interventions have emerged as a philosophy of care aimed at protecting and enhancing preterm infant's development and promoting parental outcomes. In the past two decades, many authors have suggested DC models, core measures, practice guidelines and standards of care but outlined different groupings of interventions rather than specific interventions that can be used in NICU clinical practice. Moreover, as these DC interventions are mostly implemented by neonatal nurses, it would be strategic and valuable to identify specific outcome indicators to make visible the contribution of NICU nurses to DC.

Objectives The overarching objective of this review is to identify the nature, range, and extent of the literature regarding DC nursing interventions for preterm infants in the NICU. The secondary twofold objectives are to highlight interventions that fall into identified categories of DC interventions and suggest nursing-sensitive outcome indicators related to DC interventions in the NICU.

Inclusion criteria Papers reporting on or discussing a DC nursing intervention during NICU hospitalisation will be included.

Methods and analysis The Joanna Briggs Institute's methodology for scoping reviews will be followed. CINAHL, MEDLINE, Embase, PubMed, Web of Science, Scopus, ProQuest and PsycInfo databases from 2009 to the present will be searched. Any type of paper, published in English or French, will be considered. Study selection and data extraction will be conducted by pairs of two review authors independently. A qualitative content analysis will be conducted.

Ethics and dissemination No Institutional Review Board ethical approbation is needed. Results of this review will be presented in scientific meetings and published in refereed papers.

Strengths and limitations of this study

- First scoping review that aims to identify nursing-sensitive outcome indicators related to developmental care interventions in the neonatal intensive care unit (NICU).
- New comprehensive and inclusive categories of developmental care interventions orient this scoping review.
- This scoping review protocol follows the recommendations of the Joanna Briggs Institute for the conduct of systematic and rigorous reviews.
- As the scope of this review is large and the literature search strategy is very sensitive, it will include all relevant literature but might lack specificity.
- The scope of this review is limited to developmental care interventions delivered by neonatal nurses in the NICU.

INTRODUCTION

Short and long-term neurodevelopmental outcomes are still a contemporary concern for infants who are born preterm, that is, before the 37th week of gestation (WG) is completed.¹⁻³ Compared with term infants, school-age children born preterm have significant deficits in mathematics and reading,¹ present with lower IQs⁴ and are at increased risk for anxiety and hyperactivity disorders.⁵ Throughout adulthood, young adults born preterm are still facing significant social-emotional difficulties,³ present with lower IQ⁶ are even at increased risk for autistic symptoms⁷ and obtain lower scores on neuropsychological tests.² The hospitalisation in the neonatal intensive care unit (NICU) has been identified as a strategic period to implement interventions to protect and optimise preterm infant's neurodevelopment.⁸ In fact, the most important maturation processes of the

central nervous system occur between the 24th and the 40th WG.⁹

The concept of developmental care (DC), based on the work of Dr Heidelise Als,¹⁰ is a neuroprotective NICU care philosophy that ultimately intends to promote optimal health outcomes in preterm infants and their families.^{11–13} An important aspect of DC is the individualisation of care that should match each infant and their family's needs,^{13 14} with the aim of lowering parental stress and maximising their adaptation, as well as improving the infant's development.¹⁴ DC has proven to be effective in promoting mental and psychomotor development,¹⁵ neurobehaviour and oral feeding¹⁶; reducing NICU length of stay¹⁶; and lowering parental stress and anxiety.¹⁷ Thus, it appears important to scope the DC literature to identify specific interventions neonatal nurses can implement daily in their practice in order to optimise preterm infants and families' outcomes.

However, it is unclear which specific interventions DC encompasses. Different authors have suggested groupings of DC interventions, which have been referred to as a DC model,^{18 19} practice guidelines,^{12 20} conceptual model,²¹ core measures²² and standards of care.^{23–34} For example, in their DC model, Altimier and Phillips^{18 19} suggest there are seven neuroprotective DC core measures including: the healing environment (physical, sensory, smell/test, sound/noise, light), partnering with families, positioning and handling the infant, safeguarding sleep, minimising stress and pain, protecting skin and optimising nutrition. The National Association of Neonatal Nurses' practice guidelines¹² and Coughlin *et al*²² both suggest five core measures, such as: protected sleep, assessment and management of stress and pain, developmentally supportive activities of daily living, family-centred care and creating a healing environment. Gibbins *et al*,²¹ in their universe of DC conceptual model, suggest that DC interventions fit into 12 categories: monitoring/assessing, feeding, positioning, infection control, safety, comfort, thermoregulation, skin care, respiratory care, family, staff and environment. Lindacher *et al*²³ provide 96 European standards of care for newborn health on 11 overarching topic areas, including 10 standards on infant-centred and family-centred DC²⁴: case management and transition to home²⁵; clinical consultation and supervision for healthcare professionals on supporting families²⁶; education and training for infant-centred and family-centred DC²⁷; family access²⁸; family support services²⁹; management of the acoustic environment³⁰; parental involvement³¹; support for parental–infant bonding³²; supportive sensory environment³³; and very early and continuous skin-to-skin contact.³⁴ Finally, Browne *et al*³⁵ identify six key practice domains of infant and family-centred DC in the intensive care unit: systems thinking; positioning and touch for the newborn; sleep and arousal interventions for the newborn; skin-to-skin contact with intimate family members; reducing and managing pain and stress in newborns and families; and management of feeding, eating and nutrition delivery. Still, it remains ambiguous which specific interventions fit into those global categories. For example, Jebreili *et al*³⁶ evaluated the effectiveness of an olfactory stimulation intervention to

manage procedural pain of preterm infants in the NICU. Although this intervention aims at reducing the preterm infant's pain, the authors do not identify it as a DC intervention, nor does it appear in any of the aforementioned groupings. To develop categories of DC interventions that are comprehensive for nursing, and inclusive, we propose that DC interventions fall into eight categories. Our classification encompasses all categories suggested by the various above-mentioned authors: family-centred care, feeding, positioning and handling, reduction and management of pain, sensory control, sensory stimulation, skin and routine care and sleep protection.

Even though DC is a multidisciplinary approach,¹³ DC interventions are primarily delivered by neonatal nurses.¹⁴ Indeed, by virtue of their field of practice, their professional skills and their unique proximity in the healthcare experience of preterm infants and their families, neonatal nurses are strategically positioned to implement DC interventions in the NICU.^{14 37} However, the invisibility of the contribution of neonatal nursing to infants' health is a major concern, because it does not allow to distinguish their distinctive and exclusive role in NICU clinical practice,³⁸ along with how their involvement may favourably influence infants' health outcomes. The visibility of their specific contribution is compromised by the absence of a global portrait of nursing-sensitive outcome indicators that would allow us to better understand the effects and benefits of DC interventions in the NICU. Introduced by Maas *et al*,³⁹ the concept of 'nursing-sensitive outcome indicator' refers to the distinct and measurable change in patient's state, behaviour or perception as a result of a nursing intervention. In the past years, several initiatives to identify nursing-sensitive outcome indicators have emerged.^{40–43} Although these authors have identified nursing-sensitive outcome indicators, the former remain generic and some of these indicators, such as falls and incontinence, are not transferable to a neonatal population. Consequently, the range of implemented DC interventions remains unknown and the absence of specific nursing-sensitive outcome indicators related to these neonatal DC interventions prevents the evaluation of nursing contribution to preterm infants and families' well-being. A database of outcome indicators for neonatology was developed by The Canadian Neonatal Network.⁴⁴ Nonetheless, the authors of this report did not specifically take into account outcome indicators that are specific to neonatal nursing DC interventions but rather observed medical outcomes such as sepsis, survival rates and cardiovascular complication rates. Moreover, 11 nursing-sensitive quality indicators for the NICU were developed in a study by Chen *et al*,⁴⁵ but then again, these indicators are general to NICU care (ie, rate of compliance to proper hand washing, rate of nosocomial infections, etc) and not specifically related to DC nursing interventions. Thus, there is a pressing need for a comprehensive mapping of nursing-sensitive outcome indicators with regard to DC interventions. Such effort is essential to identify outcome indicators that have been reported so far in the scientific literature and those that require further assessment, as well as to circumscribe the effects of DC interventions delivered

by nurses on preterm infants and families' health and development.

A preliminary search of PROSPERO, MEDLINE, the Cochrane Database of Systematic Reviews and the *Joanna Briggs Institute Database of Systematic Reviews and Implementation Reports* was conducted. Some systematic reviews have looked at the effectiveness of specific DC programmes, such as the Newborn Individualized Developmental Care and Assessment Program,¹⁵ or the effectiveness of interventions on preterm infant's development or health outcomes.^{16–48} To our knowledge, no current reviews scoping the literature on DC nursing interventions have been published or are underway.

Based on this lack of evidence, the primary objective for this scoping review is to: (1) identify the nature, range, and extent of the literature regarding DC nursing interventions in the NICU. The secondary objectives are twofold: (2) to highlight DC interventions that fall into our eight identified categories of DC nursing interventions; and (3) suggest nursing-sensitive outcome indicators related to DC interventions.

REVIEW QUESTIONS

The primary question guiding this scoping review is the following: What is the nature, range, and the extent of the literature regarding DC nursing interventions for preterm infants and families in the NICU?

The secondary questions addressed in this scoping review are: What are the interventions that have been associated with our eight categories of DC nursing interventions in the NICU? What are the nursing-sensitive outcome indicators related to DC interventions in the NICU?

METHODS

The proposed scoping review will be conducted in accordance with the Joanna Briggs Institute (JBI) methodology for scoping reviews.⁴⁹ Moreover, as suggested by the JBI, this protocol is based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews Checklist (see online supplemental file 1).⁵⁰

Inclusion criteria

Participants

We will consider studies that included preterm infants or their parents. For this review, we will consider the definition suggested by the WHO stating that preterm infants are infants born before the 37th WG is completed.⁵¹

Concept

We will consider studies that relate to one or many nursing interventions and that fit in one or more of our identified categories of DC. For this review, as stated before, we established eight categories of DC nursing

interventions that encompass all major categories that are suggested in other DC model,^{18–19} practice guidelines,^{12–20} conceptual model,²¹ core measures²² and standards of care.^{23–34} Those eight categories are (see table 1): sensory control, sensory stimulation, family-centred care, positioning and handling, sleep protection, comfort, skin and routine care, and feeding. In other words, any paper that discusses or is related to one or more specific nursing interventions that fall into one of these eight categories will be included in this scoping review. Also, a DC intervention will be qualified as a nursing intervention if it is delivered by nurses or if the intervention could be delivered by nurses as per their field of practice. We will also consider interventions if they are delivered by parents themselves. For example, a study evaluating a massage intervention (sensory stimulation) delivered by nurses would be eligible for inclusion in this review. On the other hand, a study evaluating the effects of specific macronutrients or micronutrients (feeding) would be excluded because it would be qualified as a medical intervention.

As for outcomes, all outcomes measured during the NICU hospitalisation will be considered for the inclusion of papers in the review. Papers that do not report any outcome as well as conference abstracts will be excluded.

Context

We will consider papers that discuss DC nursing interventions for preterm infants and their families during the NICU hospitalisation only, that being before the infant is discharged home or transferred to another care unit.

Types of sources

In this scoping review, we will consider quantitative, qualitative and mixed methods study designs for inclusion. In addition, literature reviews, text and opinion papers, practice guidelines and theoretical papers will be considered. Articles published in French or English will be included. Articles published from CINAHL, MEDLINE, Embase, PubMed, Web of Science, Scopus, ProQuest and PsycInfo databases from 2009 to the present will be included as modern DC interventions have mostly evolved over the last decade.

Search strategy

The search strategy will aim to locate both published and unpublished primary studies, reviews and opinion papers pertaining to DC nursing interventions in the NICU. An initial search strategy was developed and piloted with a librarian, based on Medical Subject Headings (MeSH) databases. A full search strategy for CINAHL, MEDLINE, Embase, PubMed, Web of Science, Scopus, ProQuest and PsycInfo (see online supplemental file 2, table S1) was then proposed. Key concepts include neonatology, DC and nursing. The



Table 1 DC categories according to different conceptual models, practice guidelines, core measures and standards of care as well as categories for this review

Neuroprotective core measures ^{18,19}	Core measures for DC ^{12,22}	Universe of DC ²¹	European standards of care for newborn health	Key practice domains of infant and family-centred DC in the intensive care unit ^{20,35}	Our categories of DC nursing interventions for this review
Healing environment ▲ Space ▲ Privacy ▲ Safety ▲ Temperature ▲ Touch ▲ Proprioception ▲ Smell ▲ Taste ▲ Sound ▲ Light	Healing environment ▲ Light and noise ▲ Healthcare workers collaboration	Environment ▲ Light levels ▲ Noise levels ▲ Cultural, racial, religious sensitivity ▲ Leadership	Management of the acoustic environment³⁰ ▲ Noise reduction ▲ Exposure to parental voice ▲ Quiet hour ▲ Etc Supportive sensory environment³³ ▲ Vocal, visual, olfactory and tactile parent–infant interactions ▲ Skin to skin ▲ Environmental noise reduction and light adjustment ▲ Minimisation of painful, stressful stimuli ▲ Well-being and self-regulation ▲ Multisensory input during breastfeeding initiation ▲ Intimacy, quietness and speech privacy ▲ Etc	Sensory control Nursing interventions controlling the preterm infant's sensory environment, that is, reducing detrimental sensory stimulation. Sensory stimulation Nursing interventions providing appropriate sensorial stimulation for the preterm infant.	
Partnering with families	Family-centred care	Family ▲ Satisfaction ▲ Involvement ▲ Knowledge ▲ Autonomy	Case management and transition to home²⁵ ▲ Parental involvement in planning and discharge ▲ Infant feeding, care, health management and development ▲ Etc Family access²⁸ ▲ 24-hour access for parents or family-designated substitutes	Skin-to-skin contact with intimate family members ▲ Early, frequent and prolonged skin to skin with parents ▲ Development, implementation, monitoring and evaluation of skin-to-skin education and policies ▲ Assessment of infant's readiness, stability and response to transfer and skin to skin ▲ Etc	Family-centred care Nursing interventions involving parents and families in their preterm infant's care plan and delivery.
		Family support services²⁹ ▲ Socioeconomic support ▲ Psychological support ▲ Pastoral/spiritual support ▲ Postpartum care ▲ Family daily activities ▲ Psychosocial support ▲ Parent associations' support ▲ Etc Parental involvement³¹ ▲ Parents as primary caregivers ▲ Parents' participation in medical rounds and decision-making processes ▲ Etc	Support for parent–infant bonding³² ▲ Early parent–infant contact, closeness and intimacy ▲ Psychological support to promote bonding ▲ Etc Very early and continuous skin-to-skin contact³⁴ ▲ Early and continuous skin to skin ▲ Early suckling and breast feeding ▲ Etc		

Continued

Table 1 Continued

Neuroprotective core measures ^{18,19}	Core measures for DC ^{12,22}	Universe of DC ²¹	European standards of care for newborn health	Our categories of DC nursing interventions for this review
Positioning and handling	Positioning	Positioning		
Developmentally supportive activities of daily living	Developmentally supportive activities of daily living	Positioning		
<ul style="list-style-type: none"> ▲ Positioning ▲ Feeding ▲ Maintaining skin integrity 				Positioning and handling Nursing interventions that aim to: (1) position the preterm infant appropriately in the NICU incubator or crib, during skin-to-skin or care delivery; (2) handle the preterm infant appropriately.
Safeguarding sleep	Protected sleep	Comfort		Sleep protection
<ul style="list-style-type: none"> ▲ Sleep/wake-based care ▲ Care that supports sleeping (swaddling, skin to skin) ▲ Sleep safety 	<ul style="list-style-type: none"> ▲ Pain assessment and management ▲ Skin to skin ▲ Massage ▲ Sleep regulation 			Nursing interventions that promote the infant's sleep-wake cycle, as well as continuous and undisturbed sleep.
Minimising stress and pain	Assessment and management of stress and pain			Sleep and arousal interventions for the newborn
				<ul style="list-style-type: none"> ▲ Promotion of appropriate sleep/arousal states and sleep/wake cycles ▲ Modifications of the physical environment and caregiving routines (reduction of sound levels; natural lighting, adjustment of lighting and diurnal cycling; temperature; positioning aids) ▲ Family presence and participation in care ▲ Etc
Reducing and managing pain	Reducing and managing pain and stress in newborns and families			Reduction and management of pain
	<ul style="list-style-type: none"> ▲ Increase parental/caregiver well-being and decrease emotional distress ▲ Minimisation of the impact of stressful and painful stimuli ▲ Etc 			Nursing interventions reducing, eliminating and/or managing procedural or prolonged pain.
Protecting skin	Skin care	Skin care		Skin and routine care
				Nursing interventions targeting care of the preterm infant's skin and hygiene care.
Optimising nutrition	Feeding	Feeding		Management of feeding, eating and nutrition delivery
	<ul style="list-style-type: none"> ▲ Early feeds (trophic, donor milk) ▲ Cue-based feeding ▲ Non-nutritive sucking 			<ul style="list-style-type: none"> ▲ Behaviour-based and baby-led feeding ▲ Breastfeeding promotion and support ▲ Optimisation of nutrition ▲ Etc
				Nursing interventions optimising directly or indirectly (ie, interventions preventing oral aversion) oral human milk feeding of the preterm infant.

Continued

Table 1 Continued

Neuroprotective core measures ^{10,19}	Core measures for DC ^{12,22}	Universe of DC ²¹	European standards of care for newborn health	Key practice domains of infant and family-centred DC in the intensive care unit ^{20,35}	Our categories of DC nursing interventions for this review
-	-	Others ▲ Thermoregulation (room temperature, swaddling, clothing, bedding, etc) ▲ Head-to-toe monitoring/assessing ▲ Infection control ▲ Patient safety measures ▲ Respiratory care	Clinical consultation and supervision for healthcare professionals on supporting families²⁶ ▲ Psychosocial and pastoral support ▲ Family support strategies ▲ Etc Education and training for infant-centred and family-centred developmental care²⁷ ▲ Formal education and recurrent training ▲ Regularly updated guidelines ▲ Etc	Systems thinking in complex adaptive systems ▲ Leadership and governance infrastructure ▲ Interprofessional collaboration ▲ Evidence-based practice ▲ Continuous monitoring of practice ▲ Transparency ▲ Etc	-

DC, developmental care; NICU, neonatal intensive care unit.

search strategy will be restricted to the last 12 years (2009–2021) due to the rise in publication in DC in the recent years. The search strategy, including all identified keywords and index terms, will be adapted for each included information source.

Information sources

In addition to the proposed databases (CINAHL, MEDLINE, Embase, PubMed, Web of Science, Scopus, ProQuest and PsycInfo), several grey literature sources will be hand searched, including Google Scholar, the Grey Guide and clinical trial registries (ClinicalTrials.gov, clinicaltrialregister.eu, isrctn.com, anzctr.org.au). Reference lists will also be analysed when appropriate to identify additional papers. Finally, a monthly bibliographic watch on DC prepared by our centre's librarian (<https://soins-dudeveloppement.wordpress.com/>) will be reviewed and analysed for potential papers. Furthermore, authors with incomplete records will be contacted as needed to obtain supplemental information.

Study selection

Following the search, all identified records will be collated and uploaded into Covidence systematic review software V.1528 (Veritas Health Innovation, Melbourne, Australia; www.covidence.org) and duplicates removed. Seven review authors (MH, MA, AL, GDC-F, GL, AB, NF), in teams of two, will then screen titles and abstracts against the inclusion criteria as a means to pilot the specificity of inclusion criteria. Each reviewer will screen 250 articles to assess the criteria's performance and the team will further refine them accordingly. Criteria will be piloted again until performance is deemed adequate by all reviewers. Initial screening will be completed by one independent reviewer. Potentially relevant papers will be retrieved in full and their citation details imported into Covidence. The full text of selected citations will be assessed in detail against the inclusion criteria by the same seven review authors, in teams of two independently. Similar to the initial screening, inclusion criteria will be piloted and further refined before completing the full-text selection process. Reasons for exclusion of full-text papers that do not meet the inclusion criteria will be recorded and reported in the scoping review. Any disagreements that arise between the reviewers at each stage of the selection process will be resolved with a third review author. The results of the search will be reported in full in the final scoping review and presented in a Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow diagram.⁵²

Data extraction

Data will be extracted from papers included in the scoping review by two independent reviewers using a data extraction tool developed by the review authors. Any disagreements that arise between the reviewers will be resolved through discussion, or with a third reviewer. The draft data extraction tool will be modified and revised as

necessary during the pilot phase of extracting data from the first 20 included papers. Authors of papers will be contacted to request missing or additional data, where required. Modifications, if needed, will be detailed in the full scoping review.

Data items

To answer to our first two review questions, those being to describe the nature, range, and extent of the literature as well as specific DC nursing interventions, the data extracted will include:

1. Descriptive data: authors, year of publication, country of origin, type of article and aim.
2. Methodological data: study design (if applicable), population (eg, gestational age of the preterm infants at birth, inclusion or not of parents).
3. Data about the specific DC nursing intervention: category of DC intervention to which it pertains according to our proposed classification, details about the intervention as per the Description and Replication checklist,⁵³ when applicable—the intervention, the materials, the procedures, the provider(s), the modes of delivery, where, when and how much (frequency, duration and dose) as well as possibilities for tailoring the intervention.

A second data extraction process will be conducted to answer to our third review question, that is, to highlight nursing-sensitive outcome indicators related to DC interventions. Thus, in order to identify nursing-sensitive outcome indicators, we will extract the following data only for papers with an experimental design:

4. Outcome data: outcomes measured, timing of outcome measure and reported results.

Critical appraisal and secondary data synthesis

Critical appraisal of included papers is not mandatory according to the scoping review JBI methodology.⁴⁹ Nevertheless, as per our third review question, we will critically appraise all studies with an experimental design using the JBI Checklist for Randomized Controlled Trials.⁵⁴ Two independent review authors will complete the checklist for each experimental study and disagreements will be resolved by a third review author.

A secondary qualitative data synthesis of the outcomes reported in experimental studies will be conducted in order to highlight nursing-sensitive outcome indicators related to DC interventions in the NICU. Provisional outcome indicators will be shared with experts with a clinical or academic background in the field of quality of care and neonatology so they can provide guidance and, ultimately, validation. Detailed methodology that pertains to the third objective will be reported in the results paper.

Data presentation

For our primary and first secondary objectives, the extracted data will be presented in tabular form. A narrative summary will accompany the tabulated results and will describe how the results relate to the reviews' objectives

and questions. As per our other secondary objective, data will be presented narratively.

Patient and public involvement

Patients and members of the public were not involved in the development of this protocol.

ETHICS AND DISSEMINATION

As this is a literature review project using already collected and published data, it will not be necessary to seek ethical approval from an Institutional Review Board. Results of this scoping review will be presented in scientific meetings and published in refereed papers. Our three objectives will be reported in three results papers.

Author affiliations

¹Faculty of Nursing, Université de Montréal, Montreal, Quebec, Canada

²Quebec Network on Nursing Intervention Research/Réseau de Recherche en Interventions en Sciences Infirmières du Québec (RRISQ), Montreal, Quebec, Canada

³Research Centre, CHU Sainte-Justine, Montreal, Quebec, Canada

⁴NICU, CHU Sainte-Justine, Montreal, Quebec, Canada

⁵Ingram School of Nursing, McGill University, Montreal, Quebec, Canada

⁶Centre for Nursing Research and Lady Davis Institute for Medical Research, Jewish General Hospital, Montreal, Quebec, Canada

Twitter Nancy Feeley @NlfeeleyN

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ORCID iDs

Marjolaine Héon <http://orcid.org/0000-0001-7450-1797>

Marilyn Aita <http://orcid.org/0000-0002-6197-8796>

Andréane Lavallée <http://orcid.org/0000-0001-5702-3084>

Gwenaëlle De Clifford-Faugère <http://orcid.org/0000-0002-9719-5531>

Geneviève Laporte <http://orcid.org/0000-0002-3612-8546>

Nancy Feeley <http://orcid.org/0000-0003-2836-4116>

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