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Nursing developmental care interventions for preterm infants in the neonatal intensive care unit: A scoping review protocol

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3 1 **Nursing developmental care interventions for preterm infants in the neonatal**
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5 2 **intensive care unit: A scoping review protocol**

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7
8 3 **Marjolaine Héon, RN, Ph.D.^{1,2} (corresponding author)**

9 4 ¹Faculty of Nursing, Université de Montréal, Montreal, Quebec, Canada

10 5 ² Quebec Network on Nursing Intervention Research (RRISIQ), Montreal, Quebec, Canada

11 6 Email: marjolaine.heon@umontreal.ca

12 7 ORCID: <https://orcid.org/0000-0001-7450-1797>

13 8
14
15
16 9 **Marilyn Aita, RN, Ph.D.^{1,2,3}**

17 10 ¹Faculty of Nursing, Université de Montréal, Montreal, Quebec, Canada

18 11 ²CHU Sainte-Justine Research Centre, Montreal, Quebec, Canada

19 12 ³ Quebec Network on Nursing Intervention Research (RRISIQ), Montreal, Quebec, Canada

20 13 Email: marilyn.aita@umontreal.ca

21 14 ORCID: <https://orcid.org/0000-0002-6197-8796>

22 15
23 16 **Andréane Lavallée, RN, PhD (c)^{1,2}**

24 17 ¹Faculty of Nursing, Université de Montréal, Montréal, Québec, Canada

25 18 ²CHU Sainte-Justine Research Centre, Montreal, Quebec, Canada

26 19 Email : andreane.lavallee@umontreal.ca

27 20 ORCID : <https://orcid.org/0000-0001-5702-3084>

28 21
29 22 **Gwenaëlle De Clifford-Faugère, RN, M.Sc., PhD(c)^{1,2,4}**

30 23 ¹Faculty of Nursing, Université de Montréal, Montreal, Quebec, Canada

31 24 ²CHU Sainte-Justine Research Centre, Montreal, Quebec, Canada

32 25 ⁴Faculté des Sciences Médicales et Paramédicales, Aix Marseille Université, EA3279-CEReSS,
33 26 Marseille, France

34 27 Email: gwenaelle.de.clifford@umontreal.ca

35 28 ORCID: <https://orcid.org/0000-0002-9719-5531>

36 29
37 30 **Geneviève Laporte, RN, Doctoral student^{1,2}**

38 31 ¹Faculty of Nursing, Université de Montréal, Montreal, Quebec, Canada

39 32 ²CHU Sainte-Justine Research Centre, Montreal, Quebec, Canada

40 33 Email : genevieve.laporte.1@umontreal.ca

41 34 ORCID : <https://orcid.org/0000-0002-3612-8546>

42 35
43 36 **Annie Boisvert, RN, Master student^{1,2}**

44 37 ¹Faculty of Nursing, Université de Montréal, Montreal, Quebec, Canada

45 38 ²CHU Sainte-Justine, Montreal, Quebec, Canada

46 39 Email: annie.boisvert.5@umontreal.ca

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41 **Nancy Feeley, RN, PhD** ^{3,5,6}

³ Quebec Network on Nursing Intervention Research (RRISIQ), Montreal, Quebec, Canada

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

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

Email : nancy.feeley@mcgill.ca

ORCID : <https://orcid.org/0000-0003-2836-4116>

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50 ABSTRACT

51 **Introduction:** Neurodevelopmental outcomes of preterm infant are still a contemporary concern. To
52 counter the detrimental effects resulting from the hospitalization in the Neonatal Intensive Care Unit (NICU),
53 Developmental Care (DC) interventions have emerged as a philosophy of care aimed at protecting and
54 enhancing preterm infant's development and promoting parental outcomes. In the past two decades, many
55 authors have suggested DC models, measures and guidelines but outlined different groupings of
56 interventions rather than specific interventions that can be used in NICU clinical practice. Moreover, as
57 these DC interventions are mostly implemented by neonatal nurses, it would be strategic and valuable to
58 identify specific indicators to make visible the contribution of NICU nurses to DC. Objectives: The
59 overarching objective of this review is to identify the nature, range and extent of the literature regarding DC
60 nursing interventions for preterm infants in the NICU. The secondary twofold objectives are to highlight
61 specific nursing interventions that fall into identified categories of DC interventions and suggest indicators
62 sensitive to neonatal nursing DC interventions in the NICU. Inclusion criteria: Papers reporting on or
63 discussing a DC nursing intervention during NICU hospitalization will be included.

64 **Methods and analysis:** The Joanna Briggs Institute's methodology for scoping reviews will be followed.
65 CINAHL, MEDLINE, Embase, PubMed, Web of Science, Scopus, ProQuest and PsychInfo databases from
66 2009 to the present will be searched. Any type of paper, published in English or French, will be considered.
67 Study selection and data extraction will be conducted by pairs of two review authors independently. A
68 qualitative content analysis will be conducted.

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

71 **Keywords:** neonatal intensive care unit; developmental care; nursing care; preterm infant; scoping review.

72 **STRENGTHS AND LIMITATIONS OF THIS STUDY**

- 73 • First scoping review that aims to identify sensitive indicators of neonatal nursing developmental care
74 interventions in the NICU.
- 75 • New comprehensive and inclusive categories of developmental care interventions orient this scoping
76 review.
- 77 • Both researchers and clinicians with expertise in neonatal intensive care nursing and developmental
78 care for preterm infants and their families collaborate to conduct this scoping review.
- 79 • The literature search will include literature published in both French and English.
- 80 • As the scope of this review is large and the literature search strategy is very sensitive, it will include
81 all relevant literature but might lack specificity.
- 82 • This scoping review protocol follows the recommendations of the Joanna Briggs Institute for the
83 conduct of systematic and rigorous reviews.

84

85 INTRODUCTION

86 Short and long-term neurodevelopmental outcomes are still a contemporary concern for infants that are
87 born preterm, that is before the 37th week of gestation (WG) is completed,[1-3]. Compared to term infants,
88 school-aged children born preterm have significant deficits in mathematics and reading,[1], present with
89 lower Intellectual Quotients (IQ),[4], and are at increased risk for anxiety and hyperactivity disorders,[5].
90 Throughout adulthood, young adults born preterm are still facing significant social-emotional difficulties,[3],
91 present with lower IQ,[6], are even at increased risk for autistic symptoms,[7], and obtain lower scores on
92 neuropsychological tests,[2]. The hospitalization in the Neonatal Intensive Care Unit (NICU) has been
93 identified as a strategic period to implement interventions to protect and optimize preterm infant's
94 neurodevelopment,[8]. In fact, the most important maturation processes of the central nervous system occur
95 between the 24th and the 40th WG,[9].

96 The concept of Developmental Care (DC), based on the work of Dr. Heidelise Als,[10], is a neuroprotective
97 NICU care philosophy that ultimately intends to promote optimal health outcomes in preterm infants and
98 their families,[11-13]. An important aspect of DC is the individualisation of care that should match each
99 infant and their family's needs,[13, 14] with the aim of lowering parental stress and maximizing their
100 adaptation, as well as improving the infant's development,[14]. DC has proven to be effective in promoting
101 mental and psychomotor development,[15], neurobehavior, and oral feeding,[16]; reducing NICU length of
102 stay,[16], and lowering parental stress and anxiety,[17]. Thus, it appears important to scope the DC
103 literature to identify specific interventions neonatal nurses can implement daily in their practice in order to
104 optimize preterm infants' and families' outcomes.

105 However, it is unclear which specific interventions DC encompasses. Different authors have suggested
106 groupings of DC interventions, which have been referred to as a DC model,[18], practice guidelines,[12], a
107 conceptual model,[19], and core measures,[20]. For example, in their DC model, Altimier and Phillips,[18]
108 suggest there are seven neuroprotective DC core measures including: the healing environment (physical,
109 sensory, smell/test, sound/noise, light), partnering with families, positioning and handling the infant,
110 safeguarding sleep, minimizing stress and pain, protecting skin and optimizing nutrition. The Neonatal
111 Association of Neonatal Nurses' practice guidelines,[12] and Coughlin, Gibbins et al.,[20] both suggest five
112 core measures, such as: protected sleep, assessment & management of stress and pain, developmentally
113 supportive activities of daily living, family-centered care and creating a healing environment. Finally,
114 Gibbins, Hoath et al.,[19] in their universe of DC conceptual model suggest that DC interventions fit into 12
115 categories: monitoring/assessing, feeding, positioning, infection control, safety, comfort, thermoregulation,
116 skin care, respiratory care, family, staff and environment. Still, it remains ambiguous which specific nursing
117 interventions fit into those global categories. For example, Jebreili, Neshat et al.,[21] evaluated the
118 effectiveness of an olfactive stimulation intervention to manage procedural pain of preterm infants in the
119 NICU. Although this intervention aims at reducing the preterm infant's pain, the authors do not identify it as
120 a DC intervention, nor does it appear in any of the aforementioned groupings. To develop categories of DC

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3 121 interventions that are comprehensive, and inclusive we propose that DC interventions fall into eight
4 122 categories. Our classification encompasses all categories suggested by the various abovementioned
5 123 authors: family-centered care, feeding, positioning and handling, reduction and management of pain,
6 124 sensory control, sensory stimulation, skin and routine care and sleep protection.

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10 125 DC interventions are primarily delivered by neonatal nurses,[14]. Indeed, by virtue of their field of practice,
11 126 their professional skills and their unique proximity in the healthcare experience of preterm infants and their
12 127 families, neonatal nurses are strategically positioned to implement DC interventions in the NICU,[14, 22].
13 128 However, the visibility of their specific contribution is compromised by the absence of indicators that would
14 129 allow us to better understand the effects and benefits of DC nursing interventions in the NICU. From a
15 130 global perspective, the invisibility of the contribution of neonatal nursing to infants' health is a major concern,
16 131 because it does not allow to distinguish their distinctive and exclusive role in NICU clinical practice,[23]
17 132 along with how their involvement may favorably influence infants' health outcomes. In the past years,
18 133 several initiatives to identify quality indicators to assess the contribution of nurses have emerged,[24-26].
19 134 Although these authors have identified nursing-sensitive quality indicators, the former remain generic and
20 135 some of these indicators, such as falls and incontinence, are not transferable to a neonatal population.
21 136 Consequently, the range of implemented DC interventions remains unknown and the absence of specific
22 137 nursing quality indicators related to these neonatal DC prevents the evaluation of nursing contribution to
23 138 preterm infants' and families' well-being. A database of quality indicators for neonatology was developed
24 139 by The Canadian Neonatal Network,[27]. However, the authors of this report did not specifically take into
25 140 account quality indicators that are specific to neonatal nursing DC interventions but rather observed medical
26 141 outcomes such as sepsis, survival rates and cardiovascular complications rates. Moreover, 11 nursing-
27 142 sensitive quality indicators for the NICU were developed in a study by Chen, Huang et al.,[28] but then
28 143 again, these indicators are general to NICU care (i.e. rate of compliance to proper hand washing, rate of
29 144 nosocomial infections, etc.) and not specifically related to DC nursing interventions.

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39 145 A preliminary search of PROSPERO, MEDLINE, the Cochrane Database of Systematic Reviews and the
40 146 *Joanna Briggs Institute Database of Systematic Reviews and Implementation Reports* was conducted.
41 147 Some systematic reviews have looked at the effectiveness of specific DC programs, such as the Newborn
42 148 Individualized Developmental Care and Assessment Program [NIDCAP],[15], or the effectiveness of
43 149 interventions on preterm infant's development or health outcomes,[16, 29-31]. To our knowledge, no current
44 150 reviews scoping the literature on DC nursing interventions have been published or is underway.

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49 151 Based on this lack of evidence, the primary objective for this scoping review is to: 1) identify the nature,
50 152 range and extent of the literature regarding DC nursing interventions for preterm infants in the NICU. The
51 153 secondary objectives are twofold: 2) highlight specific nursing interventions that fall into our eight identified
52 154 categories of DC interventions; and 3) suggest indicators sensitive to neonatal nursing related to DC
53 155 interventions.

156 REVIEW QUESTIONS

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

159 The secondary questions addressed in this scoping review are: What are the specific nursing interventions
160 that have been associated with our eight nursing DC categories in the NICU? What are the indicators
161 related to neonatal nursing DC interventions in the NICU?

162 METHODS

163 The proposed scoping review will be conducted in accordance with The Joanna Briggs Institute (JBI)
164 methodology for scoping reviews,[32]. Moreover, as suggested by The JBI, this protocol is based upon the
165 Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews
166 [PRISMA-ScR] Checklist (see Supplemental file 1),[33].

167 Inclusion criteria

168 Participants

169 We will consider studies that included preterm infants or their parents. For this review, we will consider the
170 definition suggested by the World Health Organization stating that preterm infants are infants born before
171 the 37th week of gestation is completed,[34].

172 Concept

173 We will consider studies that relate to one or many nursing interventions and that fit in one or more of our
174 identified categories of DC. For this review, as stated before, we established eight categories of DC nursing
175 interventions that encompass all major categories that are suggested in other DC models,[12, 18-20] and
176 that are related to nursing care. Those eight categories are (see Table 1): sensory control, sensory
177 stimulation, family-centered care, positioning and handling, sleep protection, comfort, skin and routine care,
178 and feeding. In other words, any paper that discusses or is related to one or more specific nursing
179 interventions that fall into one of these eight categories will be included in this scoping review. Also, a DC
180 intervention will be qualified as a nursing intervention if it is delivered by nurses or if the intervention could
181 be delivered by nurses as per their field of practice. We will also consider interventions if they are delivered
182 by parents themselves. For example, a study evaluating a massage intervention (sensory stimulation)
183 delivered by nurses would be eligible for inclusion in this review. On the other hand, a study evaluating the
184 effects of specific macro or micronutrients (feeding) would be excluded because it would be qualified as a
185 medical intervention.

186 Table 1. DC categories according to different conceptual models and clinical guidelines as well as

187 categories for this review

Neuroprotective Core Measures,[18]	Core measures for DC,[12, 20]	Universe of DC,[19]	Our categories of DC nursing interventions for this review
Healing environment <ul style="list-style-type: none"> - Space; - Privacy; - Safety; - Temperature; - Touch; - Proprioception; - Smell; - Taste; - Sound; - Light. 	Healing environment <ul style="list-style-type: none"> - Light and noise; - Healthcare workers collaboration. 	Environment <ul style="list-style-type: none"> - Light levels; - Noise levels; - Cultural, racial, religious sensitivity; - Leadership. 	Sensory control Nursing interventions controlling the preterm infant's sensory environment, that is reducing detrimental sensory stimulation.
Partnering with families	Family centered care	Family <ul style="list-style-type: none"> - Satisfaction; - Involvement - Knowledge; - Autonomy. 	Family centered care Nursing interventions involving parents and families in their preterm infant's care plan and delivery.
Positioning and handling	Developmentally supportive activities of daily living <ul style="list-style-type: none"> - Positioning; - Feeding; - Maintaining skin integrity. 	Positioning	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 <ul style="list-style-type: none"> - Sleep/wake-based care - Care that supports sleeping (swaddling, skin-to-skin); - Sleep safety. 	Comfort <ul style="list-style-type: none"> - Pain assessment and management; - Skin-to-skin; - Massage; - Sleep regulation. 	Sleep protection Considering infant's sleep-wake cycle when providing care and promoting continuous and undisturbed sleep.
Minimizing stress and pain	Assessment and management of stress and pain		Reduction and management of pain Nursing interventions reducing, eliminating and/or managing procedural or prolonged pain.
Protecting skin		Skin care	Skin and routine care Nursing interventions targeting care of the preterm infant's skin and hygiene care.
Optimizing nutrition		Feeding <ul style="list-style-type: none"> - Early feeds (trophic, donor milk); - Cue-based feeding; - Nonnutritive sucking. 	Feeding Nursing interventions optimizing directly or indirectly (i.e. interventions preventing oral aversion) oral human milk feeding of the preterm infant.
--	--	Others <ul style="list-style-type: none"> - Thermoregulation (room temperature, swaddling, clothing, bedding, etc.); - Head-to-toe Monitoring/Assessing; - Infection control; - Patient Safety measures; - Respiratory care. 	--

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189 As for outcomes, all outcomes measured during the NICU hospitalization will be considered for the inclusion
190 of papers in the review. Papers that do not report any outcome but discuss DC nursing interventions will
191 also be considered for inclusion.

192 Context

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

196 Types of sources

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

202 Search strategy

203 The search strategy will aim to locate both published and unpublished primary studies, reviews and opinion
204 papers pertaining to DC nursing interventions in the NICU. An initial search strategy was developed and
205 piloted with a librarian, based on MESH databases. A full search strategy for CINAHL, MEDLINE, Embase,
206 PubMed, Web of Science, Scopus, ProQuest and PsychInfo (see Table S1 - Supplemental file 2) was then
207 proposed. Key concepts include neonatology, DC and nursing. The search strategy will be restricted to the
208 last 10 years (2009-2019) due to the rise in publication in DC in the recent years. The search strategy,
209 including all identified keywords and index terms will be adapted for each included information source.

210 Information sources

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

219 **Study selection**

220 Following the search, all identified records will be collated and uploaded into Covidence systematic review
221 software v1528 (Veritas Health Innovation, Melbourne, Australia; www.covidence.org) and duplicates
222 removed. Seven review authors (MH, MA, AL, GDF, GL, AB, NF), in teams of two, will then screen titles
223 and abstracts against the inclusion criteria as a means to pilot the specificity of inclusion criteria. Each
224 reviewer will screen 250 articles to assess the criteria's performance and the team will further refine them
225 accordingly. Criteria will be piloted again until performance is deemed adequate by all reviewers. Initial
226 screening will be completed by one independent reviewer. Potentially relevant papers will be retrieved in
227 full and their citation details imported into Covidence. The full text of selected citations will be assessed in
228 detail against the inclusion criteria by the same seven review authors, in teams of two independently. Similar
229 to the initial screening, inclusion criteria will be piloted and further refined before completing the full-text
230 selection process. Reasons for exclusion of full text papers that do not meet the inclusion criteria will be
231 recorded and reported in the scoping review. Any disagreements that arise between the reviewers at each
232 stage of the selection process will be resolved with a third review author. The results of the search will be
233 reported in full in the final scoping review and presented in a Preferred Reporting Items for Systematic
234 Reviews and Meta-analyses [PRISMA] flow diagram,[35].

235 **Data extraction**

236 Data will be extracted from papers included in the scoping review by two independent reviewers using a
237 data extraction tool developed by the review authors. Any disagreements that arise between the reviewers
238 will be resolved through discussion, or with a third reviewer. The draft data extraction tool will be modified
239 and revised as necessary during the pilot phase of extracting data from the first 20 included paper. Authors
240 of papers will be contacted to request missing or additional data, where required. Modifications, if needed,
241 will be detailed in the full scoping review.

242 **Data items**

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

- 245 1. Descriptive data: authors, year of publication, country of origin, type of article and aim.
- 246 2. Methodological data: study design (if applicable), population (e.g. gestational age of the preterm infants
247 at birth, inclusion or not of parents).
- 248 3. Data about the specific DC nursing intervention: category of DC intervention to which it pertains
249 according to our proposed classification, details about the intervention as per the Description and
250 Replication checklist [TIDieR],[36] when applicable – the intervention, the materials, the procedures,
251 the provider(s), the modes of delivery, where, when and how much (frequency, duration and dose) as

252 well as possibilities for tailoring the intervention.

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

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

257 **Critical appraisal and secondary data synthesis**

258 Critical appraisal of included papers is not mandatory according to the scoping review JBI methodology,[32].
259 Nevertheless, as per our third review question, we will critically appraise all studies with an experimental
260 design using the Joanna Briggs Institute Checklist for Randomized Controlled Trials,[37]. Two independent
261 review authors will complete the checklist for each experimental study and disagreements will be resolved
262 by a third review author.

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

268 **Data presentation**

269 Our primary and first secondary objective are to describe the extent, range and nature of the literature
270 related to DC nursing interventions as well as the specific nursing interventions that relate to DC. The
271 extracted data will be presented in tabular form. A narrative summary will accompany the tabulated results
272 and will describe how the results relate to the reviews objectives and questions. As per our other secondary
273 objective to highlight indicators related to DC nursing interventions, data will be presented narratively.

274 **ETHICS AND DISSEMINATION**

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

279 **PATIENT AND PUBLIC INVOLVMENT**

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

281 **ACKNOWLEDGMENTS**

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286 review process.

287 **COMPETING INTERESTS**

288 The authors declare no conflict of interest.

289 **DATA AVAILABILITY STATEMENT**

290 No data are available as this is a systematic scoping review protocol.

291 **PATIENT AND PUBLIC INVOLVEMENT**

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

293 **AUTHOR CONTRIBUTIONS**

294 MH (PI) drafted the first version of the review protocol revised by MA and NF (Co-Is) to obtain funding from
295 RRISIQ. AL wrote the first version of this manuscript with the contribution of MH, MA, GL, GD, and NF. All
296 authors read and approved the final version. MH, GL and AB drafted the initial search strategy.

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45 371 [birth#:~:text=Preterm%20is%20defined%20as%20babies,preterm%20\(28%20to%2032%20week](https://www.who.int/news-room/fact-sheets/detail/preterm-birth#:~:text=Preterm%20is%20defined%20as%20babies,preterm%20(28%20to%2032%20weeks))
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Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
TITLE			
Title	1	Identify the report as a scoping review.	
ABSTRACT			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	
METHODS			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	



SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
RESULTS			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	
DISCUSSION			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	
Limitations	20	Discuss the limitations of the scoping review process.	
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	
FUNDING			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	

JBI = Joanna Briggs Institute; PRISMA-ScR = Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.

* Where *sources of evidence* (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and Web sites.

† A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with *information sources* (see first footnote).

‡ The frameworks by Arksey and O'Malley (6) and Levac and colleagues (7) and the JBI guidance (4, 5) refer to the process of data extraction in a scoping review as data charting.

§ The process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 and 19 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document).

From: Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Ann Intern Med.* 2018;169:467–473. doi: [10.7326/M18-0850](https://doi.org/10.7326/M18-0850).



SUPPLEMENTAL FILE 2: EXAMPLE OF OUR SEARCH STRATEGY

Table S1. Search strategy in CINAHL

Search	CINAHL (octobre, 2019)	Records retrieved
#1 Subject heading search	(MH "Evaluation and Quality Improvement Program") OR (MH "Magnet Hospital Accreditation") OR (MH "Joint Commission") OR (MH "Quality Patient Care Scale") OR (MH "Nursing Practice, Evidence-Based+") OR (MH "Nursing Assessment") OR (MH "Health Care Delivery") OR (MH "Health Care Delivery, Integrated") OR (MH "Health Resource Allocation") OR (MH "Health Resource Utilization") OR (MH "Accountable Care Organizations") OR (MH "Health Care Reform") OR (MH "Health Services Accessibility") OR (MH "Program Evaluation") OR (MH "Quality of Care Research") OR (MH "Performance Measurement Systems") OR (MH "Health Status Indicators") OR (MH "Clinical Assessment Tools") OR (MH "Quality of Health Care+")	958,800
#2 Subject heading search	(MH "Intensive Care Units, Neonatal") OR (MH "Neonatal Assessment+") OR (MH "Neonatal Intensive Care Nursing") OR (MH "Intensive Care, Neonatal") OR (MH "Neonatal Nurse Practitioners") OR (MH "Neonatal Nursing") OR (MH "Infant, Low Birth Weight+") OR (MH "Infant, Premature") OR (MH "Infant, Hospitalized") OR (MH "Infant, High Risk") OR (MH "Infant, Drug-Exposed")	47,945
#3 Subject heading search	Nurs*	173,295
#4 keyword search	TI(Indicator* OR quality OR performance OR outcome* OR metrics OR standard* OR (evidence* N2 practice) OR benchmarking OR "report card*" OR "EBP" OR (Evidence* N2 nursing) OR "EBN" OR "practice guidelines" OR (program* N3 evaluati*) OR AB (Indicator* OR quality OR performance OR outcome* OR metrics OR standard* OR (evidence* N2 practice) OR benchmarking OR "report card*" OR "EBP" OR (Evidence* N2 nursing) OR "EBN" OR "practice guidelines" OR (program* N3 evaluati*) OR MW (Indicator* OR quality OR performance OR outcome* OR metrics OR standard* OR (evidence* N2 practice) OR benchmarking OR "report card*" OR "EBP" OR (Evidence* N2 nursing) OR "EBN" OR "practice guidelines" OR (program* N3 evaluati*))	1,665,707
#5 keyword search	TI (((preterm OR "pre-term" OR premature OR (low* N2 Weight) OR small*) AND (newborn* OR infant* OR bab* OR child*)) OR Neonat*) OR AB (((preterm OR "pre-term" OR premature OR (low* N2 Weight) OR small*) AND (newborn* OR infant* OR bab* OR child*)) OR Neonat*) OR MW (((preterm OR "pre-term" OR premature OR (low* N2 Weight) OR small*) AND (newborn* OR infant* OR bab* OR child*)) OR Neonat*)	114,605

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#6 keyword search	TX nurs*	1,678,740
#4	(#1 AND #2 AND #3) OR (#4 AND #5 AND #6)	7991
Limited to 2009-current, french and english (DT 2009-current AND LA(english OR french))		

For peer review only

BMJ Open

A comprehensive mapping and nursing-sensitive outcome indicators of developmental care interventions in NICU: A Scoping review protocol

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Secondary Subject Heading:	Nursing
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A comprehensive mapping and nursing-sensitive outcome indicators of developmental care interventions in NICU: A Scoping review protocol

Marjolaine Héon, RN, Ph.D.^{1,2} (corresponding author)

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

² Quebec Network on Nursing Intervention Research (RRISIQ), Montreal, Quebec, Canada

Email: marjolaine.heon@umontreal.ca

ORCID: <https://orcid.org/0000-0001-7450-1797>

Marilyn Aita, RN, Ph.D.^{1,2,3}

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

²CHU Sainte-Justine Research Centre, Montreal, Quebec, Canada

³ Quebec Network on Nursing Intervention Research (RRISIQ), Montreal, Quebec, Canada

Email: marilyn.aita@umontreal.ca

ORCID: <https://orcid.org/0000-0002-6197-8796>

Andréane Lavallée, RN, PhD^{1,2}

¹Faculty of Nursing, Université de Montréal, Montréal, Québec, Canada

²CHU Sainte-Justine Research Centre, Montreal, Quebec, Canada

Email : andreane.lavallee@umontreal.ca

ORCID : <https://orcid.org/0000-0001-5702-3084>

Gwenaëlle De Clifford-Faugère, RN, M.Sc., PhD(c)^{1,2,4}

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

²CHU Sainte-Justine Research Centre, Montreal, Quebec, Canada

⁴Faculté des Sciences Médicales et Paramédicales, Aix Marseille Université, EA3279-CEReSS, Marseille, France

Email: gwenaelle.de.clifford@umontreal.ca

ORCID: <https://orcid.org/0000-0002-9719-5531>

Geneviève Laporte, RN, PhD(c)^{1,2}

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

²CHU Sainte-Justine Research Centre, Montreal, Quebec, Canada

Email : genevieve.laporte.1@umontreal.ca

ORCID : <https://orcid.org/0000-0002-3612-8546>

Annie Boisvert, RN, Master student^{1,2}

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

²CHU Sainte-Justine, Montreal, Quebec, Canada

1
2
3 40 Email: annie.boisvert.5@umontreal.ca
4 41

5
6 42 **Nancy Feeley, RN, PhD** ^{3,5,6}

7 43 ³ Quebec Network on Nursing Intervention Research (RRISIQ), Montreal, Quebec, Canada

8
9 44 ⁵ Ingram School of Nursing, McGill University, Montreal, Quebec, Canada

10 45 ⁶ Centre for Nursing Research and Lady Davis Institute, Jewish General Hospital, Montreal,
11 46 Quebec, Canada

12
13 47 **Email :** nancy.feeley@mcgill.ca

14 48 **ORCID :** <https://orcid.org/0000-0003-2836-4116>
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51 ABSTRACT

52 **Introduction:** Neurodevelopmental outcomes of preterm infant are still a contemporary concern. To
53 counter the detrimental effects resulting from the hospitalization in the Neonatal Intensive Care Unit (NICU),
54 Developmental Care (DC) interventions have emerged as a philosophy of care aimed at protecting and
55 enhancing preterm infant's development and promoting parental outcomes. In the past two decades, many
56 authors have suggested DC models, core measures, practice guidelines, and standards of care but outlined
57 different groupings of interventions rather than specific interventions that can be used in NICU clinical
58 practice. Moreover, as these DC interventions are mostly implemented by neonatal nurses, it would be
59 strategic and valuable to identify specific outcome indicators to make visible the contribution of NICU nurses
60 to DC. Objectives: The overarching objective of this review is to identify the nature, range and extent of the
61 literature regarding DC nursing interventions for preterm infants in the NICU. The secondary twofold
62 objectives are to highlight interventions that fall into identified categories of DC interventions and suggest
63 nursing-sensitive outcome indicators related to DC interventions in the NICU. Inclusion criteria: Papers
64 reporting on or discussing a DC nursing intervention during NICU hospitalization will be included.

65 **Methods and analysis:** The Joanna Briggs Institute's methodology for scoping reviews will be followed.
66 CINAHL, MEDLINE, Embase, PubMed, Web of Science, Scopus, ProQuest and PsychInfo databases from
67 2009 to the present will be searched. Any type of paper, published in English or French, will be considered.
68 Study selection and data extraction will be conducted by pairs of two review authors independently. A
69 qualitative content analysis will be conducted.

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

72 **Keywords:** neonatal intensive care unit; developmental care; nursing care; preterm infant; scoping review.

73 **STRENGTHS AND LIMITATIONS OF THIS STUDY**

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

84 INTRODUCTION

85 Short and long-term neurodevelopmental outcomes are still a contemporary concern for infants that are
86 born preterm, that is before the 37th week of gestation (WG) is completed,[1-3]. Compared to term infants,
87 school-aged children born preterm have significant deficits in mathematics and reading,[1], present with
88 lower Intellectual Quotients (IQ),[4], and are at increased risk for anxiety and hyperactivity disorders,[5].
89 Throughout adulthood, young adults born preterm are still facing significant social-emotional difficulties,[3],
90 present with lower IQ,[6], are even at increased risk for autistic symptoms,[7], and obtain lower scores on
91 neuropsychological tests,[2]. The hospitalization in the Neonatal Intensive Care Unit (NICU) has been
92 identified as a strategic period to implement interventions to protect and optimize preterm infant's
93 neurodevelopment,[8]. In fact, the most important maturation processes of the central nervous system occur
94 between the 24th and the 40th WG,[9].

95 The concept of Developmental Care (DC), based on the work of Dr. Heidelise Als,[10], is a neuroprotective
96 NICU care philosophy that ultimately intends to promote optimal health outcomes in preterm infants and
97 their families,[11-13]. An important aspect of DC is the individualisation of care that should match each
98 infant and their family's needs,[13, 14] with the aim of lowering parental stress and maximizing their
99 adaptation, as well as improving the infant's development,[14]. DC has proven to be effective in promoting
100 mental and psychomotor development,[15], neurobehavior, and oral feeding,[16]; reducing NICU length of
101 stay,[16], and lowering parental stress and anxiety,[17]. Thus, it appears important to scope the DC
102 literature to identify specific interventions neonatal nurses can implement daily in their practice in order to
103 optimize preterm infants' and families' outcomes.

104 However, it is unclear which specific interventions DC encompasses. Different authors have suggested
105 groupings of DC interventions, which have been referred to as a DC model,[18, 19], practice guidelines,[12,
106 20], a conceptual model,[21], core measures,[22], and standards of care [23-34]. For example, in their DC
107 model, Altimier and Phillips,[18, 19] suggest there are seven neuroprotective DC core measures including:
108 the healing environment (physical, sensory, smell/test, sound/noise, light), partnering with families,
109 positioning and handling the infant, safeguarding sleep, minimizing stress and pain, protecting skin and
110 optimizing nutrition. The Neonatal Association of Neonatal Nurses' practice guidelines,[12] and Coughlin,
111 Gibbins et al.,[22] both suggest five core measures, such as: protected sleep, assessment & management
112 of stress and pain, developmentally supportive activities of daily living, family-centered care and creating a
113 healing environment. Gibbins, Hoath et al.,[21] in their universe of DC conceptual model suggest that DC
114 interventions fit into 12 categories: monitoring/assessing, feeding, positioning, infection control, safety,
115 comfort, thermoregulation, skin care, respiratory care, family, staff and environment. Lindacher,
116 Altebaeumer [23] provide 96 European standards of care for newborn health on 11 overarching topic areas,
117 including ten standards on infant- and family-centered developmental care [24] : case management and
118 transition to home [25]; clinical consultation and supervision for healthcare professionals on supporting
119 families [26]; education and training for infant- and family-centered developmental care [27]; family access

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3 120 [28]; family support services [29]; management of the acoustic environment [30]; parental involvement [31];
4 121 support for parental-infant bonding [32]; supportive sensory environment [33]; and very early and
5 122 continuous skin-to-skin contact [34]. Finally, Browne, Jaeger [35] identify six key practice domains of infant
6 123 and family centered developmental care in the intensive care unit: systems' thinking; positioning and touch
7 124 for the newborn; sleep and arousal interventions for the newborn; skin-to-skin contact with intimate family
8 125 members; reducing and managing pain and stress in newborns and families; and management of feeding,
9 126 eating, and nutrition delivery. Still, it remains ambiguous which specific interventions fit into those global
10 127 categories. For example, Jebreili, Neshat [36] evaluated the effectiveness of an olfactive stimulation
11 128 intervention to manage procedural pain of preterm infants in the NICU. Although this intervention aims at
12 129 reducing the preterm infant's pain, the authors do not identify it as a DC intervention, nor does it appear in
13 130 any of the aforementioned groupings. To develop categories of DC interventions that are comprehensive
14 131 for nursing, and inclusive we propose that DC interventions fall into eight categories. Our classification
15 132 encompasses all categories suggested by the various abovementioned authors: family-centered care,
16 133 feeding, positioning and handling, reduction and management of pain, sensory control, sensory stimulation,
17 134 skin and routine care and sleep protection.

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26 135 Even though DC is a multidisciplinary approach [13], DC interventions are primarily delivered by neonatal
27 136 nurses,[14]. Indeed, by virtue of their field of practice, their professional skills and their unique proximity in
28 137 the healthcare experience of preterm infants and their families, neonatal nurses are strategically positioned
29 138 to implement DC interventions in the NICU,[14, 37]. However, the invisibility of the contribution of neonatal
30 139 nursing to infants' health is a major concern, because it does not allow to distinguish their distinctive and
31 140 exclusive role in NICU clinical practice,[38] along with how their involvement may favorably influence
32 141 infants' health outcomes. The visibility of their specific contribution is compromised by the absence of a
33 142 global portrait of nursing-sensitive outcome indicators that would allow us to better understand the effects
34 143 and benefits of DC interventions in the NICU. Introduced by Maas, Johnson [39], the concept of "nursing-
35 144 sensitive outcome indicator" refers to the distinct and measurable change in patient's state, behavior or
36 145 perception as a result of a nursing intervention. In the past years, several initiatives to identify nursing-
37 146 sensitive outcome indicators have emerged,[40-43]. Although these authors have identified nursing-
38 147 sensitive outcome indicators, the former remain generic and some of these indicators, such as falls and
39 148 incontinence, are not transferable to a neonatal population. Consequently, the range of implemented DC
40 149 interventions remains unknown and the absence of specific nursing-sensitive outcome indicators related to
41 150 these neonatal DC prevents the evaluation of nursing contribution to preterm infants' and families' well-
42 151 being. A database of outcome indicators for neonatology was developed by The Canadian Neonatal
43 152 Network,[44]. Nonetheless, the authors of this report did not specifically take into account outcome
44 153 indicators that are specific to neonatal nursing DC interventions but rather observed medical outcomes
45 154 such as sepsis, survival rates and cardiovascular complications rates. Moreover, 11 nursing-sensitive
46 155 quality indicators for the NICU were developed in a study by Chen, Huang [45] but then again, these
47 156 indicators are general to NICU care (i.e. rate of compliance to proper hand washing, rate of nosocomial

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3 157 infections, etc.) and not specifically related to DC nursing interventions. Thus, there is a pressing need for
4 158 a comprehensive mapping of nursing-sensitive outcome indicators with regard to DC interventions. Such
5 159 effort is essential to identify outcome indicators that have been reported so far in the scientific literature and
6 160 those that require further assessment, as well as to circumscribe the effects of DC interventions on
7 161 delivered by nurses on preterm infants' and families' health and development.

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11 162 A preliminary search of PROSPERO, MEDLINE, the Cochrane Database of Systematic Reviews and the
12 163 *Joanna Briggs Institute Database of Systematic Reviews and Implementation Reports* was conducted.
13 164 Some systematic reviews have looked at the effectiveness of specific DC programs, such as the Newborn
14 165 Individualized Developmental Care and Assessment Program [NIDCAP],[15], or the effectiveness of
15 166 interventions on preterm infant's development or health outcomes,[16, 46-48]. To our knowledge, no current
16 167 reviews scoping the literature on DC interventions have been published or is underway.

17
18 168 Based on this lack of evidence, the primary objective for this scoping review is to: 1) identify the nature,
19 169 range and extent of the literature regarding DC interventions in the NICU. The secondary objectives are
20 170 twofold: 2) highlight DC interventions that fall into our eight identified categories of DC interventions; and 3)
21 171 suggest nursing-sensitive outcome indicators related to DC interventions.

22 172 **REVIEW QUESTIONS**

23 173 The primary question guiding this scoping review is the following: What is the nature, range and the extent
24 174 of the literature regarding DC interventions for preterm infants and families in the NICU?

25 175 The secondary questions addressed in this scoping review are: What are the interventions that have been
26 176 associated with our eight DC categories in the NICU? What are the nursing-sensitive outcome indicators
27 177 related to DC interventions in the NICU?

28 178 **METHODS**

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30 179 The proposed scoping review will be conducted in accordance with The Joanna Briggs Institute (JBI)
31 180 methodology for scoping reviews,[49]. Moreover, as suggested by The JBI, this protocol is based upon the
32 181 Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews
33 182 [PRISMA-ScR] Checklist (see Supplemental file 1),[50].

34 183 **Inclusion criteria**

35 184 **Participants**

36 185 We will consider studies that included preterm infants or their parents. For this review, we will consider the
37 186 definition suggested by the World Health Organization stating that preterm infants are infants born before
38 187 the 37th week of gestation is completed,[51].

188 Concept

189 We will consider studies that relate to one or many nursing interventions and that fit in one or more of our
 190 identified categories of DC. For this review, as stated before, we established eight categories of DC nursing
 191 interventions that encompass all major categories that are suggested in other DC model,[18, 19], practice
 192 guidelines,[12, 20], conceptual model,[21], core measures,[22], and standards of care [23-34]. Those eight
 193 categories are (see Table 1): sensory control, sensory stimulation, family-centered care, positioning and
 194 handling, sleep protection, comfort, skin and routine care, and feeding. In other words, any paper that
 195 discusses or is related to one or more specific nursing interventions that fall into one of these eight
 196 categories will be included in this scoping review. Also, a DC intervention will be qualified as a nursing
 197 intervention if it is delivered by nurses or if the intervention could be delivered by nurses as per their field
 198 of practice. We will also consider interventions if they are delivered by parents themselves. For example, a
 199 study evaluating a massage intervention (sensory stimulation) delivered by nurses would be eligible for
 200 inclusion in this review. On the other hand, a study evaluating the effects of specific macro or micronutrients
 201 (feeding) would be excluded because it would be qualified as a medical intervention.

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203 **Table 1. DC categories according to different conceptual models, practice guidelines, core**
 204 **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 Centered 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 environment [30]; – Noise reduction; – Exposure to parental voice; – Quiet hour; – Etc.. Supportive sensory environment [33]. – Vocal, visual, olfactory and tactile parent-infant interactions; – Skin-to-skin;		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.

			<ul style="list-style-type: none"> - Environmental noise reduction and light adjustment; - Minimization of painful, stressful stimuli; - Well-being and self-regulation; - Multisensory input during breastfeeding initiation; - Intimacy, quietness, and speech privacy; - Etc. 		
Partnering with families	Family centered care	Family <ul style="list-style-type: none"> - Satisfaction; - Involvement - Knowledge; - Autonomy. 	Case management and transition to home [25]; <ul style="list-style-type: none"> - Parental involvement in planning and discharge; - Infant feeding, care, health management and development; - Etc. Family access [28]; <ul style="list-style-type: none"> - 24-hour access for parents or family designated substitutes. Family support services [29]; <ul style="list-style-type: none"> - Socio-economic support; - Psychological support; - Pastoral/spiritual support; - Postpartum care; 	Skin-to-skin contact with intimate family members <ul style="list-style-type: none"> - 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 centered care Nursing interventions involving parents and families in their preterm infant's care plan and delivery.

			<ul style="list-style-type: none"> - Family daily activities; - Psycho-social support; - Parent associations' support; - Etc. <p>Parental involvement [31];</p> <ul style="list-style-type: none"> - Parents as primary caregivers; - Parents' participation in medical rounds, decision-making processes; - Etc. <p>Support for parental-infant bonding [32];</p> <ul style="list-style-type: none"> - Early parent-infant contact, closeness, and intimacy; - Psychological support to promote bonding; - Etc. <p>Very early and continuous skin-to-skin contact [34].</p> <ul style="list-style-type: none"> - Early and continuous skin-to-skin; - Early suckling and breastfeeding; - Etc. 		
Positioning and handling	Developmentally supportive activities of daily living <ul style="list-style-type: none"> - Positioning; - Feeding; - Maintaining skin integrity. 	Positioning		Positioning and touch for the newborn <ul style="list-style-type: none"> - Support of musculoskeletal, physiological, and behavioral stability; - Support of optimal cranial shaping, 	Positioning and Handling Nursing interventions that aim to: (1) position the preterm infant appropriately in the NICU

				<p>prevention of torticollis and skull deformity; Touch by family and caregivers; Etc.</p>	<p>incubator or crib, during skin-to-skin or care delivery; (2) handle the preterm infant appropriately.</p>
Safeguarding sleep	<p>Protected sleep</p> <ul style="list-style-type: none"> - Sleep/wake-based care - Care that supports sleeping (swaddling, skin-to-skin); - Sleep safety. 	<p>Comfort</p> <ul style="list-style-type: none"> - Pain assessment and management; - Skin-to-skin; - Massage; - Sleep regulation. 		<p>Sleep and arousal interventions for the newborn</p> <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. 	<p>Sleep protection Considering infant's sleep-wake cycle when providing care and promoting continuous and undisturbed sleep.</p>
Minimizing stress and pain	<p>Assessment and management of stress and pain</p>			<p>Reducing and managing pain and stress in newborns and families</p> <ul style="list-style-type: none"> - Increase parental/caregiver well-being and decrease emotional distress; - Minimization of the impact of stressful and painful stimuli; - Etc. 	<p>Reduction and management of pain Nursing interventions reducing, eliminating and/or managing procedural or prolonged pain.</p>
Protecting skin		<p>Skin care</p>			<p>Skin and routine care Nursing interventions targeting care of the</p>

					preterm infant's skin and hygiene care.
Optimizing nutrition		Feeding <ul style="list-style-type: none"> - Early feeds (trophic, donor milk); - Cue-based feeding; - Nonnutritive sucking. 		Management of feeding, eating and nutrition delivery <ul style="list-style-type: none"> - Behavior-based and baby- led feeding; - Breastfeeding promotion and support; - Optimization of nutrition; - Etc. 	Feeding Nursing interventions optimizing directly or indirectly (i.e. interventions preventing oral aversion) oral human milk feeding of the preterm infant.
--	--	Others <ul style="list-style-type: none"> - 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 families [26]; <ul style="list-style-type: none"> - Psycho-social and pastoral support; - Family support strategies; - Etc. Education and training for infant- and family-centered developmental care [27]; <ul style="list-style-type: none"> - Formal education and recurrent training; - Regularly updated guidelines; - Etc. 	Systems thinking in complex adaptive systems <ul style="list-style-type: none"> - Leadership and governance infrastructure; - Interprofessional collaboration; - Evidence-based practice; - Continuous monitoring of practice; - Transparency; - Etc. 	--

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

209 Context

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

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8 214 Types of sources

9 215 In this scoping review we will consider quantitative, qualitative and mixed methods study designs for
10 216 inclusion. In addition, literature reviews, text and opinion papers, practice guidelines and theoretical papers
11 217 will be considered. Articles published in French or English will be included. Articles published from CINAHL,
12 218 MEDLINE, Embase, PubMed, Web of Science, Scopus, ProQuest and PsychInfo databases from 2009 to
13 219 the present will be included as modern DC interventions have mostly evolved in the past ten years.
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18 220 Search strategy

19 221 The search strategy will aim to locate both published and unpublished primary studies, reviews and opinion
20 222 papers pertaining to DC nursing interventions in the NICU. An initial search strategy was developed and
21 223 piloted with a librarian, based on MESH databases. A full search strategy for CINAHL, MEDLINE, Embase,
22 224 PubMed, Web of Science, Scopus, ProQuest and PsychInfo (see Table S1 - Supplemental file 2) was then
23 225 proposed. Key concepts include neonatology, DC and nursing. The search strategy will be restricted to the
24 226 last 10 years (2009-2019) due to the rise in publication in DC in the recent years. The search strategy,
25 227 including all identified keywords and index terms will be adapted for each included information source.
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31 228 Information sources

32 229 In addition to the proposed databases (CINAHL, MEDLINE, Embase, PubMed, Web of Science, Scopus,
33 230 ProQuest and PsychInfo), several gray literature sources will be hand-searched, including Google Scholar,
34 231 the Grey Guide and clinical trial registries (clinicaltrial.gov, clinicaltrialregister.eu, isrctn.com, anzctr.org.au).
35 232 References lists will also be analysed when appropriate to identify additional papers. Finally, a monthly
36 233 bibliographic watch on DC prepared by our center's librarian
37 234 (<https://soinsdudeveloppement.wordpress.com/>) will be reviewed and analysed for potential papers.
38 235 Furthermore, authors with incomplete records will be contacted as needed to obtain supplemental
39 236 information.
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47 237 Study selection

48 238 Following the search, all identified records will be collated and uploaded into Covidence systematic review
49 239 software v1528 (Veritas Health Innovation, Melbourne, Australia; www.covidence.org) and duplicates
50 240 removed. Seven review authors (MH, MA, AL, GDF, GL, AB, NF), in teams of two, will then screen titles
51 241 and abstracts against the inclusion criteria as a means to pilot the specificity of inclusion criteria. Each
52 242 reviewer will screen 250 articles to assess the criteria's performance and the team will further refine them
53 243 accordingly. Criteria will be piloted again until performance is deemed adequate by all reviewers. Initial
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244 screening will be completed by one independent reviewer. Potentially relevant papers will be retrieved in
245 full and their citation details imported into Covidence. The full text of selected citations will be assessed in
246 detail against the inclusion criteria by the same seven review authors, in teams of two independently. Similar
247 to the initial screening, inclusion criteria will be piloted and further refined before completing the full-text
248 selection process. Reasons for exclusion of full text papers that do not meet the inclusion criteria will be
249 recorded and reported in the scoping review. Any disagreements that arise between the reviewers at each
250 stage of the selection process will be resolved with a third review author. The results of the search will be
251 reported in full in the final scoping review and presented in a Preferred Reporting Items for Systematic
252 Reviews and Meta-analyses flow diagram [52].

253 **Data extraction**

254 Data will be extracted from papers included in the scoping review by two independent reviewers using a
255 data extraction tool developed by the review authors. Any disagreements that arise between the reviewers
256 will be resolved through discussion, or with a third reviewer. The draft data extraction tool will be modified
257 and revised as necessary during the pilot phase of extracting data from the first 20 included paper. Authors
258 of papers will be contacted to request missing or additional data, where required. Modifications, if needed,
259 will be detailed in the full scoping review.

260 **Data items**

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

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

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

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

275 **Critical appraisal and secondary data synthesis**

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

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

286 **Data presentation**

287 Our primary and first secondary objective are to describe the extent, range and nature of the literature
288 related to DC interventions as well as the specific nursing interventions that relate to DC. The extracted
289 data will be presented in tabular form. A narrative summary will accompany the tabulated results and will
290 describe how the results relate to the reviews objectives and questions. As per our other secondary
291 objective to highlight nursing-sensitive outcome indicators related to DC interventions, data will be
292 presented narratively.

293 **Patient and public involvement**

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

295 **ETHICS AND DISSEMINATION**

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

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302

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306 review process.

307 COMPETING INTERESTS

308 The authors declare no conflict of interest.

309 DATA AVAILABILITY STATEMENT

310 No data are available as this is a systematic scoping review protocol.

311 PATIENT AND PUBLIC INVOLVEMENT

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

313 AUTHOR CONTRIBUTIONS

314 MH (PI) drafted the first version of the review protocol revised by MA and NF (Co-Is) to obtain funding from
315 RRISIQ. AL wrote the first version of this manuscript with the contribution of MH, MA, GL, GD, and NF. All
316 authors read and approved the final version. MH, GL and AB drafted the initial search strategy.

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Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
TITLE			
Title	1	Identify the report as a scoping review.	
ABSTRACT			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	
METHODS			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	



SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
RESULTS			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	
DISCUSSION			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	
Limitations	20	Discuss the limitations of the scoping review process.	
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	
FUNDING			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	

JBI = Joanna Briggs Institute; PRISMA-ScR = Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.

* Where *sources of evidence* (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and Web sites.

† A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with *information sources* (see first footnote).

‡ The frameworks by Arksey and O'Malley (6) and Levac and colleagues (7) and the JBI guidance (4, 5) refer to the process of data extraction in a scoping review as data charting.

§ The process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 and 19 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document).

From: Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Ann Intern Med.* 2018;169:467–473. doi: [10.7326/M18-0850](https://doi.org/10.7326/M18-0850).



SUPPLEMENTAL FILE 2: EXAMPLE OF OUR SEARCH STRATEGY

Table S1. Search strategy in CINAHL

Search	CINAHL (octobre, 2019)	Records retrieved
#1 Subject heading search	(MH "Evaluation and Quality Improvement Program") OR (MH "Magnet Hospital Accreditation") OR (MH "Joint Commission") OR (MH "Quality Patient Care Scale") OR (MH "Nursing Practice, Evidence-Based+") OR (MH "Nursing Assessment") OR (MH "Health Care Delivery") OR (MH "Health Care Delivery, Integrated") OR (MH "Health Resource Allocation") OR (MH "Health Resource Utilization") OR (MH "Accountable Care Organizations") OR (MH "Health Care Reform") OR (MH "Health Services Accessibility") OR (MH "Program Evaluation") OR (MH "Quality of Care Research") OR (MH "Performance Measurement Systems") OR (MH "Health Status Indicators") OR (MH "Clinical Assessment Tools") OR (MH "Quality of Health Care+")	958,800
#2 Subject heading search	(MH "Intensive Care Units, Neonatal") OR (MH "Neonatal Assessment+") OR (MH "Neonatal Intensive Care Nursing") OR (MH "Intensive Care, Neonatal") OR (MH "Neonatal Nurse Practitioners") OR (MH "Neonatal Nursing") OR (MH "Infant, Low Birth Weight+") OR (MH "Infant, Premature") OR (MH "Infant, Hospitalized") OR (MH "Infant, High Risk") OR (MH "Infant, Drug-Exposed")	47,945
#3 Subject heading search	Nurs*	173,295
#4 keyword search	TI(Indicator* OR quality OR performance OR outcome* OR metrics OR standard* OR (evidence* N2 practice) OR benchmarking OR "report card*" OR "EBP" OR (Evidence* N2 nursing) OR "EBN" OR "practice guidelines" OR (program* N3 evaluati*) OR AB (Indicator* OR quality OR performance OR outcome* OR metrics OR standard* OR (evidence* N2 practice) OR benchmarking OR "report card*" OR "EBP" OR (Evidence* N2 nursing) OR "EBN" OR "practice guidelines" OR (program* N3 evaluati*) OR MW (Indicator* OR quality OR performance OR outcome* OR metrics OR standard* OR (evidence* N2 practice) OR benchmarking OR "report card*" OR "EBP" OR (Evidence* N2 nursing) OR "EBN" OR "practice guidelines" OR (program* N3 evaluati*))	1,665,707
#5 keyword search	TI (((preterm OR "pre-term" OR premature OR (low* N2 Weight) OR small*) AND (newborn* OR infant* OR bab* OR child*)) OR Neonat*) OR AB (((preterm OR "pre-term" OR premature OR (low* N2 Weight) OR small*) AND (newborn* OR infant* OR bab* OR child*)) OR Neonat*) OR MW (((preterm OR "pre-term" OR premature OR (low* N2 Weight) OR small*) AND (newborn* OR infant* OR bab* OR child*)) OR Neonat*)	114,605

#6 keyword search	TX nurs*	1,678,740
#4	(#1 AND #2 AND #3) OR (#4 AND #5 AND #6)	7991
Limited to 2009-current, french and english (DT 2009-current AND LA(english OR french))		

For peer review only