Developmental Care to Mitigate Stress In NICU Infants: State of the Science

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Background

- Nearly one-half million NICU admissions/year in the US.
- The neonatal period is a critical period of neuro-development; the developing brain is particularly sensitive to stress.
- Toxic stress is severe, repeated or prolonged activation of the stress response system during critical periods of development, in the absence of buffering relationships.
- NICU infants experience severe and repeated stressors, including separation from parents, that contribute to adverse outcomes observed in this population.
- Developmental Care (DC) integrates neuroprotective practices with NICU care: central goal is mitigating NICU infant stress.
- Growing body of evidence supports DC to improve NICU infant outcomes, but DC is not consistently implemented.
- Positive outcomes associated with DC may be related to the ability of DC programs or practices to mitigate toxic stress in NICU infants.

Purpose

- The purpose of this project was to synthesize the state of the science regarding the impact of DC on toxic stress in NICU infants.

Method

- A systematic review (SR) published in 2018 using DC and stress as key-words identified 22 papers. Many DC practices not included.
- A targeted, systematic literature search was conducted for 11 well-known DC programs & DC practices using PubMed, CINAHL, Ovid Medline, PsychInfo & Embase.

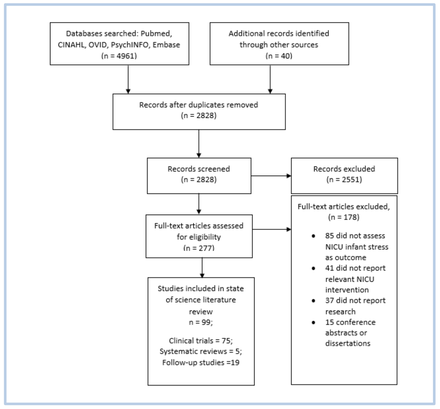
  ✓ ***Newborn Individualized Developmental Care & Assessment Program (NIDCAP)***
  ✓ ***Creating opportunities for parent empowerment (COPE)***
  ✓ ***Auditory, tactile, visual, vestibular (ATVV)***
  ✓ ***Family integrated care (FIC)***
  ✓ ***Family nurture intervention (FNI)***
  ✓ ***Supporting & enhancing NICU sensory experience (SENSE)***
  ✓ ***Kangaroo care (KC)***
  ✓ ***Clustered care***
  ✓ ***Nesting & swaddling***
  ✓ ***Four-handed care***
  ✓ ***Environmental modifications (cycled lighting, single room)***

- As reducing stress is central goal of DC, stress was not targeted in electronic search, but was considered outcome of interest in screening studies for inclusion.

Results

- Included: Behavioral, physiologic or biomarkers of stress related to DC thru 44 weeks post-menstrual age (PMA)
- Excluded: published before 1990, non-English papers
- Two DC programs did not report NICU infant stress as an outcome and were excluded from review (COPE, FIC)
- If NICU follow-up was reported in multiple papers, all were included as extensions of the original studies
- Final sample included 75 clinical trials, 5 systematic reviews and 19 follow-up reports
- Dates of publication: 16% published in 1990-1999; 21% published in 2000-2009; 63% published in 2010-2021

1. Systematic Flow Diagram



2. Study Quality

- Criteria for quality review were derived from the literature. Areas assessed for quality included conceptual clarity, design, measures, analyses and interpretation of findings.
- Criteria were broad enough for all study types, including SRs.
- Studies were rated good, fair or poor in each area according to predetermined criteria, then assigned an overall rating based on pre-determined criteria.

Literature Synthesis

3. Reduced NICU Infant Stress: Associations with Developmental Care by Post-Menstrual Age

	Post Menstrual Age (in weeks)																
DSC	#Studies	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	Quality
NIDCAP	9	2	2	4	4	6	8	8	8	7	7	7	6	6	6	6	4 G - 5 F
ATVV	5						1	1	5	5	3	3	2	2	2	2	1 G - 4 F
FNI	1						1	1	1	1	1	1	1	1	1	1	1 G
SENSE	1																1 F
Kangaroo care	26*	1	3	4	6	8	11	11	10	12	9	6	5	4	4	4	2 G -24 F
Clustered care	3				1	1	1	1									3 F
Nesting/Swaddling	6					3	4	5	5	5	4	2	1	1	1	1	3 G - 3 F
Four-handed care	2				2	2	2	2	2	2	2	2	1				2 F
Environmental	2			1	1	1	1	1									2 F
Cycled lighting	7	1	1	2	4	4	4	6	6	6	6	6	6	6	6	6	1 G - 6 F
Single rooms	4	1	1	2	2	3	3	3	3	3	3	3	2	2	2	2	1 G – 3 F

- 53/66 DC clinical trials of fair to good quality reported positive associations with reduced NICU infant stress.
- Behavioral stress most often measured. In 15/17 studies using biomarkers to measure stress, Kangaroo Care was intervention.
- General DC recommendations are difficult due to different timing, dose and different types of DC reported in studies.
- Study limitations included small samples, treatment concealment issues, difficulties measuring fidelity, DC contamination.

Implications for Research & Practice

Practice: Evidence supports use of DC programs, including NIDCAP, ATVV, FNI, and practices including kangaroo care, cycled lighting and single-family rooms to mitigate stress in preterm infants.

DC research: consider use of biomarkers of stress, application of precision medicine principles, giving longitudinal studies of DC outcomes priority, and implementation of large, collaborative programs of DC research.

Conclusions

- The evolution of DSC to mitigate toxic stress experienced by NICU infants is essential for their lifelong health and development.
- A growing body of evidence supports associations between DSC programs and practices and reduced stress in NICU infants, with follow-up studies of infant cohorts emerging in the literature.
- Gaps remain in the state of the DSC science.
- Nurse scientists should consider DSC among their priority areas for future research.