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

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.

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

- 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.