Environment of Care Literature Review

Shannon Usher, MSOT, OTR/L, NTMTC

To all researchers who have spent studying the neurodevelopment of the premature infant. Your research guides our clinical practice.

Levels of Evidence

- Systematic review & meta-analysis of randomized controlled trials; clinical guidelines based on systematic reviews
- One or more randomized controlled trials
- Controlled trial (no randomization)
- Case-control or cohort study
- Systematic review of descriptive & qualitative studies
- Single descriptive or qualitative study
- Expert opinion


Nonpharmacologic Approaches to Reducing Stress

  - Double Blinded Randomized Controlled Trial
  - Subjects: Clinically Stable preterm infants within first 7 days of life
  - Test Subjects Received Sucrose, Control Subjects received water
  - Evaluated Pain using Premature Infant Pain Profile (PIPP), Heart Rate and SpO2 changes
  - Results: Post procedure PIPP score was significantly lower in test subjects compared to controls

  - Integrative literature review
  - Synergistic effect combining sucrose with non nutritive sucking

Nonpharmacologic Approaches to Reducing Stress

- Swaddled Bathing
- NICU Design
- Sound Exposure
- Skin-to-Skin
- Infant Massage
- Oral Feeding
- Neonatal Therapy
- Staff Education

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Nonpharmacologic Approaches to Reducing Stress

- Randomized controlled trial
- Subjects: 54 preterm infants between 30-37 weeks GA
- Infants were assigned to either a control group (standard care) or swaddling group
- Pain was assessed during heel stick
- Results: PIPP scores, SpO2 and HR were significantly lower in swaddling group compared to controls

Clinical Application

- Provide Sucrose and pacifier prior to all painful procedures, including routine procedures like OG tube insertions
- Make sure there are consistent and safe policies and procedures to guide proving sucrose
- Swaddle infants when able
- Facilitated tuck as an alternative to swaddling or skin to skin

NICU Design

- Prospective Longitudinal Cohort Study
- Subjects: 196 Preterm infants <30 weeks GA
- Randomly assigned to either single family room or open bay unit
- Results: Infants in private rooms had trend toward having lower electroencephalograph cerebral maturation scores at term equivalent and lower language and trend toward lower motor scores at 2 years.

Clinical Application

- Open Bay NICUs
- Ensure sensory stimulation is appropriate and not noxious
- Single Family Rooms
- Ensure infants are provided with enough interaction and sensory exposure, especially if family visitation is limited
- Play an active role on your NICU design committee

Nonpharmacologic Approaches to Reducing Stress

- Meta Analysis
- Facilitated tuck reduces pain
- May be used as early as 23 weeks

Clinical Application

- Subjects: Preterm infants weighing <1500 grams
- 151 admitted open-bay NICU
- 252 preterm infants admitted to single family rooms
- Results: Improved medical and neurobehavioral outcomes at discharge, maternal involvement and psychosocial status, family-centered care, developmental support, and nurses’ attitudes related to single family rooms
Sound Exposure

- Subjects: 36 medically stable preterm infants
- Recorded voice exposure at 32 and 36 weeks PMA
- Follow up was completed at 7 and 18 months CA
- Results: Higher word count during the NICU admission was associated with higher cumulative cognitive and language and receptive communication at 7 months CA and higher expressive communication scores at 18 months CA

Sound Exposure

- Randomized controlled trial
- Subjects: 40 preterm infants born between 25-32 weeks GA
- Randomly assigned to either control group (routine hospital sounds) or test group (audio recordings of mother’s heartbeat and voice)
- Results: At 30 days of life infants in the test group had significantly larger bilateral auditory cortex

Sound Exposure

- Subjects: 14 preterm infant born between 26-32 weeks GA
- Infants served as their own control
- Compared cardiorespiratory events when exposed to routine hospital sounds to recordings of maternal voice and heartbeat
- Results: Lower frequency of events during maternal sound stimulation compared to routine hospital sounds

Sound Exposure

- Meta analysis
- NICU Music therapy was highly beneficial
- Greatest Benefits:
  - Live Music
  - Initiated Early in the NICU stay (<1000 grams, <28 weeks GA)
- Uses: pacification, reinforcement of sucking and part of a multimodal, multilayered stimulation

Clinical Application

- Educate moms
- Talk to their baby
- Bring in books to read
- Sing
- Skin-to-skin holding
- Talk, read, sing to the babies while you care for them
- Implement a music therapy program in your NICU
- Provide CD players/radios for babies when developmentally appropriate

Skin-to-skin

- Subjects: 166 preterm infants at 32 weeks PMA
- Test subjects received skin-to-skin holding for 1 hour per day for 14 consecutive days compared to controls who received routine, incubator only care
- Follow up completed at 3, 6, 12 and 24 months, 5 years and 10 years
- Outcomes:
  - 6 months to 1 year follow up showed improved autonomic functioning, maternal attachment, reduced maternal anxiety, and enhanced child cognitive development and executive functions
  - 10 year follow up showed better neurophysiological ability, autonomic function and sleep efficiency, marginally quicker recovery from stress, milder cortisol stress activity and autonomic reactions to stress, mothers demonstrated greater responsivity during interactions

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**Skin-to-skin**


- **Benefits:**
  - Improved milk production
  - Longer duration of breastfeeding
  - Improve attachment and bonding
  - Strengthens family role in care of infant
  - Increased parent satisfaction
  - Better sleep organization
  - Longer duration of quiet sleep
  - Decreased pain perceptions.
- **Risk:** Must ensure an open airway during skin-to-skin holding

**Clinical Application**

- Skin to skin should be provided as soon as possible, as often as possible, for as long as possible!
- Creating policies and procedures for staff to follow for skin to skin
- Educational competencies to ensure staff comfort with transfers and positioning
- Creating a comfortable environment for parents so that they enjoy their time holding their infant
- Ex: Skin to skin chairs, Wraps, Mirrors, Water, DVD players

**Environmental of Care Literature Review**

**Skin-to-skin**


- Randomized Controlled Trial
- 100 preterm infants with birth weight 1500-2000 grams
- Test subjects: Transitioned to extrauterine life skin-to-skin
- Control group: Received standard hospital care and admitted to resuscitation room then to incubators
- Observed transition to extrauterine life 6 hours after birth using stability of cardio-respiratory system in preterms
- Results: Test subjects had better SCRIP scores, needed less respiratory support, IV fluids and antibiotics during remainder of hospital stay

**Infant Massage**


- Meta Analysis
- 34 studies met inclusion criteria
- Results: Massage improves daily weight gain and mental scores

**Infant Massage**


- Systematic Literature Review
- Term Infant Benefits:
  - Improved weight gain
  - Improved Growth
  - Improved Sleep
  - Decreased Hyperbilirubinemia
- Preterm Infant Benefits:
  - Improved weight gain
  - Decreased response to pain
  - Increased interactions with parents.
**Infant Massage**


- Qualitative Study
- Subjects: Infants with a diagnosis of NAS, at least 48 hours old, >32 weeks PMA, >1500 grams and alert time before feeding
- Educated mom how to complete infant massage
- Interviews completed with mom after education and 2 weeks after discharge
- Results: Empowerment, Enjoyment and Bonding and Calm and Comfort were the themes derived

**Clinical Application**

- Benefits of Massage
  - Improved Weight Gain
  - Improved Mental Scores
  - Improved Heart Rate Variability
  - Improved Neurobehavioral States
  - Decreased Pain Response
  - Improved Maternal Outcomes
  - Improved Breastfeeding
  - Improved Physiologic Parameters
  - Improved Bone Formation
  - Improved Immunologic Markers
  - Improved Brain Maturity
  - Improved Temperature
  - Improved Interactions with Parents
  - Improved Growth Velocity

**Clinical Application**

- Educate staff on the benefits and importance of neonatal massage
- Ensure policies are in place to support massage in the NICU
- Create educational handouts or references for staff and family
- Use this information for Grant writing

**Swaddled Bathing**


- Created swaddled bathing guidelines based on lack of research
- Recommendations included:
  - Swaddling
  - Water Temperature between 100-102 degrees
  - Bath limited to 8 minutes

**Clinical Application**

- Swaddled bathing should be provided for all bathing procedures, regardless of PMA
- Education needs to be completed with staff to ensure consistency of bathing procedures and families to ensure comfort prior to discharge
- Swaddled Bathing Procedures:
  - Swaddle with a blanket during submersion or bed bath
  - Water temperature between 100-102 degrees
  - Baths should be limited to 8 minutes
- Adaptations for different diagnosis may include:
  - Progressive baths for ELBW or Extremely premature infants
  - Warmer blanket heat for smaller infants
  - Therapeutic bath for those infants with Neonatal Abstinence Syndrome
Positioning and Handling

- Randomized Controlled Trial
- Subjects: 100 preterm infants born <32 weeks GA
- Compared alternative positioning (DandleRoo by DandleLion Medical) to traditional positioning (swaddling, snuggle up, bendy bumper, sleep sack and blanket rolls)
- Results: At term equivalent infants in the alternative positioning group had less asymmetry of reflexes and motor responses

Positioning and Handling

- Subjects: 22 preterm infants born < 30 weeks GA
- Cerebral oxygen saturation was monitored with head in midline, head turned 45-60 degrees toward the left and head turned 45-60 degrees to the right for 30 minutes periods
- Results: In relatively stable preterm SpO2 remained within normal limits when head was turned from midline to either side.

Positioning and Handling

- Subjects: 120 preterm infants <30 weeks GA or Birthweight < 1000 grams
- Examined positional preferences and deformational plagiocephaly at term equivalent, 3 months and 6 months CA
- Results:
  - Positional preferences was 65.8% at term equivalent, 36.7% at 3 months CA and 15.3% at 6 months CA
  - Deformational plagiocephaly was 50.5% at term equivalent, 50% at 3 months CA and 23.3% at 6 months CA

Positioning and Handling

- Subjects: 20 children with deformational plagiocephaly (DP) and 21 children without deformational plagiocephaly with the mean age of 7.9 months
- MRI imagining and neurodevelopmental assessment using Bayley Scales of Infant and Toddler Development
- Results: Children with DP had greater asymmetry and flattening of posterior brain and cerebellar vermis, shortening and differing orientation of the corpus callosum. As well as lower scores on the BSID-III

Clinical Application

- Maximize motor development with use of developmental equipment
- Use this research to apply for a grant to access funding for your NICU
- Deformational Plagiocephaly
- Education to families during the NICU admission and also how to avoid upon discharge

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Oral Feeding


- Quality improvement project evaluating time to full feedings and discharge following Infant Driven Feeding Approach (IDF) or Practitioner Drive Feeding (PDF)
- Subjects: Categorized as <28 weeks GA, 28-31 weeks GA and 32-34 weeks GA
- Results:
  - PMA at full nipple feedings and at discharge was significantly lower in the IDF group
  - <28 weeks: Full oral feedings 7 days sooner and discharged 9 days sooner
  - 28-31 weeks: Full oral feedings 11 days sooner and discharged 9 days sooner
  - 32-34 weeks: Full oral feedings 3 days sooner and discharged 3 days sooner

Oral Feeding


- Randomized Controlled Trial
- Subjects: 32 preterm infants 26-32 weeks PMA
- Groups: NNS, pre-feeding oral stimulation and control
- Results:
  - NNS reached full oral feedings 7.55 days sooner than controls
  - Oral stimulation reached full oral feedings 6.07 days sooner

Oral Feeding


- Subjects: 22 mothers who had given birth to premature infant <35 weeks PMA
- Analyzed themes posted on social medial site
- Results: Main themes included; the breastfeeding paradox in hospital, the ‘reality check’ of breastfeeding at home and the breastfeeding experience as part of being a mother.

Clinical Application

- Ensure your hospital has an infant driven/cue based feeding policy in place that is consistently followed
- Hold infants during their NG/OG feedings and offering a pacifier to provide NNS in preparation of oral feeding
- Treatment recommendation for therapists could include oral stimulation
- Stay present in the room with mom during breastfeeding attempts to ensure mom’s comfort and infant’s true success with breastfeeding prior to discharge

Neonatal Therapy


- Systematic Literature Review
- Results: Education by OTs to parents with preterm infants helped the parents to be more sensitive to their child’s needs and more responsive in their interactions

Neonatal Therapy


- Meta analysis
- Reviewed the effectiveness of early intervention when initiated in the first 12 months for those infants born < 37 weeks gestation
- Results: Therapeutic intervention improved cognitive outcomes at infant age (0-2 years) and preschool age (3-<5 years) but did not find that this effect was sustained through school age (5-17 years)
**Neonatal Therapy**


- Analysis of the predictive validity of the Alberta Infant Motor Scale (AIMS) and the Neuro-Sensory Motor Developmental Assessment (NSMDA)
- Subjects: 99 infants born < 30 weeks gestation
- Follow up assessments completed at 4, 8, and 12 months CA
- Results:
  - Motor impairment on the MABC-2 was most accurately predicted by the AIMS at 4 months
  - CP was most accurately predicted by the NSMDA at 12 months
  - The likelihood ratio for motor impairment increased with the number of delayed assessments.
  - When combining both the NSMDA and AIMS the best accuracy was achieved at 4 months.

**Clinical Application**

- Parent education is a huge opportunity for neonatal therapists!
- Alberta Infant Motor Scale and Neuro-Sensory Motor Development Assessment may be useful tools in assessing and predicting later neuromotor outcomes
- We need more research in regards to neonatal therapists effectiveness

**Staff Education**


- Nurse to nurse education is the best way to get staff ‘buy in’
- Having a team that randomly assess performance improved positioning.
- Immediate feeding with hands on correction of positioning allowed nurses to see first hand what a difference proper positioning can create.

**Staff Education**


- Provided 7.5 hours of education to staff on skin-to-skin, both lecture and hands-on training
- Results: After the education and simulation:
  - Staff competency increased from 30%-45% when KMC was practiced with intubation and ventilation
  - Discomfort with providing KCM dropped to 0%
  - Actual practice of skin-to-skin with eligible babies increased from 26.5% to 85.9%

**Clinical Application**

- Education Should Include the Following
  - Clear policies or guidelines to guide practices
  - Peer to peer education
  - Interactive training opportunities in a controlled environment
  - At the bedside as much as possible to minimize other daily caregiving interruptions
  - Instant feedback changes so learner is able to visualize how a change positively affects the outcome

**Where to go from here?**