Kangaroo Care:
Science underlying practice and issues of implementation

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Thank you for

- Special contributions by

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  Both with

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  Raleigh, NC

Kangaroo Care

Objectives: To describe

- literature that establishes importance of experience on the fetal brain
- benefits of kangaroo care for both infants and mothers
- issues associated with early and often kangaroo care in high-tech nurseries

Kangaroo Care or Skin-To-Skin Care

Holding baby, wearing only a diaper, against mother's or father's chest under their clothing

History

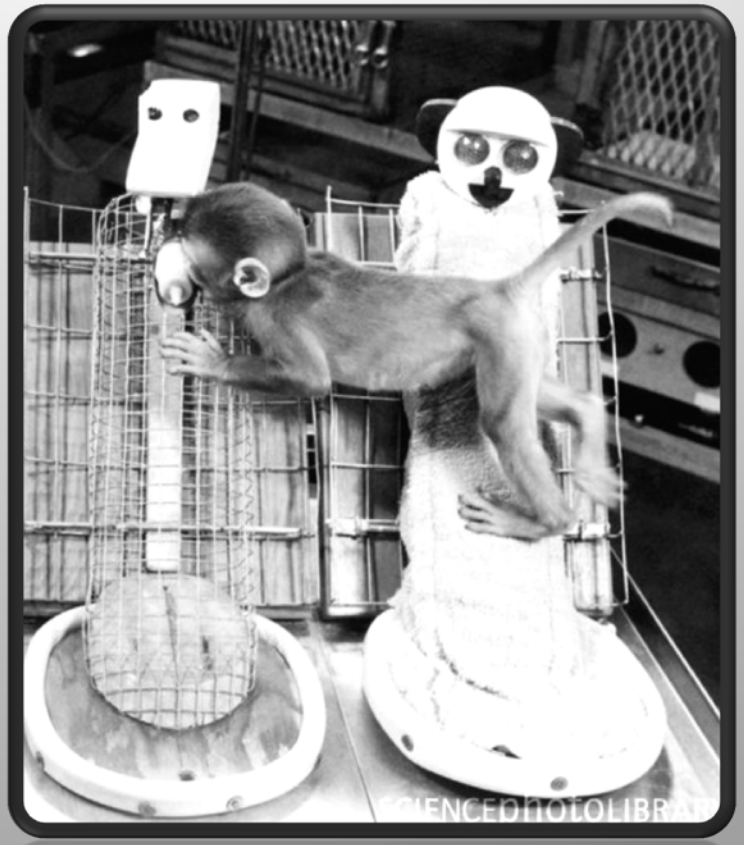
- 1978 Bogota Columbia, Rey & Martinez (1985)
  - Originally developed as “incubator substitute”
  - Reduced infant mortality and morbidity

- Widely used and researched
  - Continuous – low income, 3rd world settings
  - Intermittent - affluent, high-tech settings

Importance of touch

- Touch critical in mother-child attachment
  - H. Harlow

    1958-1963



Importance of touch

- Importance of touch, breast feeding
  - A. Montagu: Touching: The human significance of skin. Columbia Un Press, (1971)
    - Sense of touch the mother of all other senses
    - Most basic sensory system, activated first, the only one we can't live without

Importance of touch

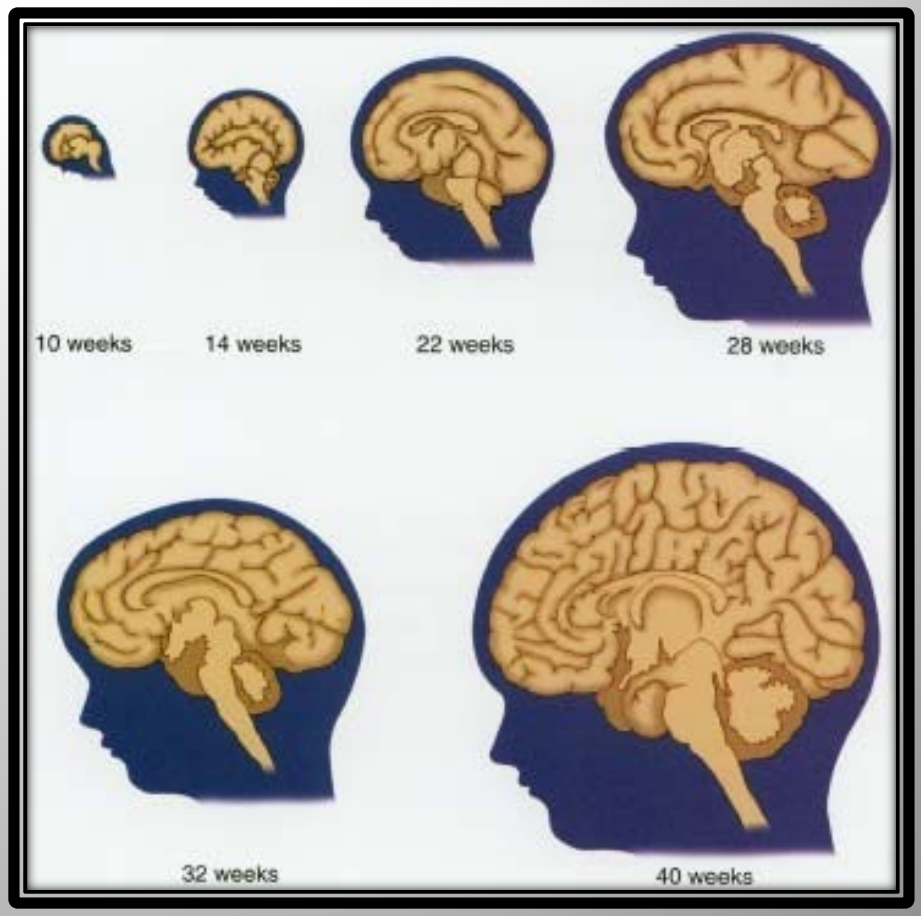
- Massage, gentle touch important for preemies
  - T. Fields (research from 1986…)
  - (http://www6.miami.edu/touch-research/InfantMassage)
  - Better weight gain
  - Better scores on Brazelton exams
    - More alert time, more active behavior
  - Less stress behaviors
  - Decrease length of stay in hospital

Importance of touch

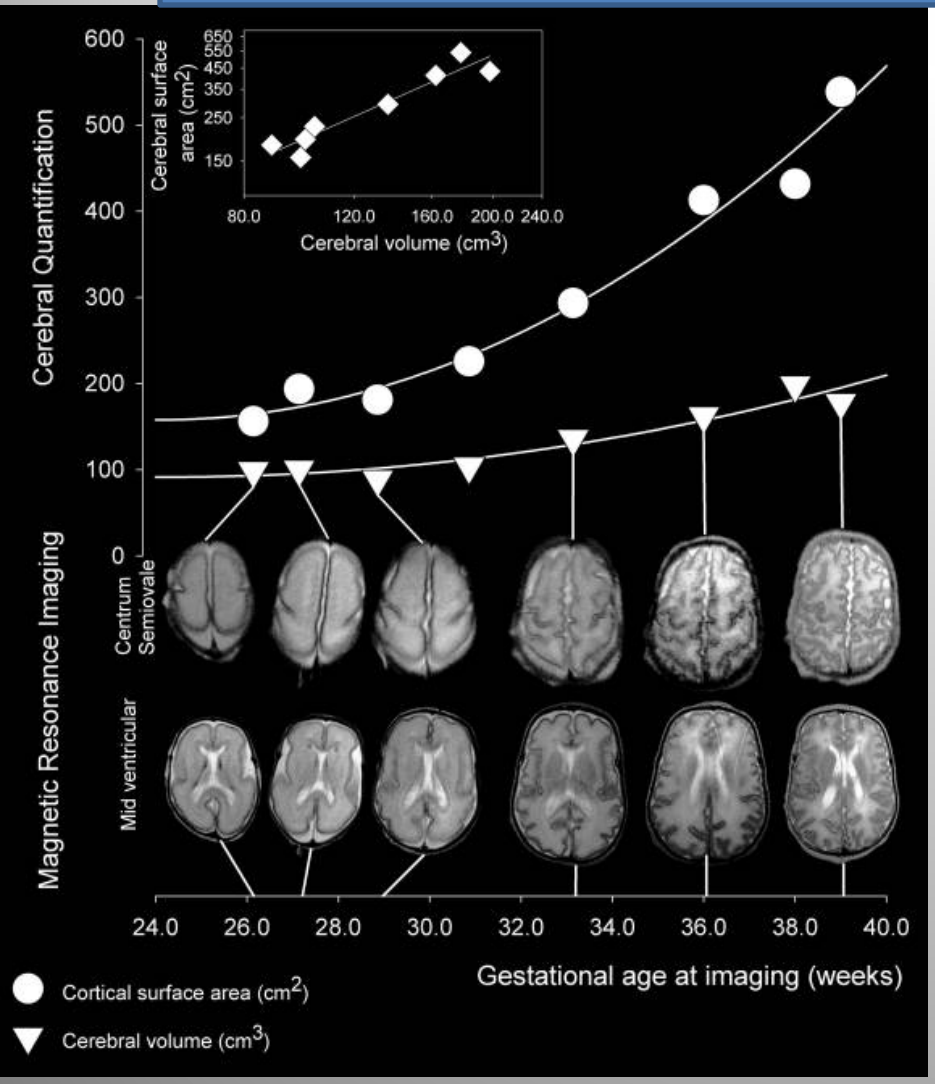
- Kangaroo Care / Skin-to-skin
  - For mothers
  - For babies

Developing Brain

- Brain weight increases 400% from 26 weeks to term (in 3 months!)
- Brain weight increases 400% from term to adulthood (in 18 years)



Why does it matter?
Brain Development !



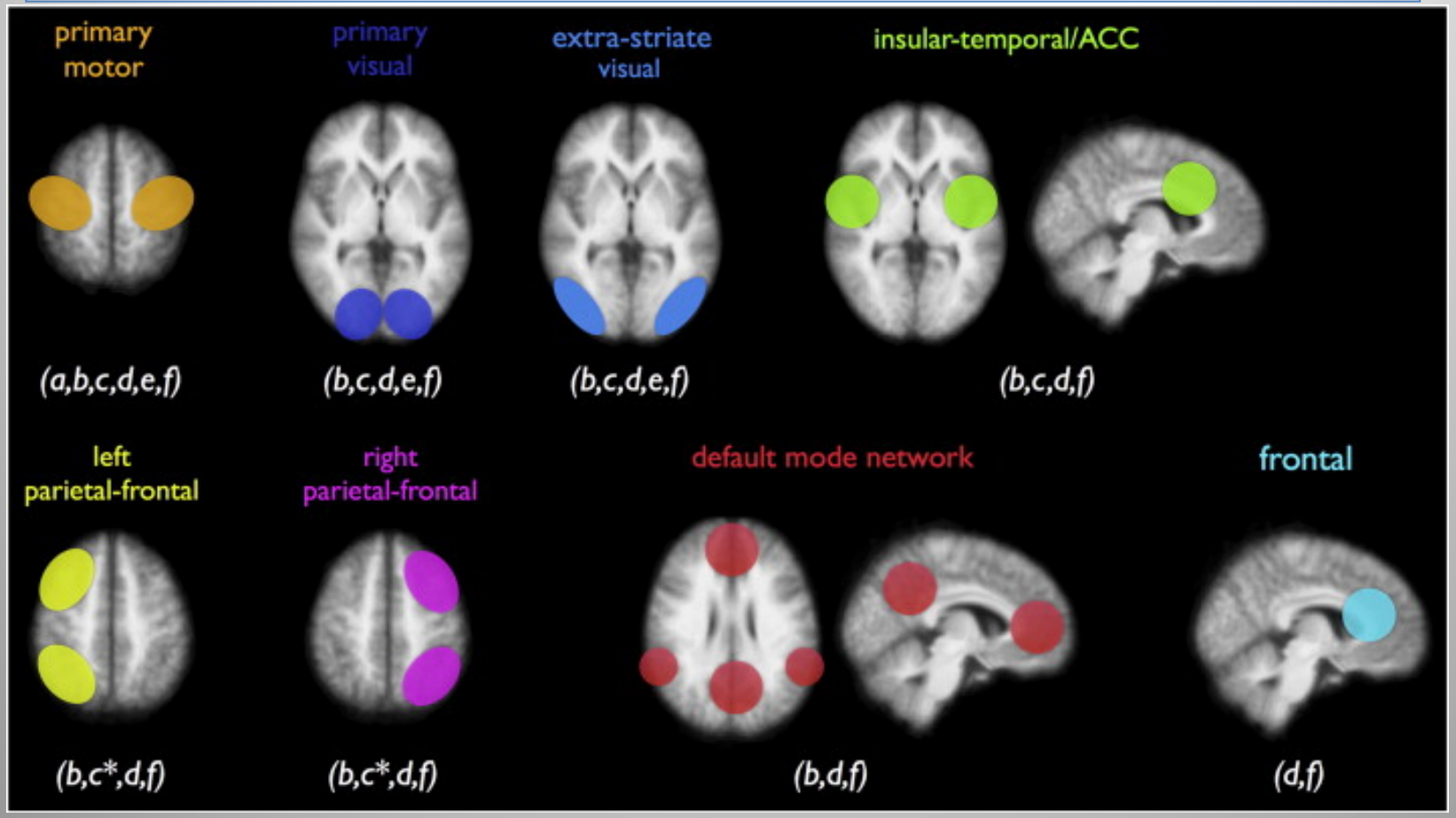
Cortical Surface Area

Cerebral Volume

Gyral Formation
Myelination

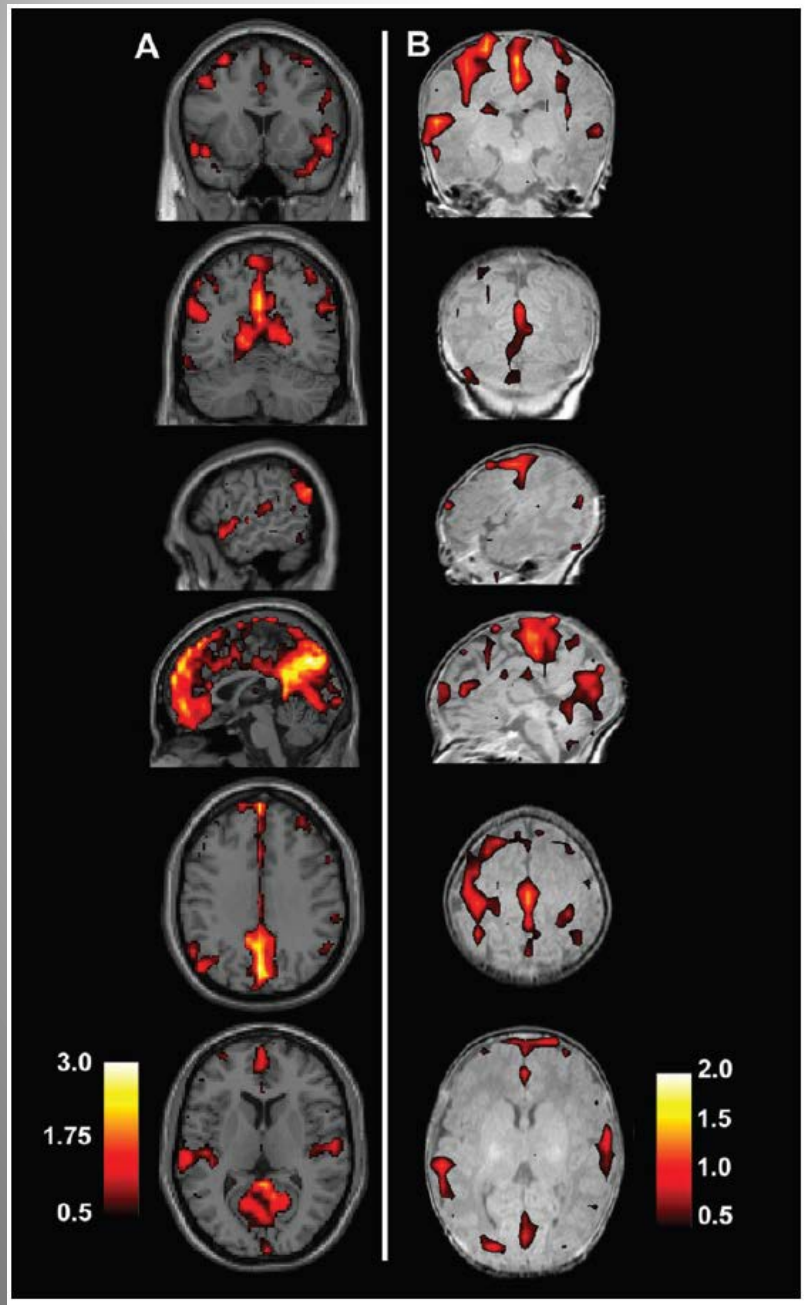
Kapellou, 2006

Functional MRI demonstrates that our brain is a complex network of interconnected regions



Communication and integration of information between brain regions is likely a key factor in complex cognitive processes

Adult Newborn



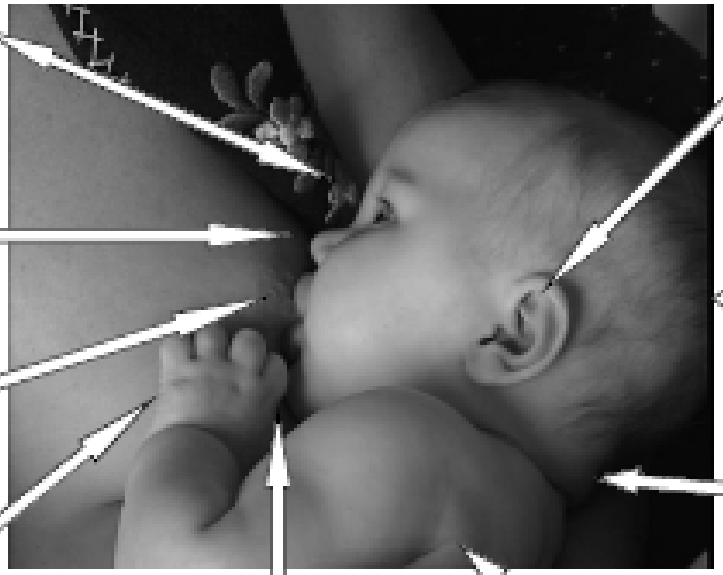
Functional Cortical Hubs "Connectomes"

Adults: Primarily areas associated with Higher cognitive functions

Newborns: Primarily areas associated with **Sensation, Auditory, Visual, and Motor**

Frannson, et al. *Cerebral Cortex* 2011

SENSATIONS THAT WIRE BRAIN



SEES
Mum's eyes

Ear HEARS
Mum's voice

SMELLS
Mum's milk

MOVES
with Mum's

TASTES
Mum's milk

Back FEELS
Mum's arm
holding

Hand TOUCH
Mum's skin

Skin-to-skin
CONTACT

WARMED on
Mum's front

Bergman, N

"That kangaroo care idea is nice for moms, but does it really matter to the baby?"

Environment of care	**Mother's Arms**	**Incubator/ Warmer**
Appropriate sound	**X**	
Familiar odors	**X**	
Circadian stimuli	**X**	
Kinesthetic	**X**	
Caress/massage	**X**	
Hormonal/immunologic/neural communication	**X**	
Protection	**X**	

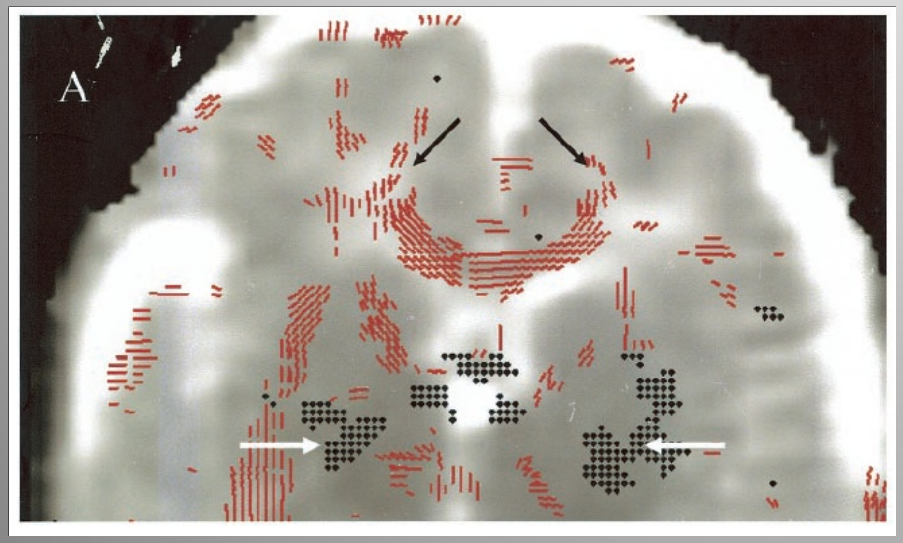
Infant Brains Influenced by Experience

- NIDCAP research
  - Newborn Individualized Developmental Care and Assessment Program
    - Care provided in a way to optimize organized behavior, to minimize stress and disorganized behavior and to support efforts of the baby to self regulate
    - www.nidcap.org

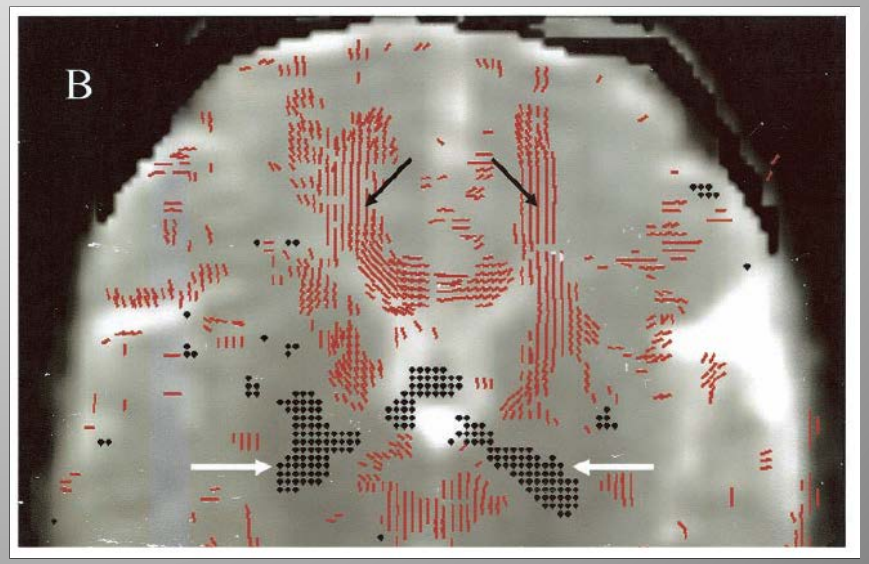
Als H, et al. Pediatrics 2004:113:846-857
Early experience alters brain function and structure

Low risk preemies (28-33 wk GA), daily support to staff on developmentally supportive care, weekly formal evaluations; N=15 randomly assigned to each group

Control



NIDCAP: adv white matter dev

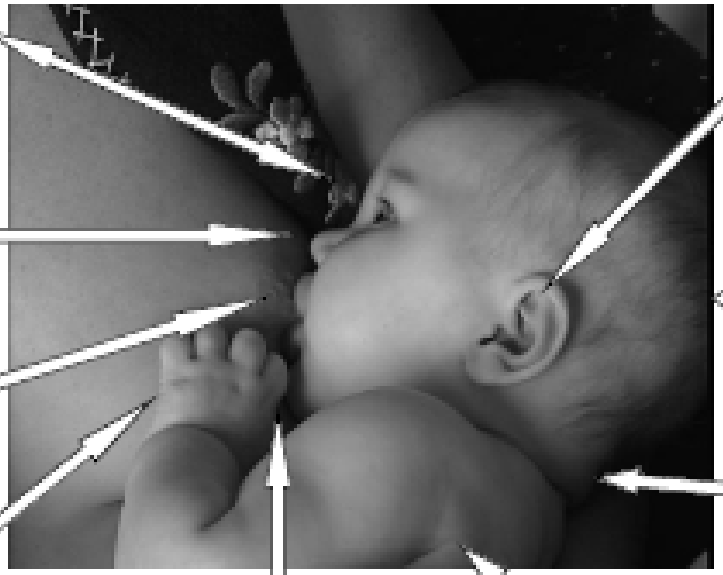


Skin-to-skin (kangaroo) care: Background

As altricial mammals (newborns are unable to care for themselves for an extended period), the brain of newborn infants is exquisitely sensitive to multisensory input, especially from its mother. The baby begins to learn its mother's taste, smell, voice, and biorhythms before birth, although with preterm birth much of this vital time is spent outside the womb.

Robert D. White, MD

SENSATIONS THAT WIRE BRAIN



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Skin-to-skin (kangaroo) care: Background

After birth, a rich array of nonverbal biological communication is meant to occur between mother and infant, mutually influencing each other's neuronal, hormonal, immunologic, and emotional makeup. From a rapidly growing literature, we have learned how important the presence of the mother or a surrogate is to the normal development of the newborn, and via epigenetic influences, even to that infant's offspring.

Robert D. White, MD

Current US Use

Current US Use

- STS widely recommended
- Widespread use in NICUs
  - 2002 survey, of 215 units surveyed, 73% offer STS contact to extubated babies, and 45% offer to intubated babies (Franck, *Neonatal Netw*)
- Critical component of the WHO 10 Steps of Successful Breastfeeding for term babies

General STS Benefits

- Decreases impact of separation/protest-despair response (few human studies, multiple animal studies)
- Promotes oxytocin release for mother and baby
- Promotes physiologic stability
  - CR stability, protection of thermoregulation, improved sleep patterns, organized activity levels

General STS Benefits, cont'd

- More quiet alert state and less crying
- Promotes deep sleep
- Facilitates bonding and contributes to the humanization of neonatal care
- Mothers feel more competent, more confident and more satisfied by the hospital experience

Adapted from 2 NeoReview articles, Martinez 2007 and Philip 2004, and WHO Document on KMC

General STS Benefits, cont'd

- May trigger production of maternal antibodies to specific pathogens in environment via the enteromammary pathway
- Improved weight gain and earlier discharge
  - note, Rojas 2003 (in *J Dev Ped*) showed improved head circumference in STS vs traditional holding (both held for similar times, ~ 4 times a week ~ 80 minutes each time)
- Significant cost savings reported

Skin-to Skin Contact

- In sum
  - effective for thermal control
  - Breastfeeding
  - Bonding

In all newborn infants, regardless of weight, gestational age, clinical conditions, and setting

If infant left STS with mother after delivery….

- Predictable pattern of prefeeding and suckling behaviors, but timing varies widely
- STS elicits oxytocin release – relaxation (decreased cortisol levels), increased dilation of maternal cutaneous blood vessels helping infant to stay warm; it will also increase uterine contractions (may help to decrease uterine bleeding)
- Oxytocin further elicited as infants begin massage breasts with hands, and as mothers stroke their infants; also released by certain sounds, odors, sight

Impact of STS on Establishment of Breastfeeding

- Righard and Alade (1990) compared
  - contact group (min 1 hour of STS after birth)
  - separation group (20 min STS, then separation for 20 min, then return)
  - 24/38 contact infants suckling in mean 49 min
  - 7/34 separation babies suckled in first two hrs ($p<0.001$)

Impact of STS on Duration of Breastfeeding

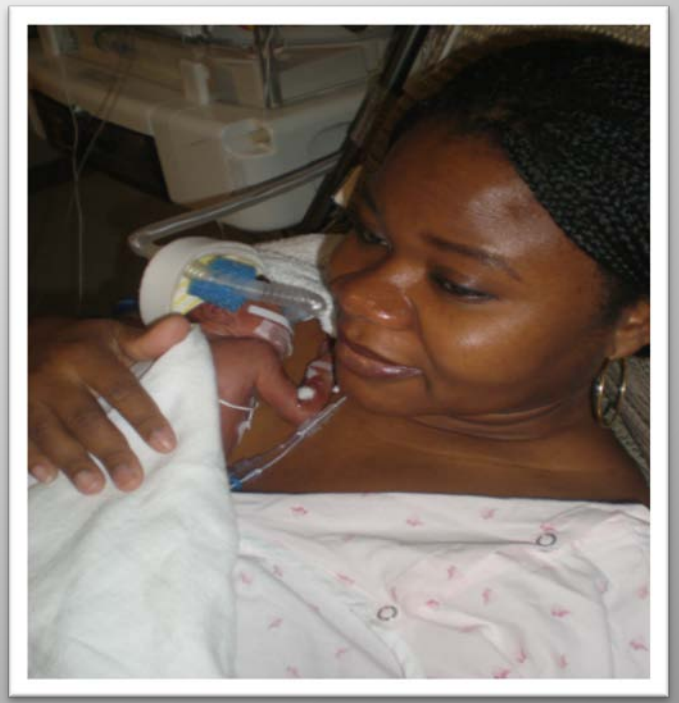
- Perez-Escamilla, 1994 Cochrane review,
  - early STS has positive influence on breastfeeding out to 2-3 months
- Guatemalan study - improvement in BF duration from 109 days to 196 days
- Swedish study - 58% still BF at 3 mos, vs. 26%

STS Impact on Subsequent BF Success

- Many studies in 1980's and 1990's showed increased number of feeds a day, increased breastfeeding competence, and longer duration of breastfeeding for STS infants than for incubator controls (WHO document on KMC, and Kristen, 2001 *Ped Clin NA*)
- 2008 *Neonatal Netw* study by Hake-Brooks used longer periods of STS (nearly 5 hours a day, "unlimited STS"): those dyads breastfed much longer (5 months vs 2 months), and more were feeding exclusively BM at discharge and at 1.5, 3 and 6 months

Incubator or Skin-to-skin Stablization?

- Bergman N, et al. *Acta Paediatr* 2004; 93:779-784



Skin-to-Skin Contact / Stabilization beginning at delivery

- Cape Town, South Africa
- Randomized trial, vaginal deliveries
- BW 1200-2199 grams, Apgar(5) ≥ 6
- All infants stabilized on mother, weighed, given Vit.K and eye prophylaxis
- SSC group placed naked on mother's chest, OB care completed, then after 60 minutes of observation was transferred to NICU in SSC with mother
- Conv. Care group placed in incubator
- Intervention period was the first 6 hours

Skin-to-Skin Contact / Stabilization beginning at delivery

- After transfer to NICU, both groups had OG tubes placed and IV fluids started.
- Respiratory support was either nasal cannula oyxgen or nasal CPAP
- If doing well, both groups were breastfed at 50 min, 3 hrs, 5 hrs.

Bergman N, et al. *Acta Paediatr* 2004;93:779-784

Skin-to-Skin Contact / Stabilization beginning at delivery

- "Bail out" if instability
  - 17/20 STS stable, 1/13 Control stable, $p<.05$
- SCRIPT Score (Stability of cardio-respiratory system in preterm infants)
  - $p<.05$ favoring STS

Prematurity, Sleep, and State Organization

- Preterm infants compared to term infants
  - Spend shorter periods in alert wake and quiet sleep states
  - Spend longer periods in active sleep states, and
  - Show less organized sleep–wake rhythmicity.
- Earlier gestational age and greater severity of illness are associated with greater disturbances in state organization and a slower rate of maturation
- The degree of state organization at term postmenstrual age predicts neurobehavioral, cognitive, and motor development in infancy and early childhood

Kangaroo Care
Effects on State Organization

- N = 70 (35 in each group), case-control study
- Gestational Age 25 – 33 weeks (mean = 30)
- Birth weight 540 – 1650 g (mean 1230 g)
- Controls matched for BW, sex, CRIB score, and family demographics
- Kangaroo care mothers had to agree to 1 hour per day for at least 14 consecutive days
- Intervention started at 31 to 33 weeks PMA
- Infants were ‘stable’ but could be on NC oxygen and have IV fluids

Feldman R, Eidelman AI. *Dev Med Child Neurol* 2003;45:274-81.

Kangaroo Care
Effect on Sleep Regulation

Quiet Sleep

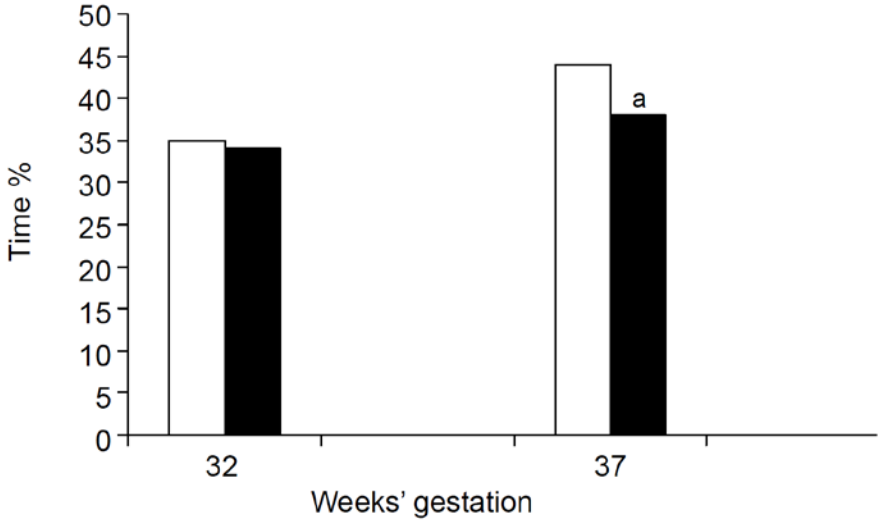


Figure 2: *Changes in state organization in* □ *KC and* ■ *control infants: quiet sleep.* [a]*p=0.016*

Active Sleep

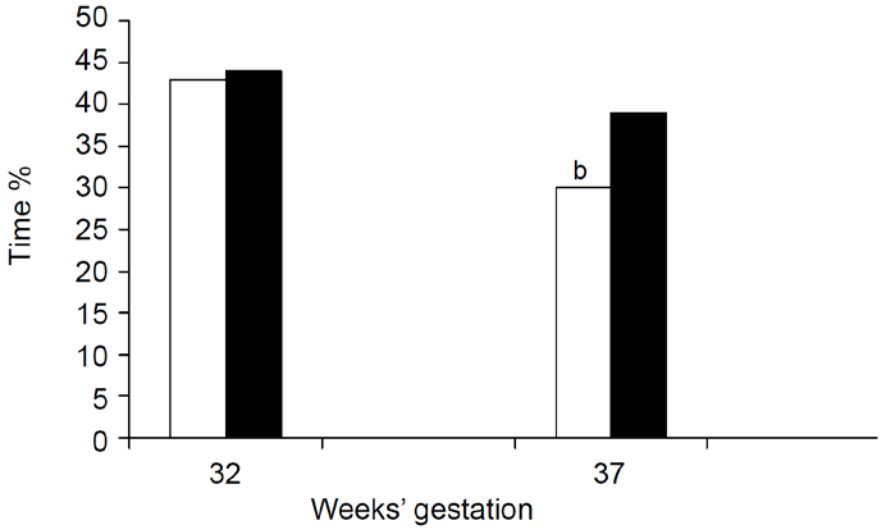


Figure 3: *Changes in state organization in* □ *KC and* ■ *control infants: active sleep.* [b]*p=0.005*

Feldman R, Eidelman AI. *Dev Med Child Neurol* 2003;45:274-81.

Skin-to-Skin Care and EEG measures of Brain Maturation

- Eight study infants enrolled at 28 to 32 weeks PMA.
- Each infant received 90 minutes of SSC per day, 4 days a week, for 8 weeks.
- EEG recordings were conducted during two consecutive inter-feeding periods.
- Two control cohorts (N = 126) were recorded at term.
  - healthy preterm infants studied at term PMA.
  - healthy full-term infants studied at 1–3 days of age

Scher MS, et al. *Clin Neurophysiol* 120 (2009) 1812–1818

Skin-to-Skin Care and EEG measures of Brain Maturation

Skin-to-skin contact accelerates brain maturation in healthy preterm infants

- Fewer REMs, more quiet sleep, increased respiratory regularity, and longer sleep/wake cycles when compared to the non-SSC preterm group at term.
- EEG wave complexity in the SSC preterm group was closer to the full-term cohort than the non-SSC group.

Scher MS, et al. *Clin Neurophysiol* 120 (2009) 1812–1818

STS by Fathers

- Studies that included fathers report benefits to babies
  - Babies calmed after c/s birth STS with fathers better than in cribs (Erlandsson et al, 2007)
  - Fathers effectively heat healthy newborns (Christensson,K, 1996)

Benefits of skin-to-skin

- Mothers
  - Attachment: better infant-mother interaction
  - Breastfeeding: milk supply, increased rates
  - Recovery: physically & psychologically
  - Increased father participation

Benefits of skin-to-skin

- Mothers
  - Reduction of stress
  - Release of oxytocin (Unvas-Moberg..'98,'02)
    - Involution of uterus
    - Reduction of stress
    - Initiation of maternal caregiving behaviors
  - Increased sense of competence

Benefits of skin-to-skin

- Babies
  - Increased survival in poor countries
  - Physiological stability improved
    - HR, respirations, O2 saturations, temperature
  - Lower cortisol (less stress)
  - Decreased pain responses
  - More mature sleep patterns
  - Better nursing & better weight gain

The "Elevator Speech":

- Comparing the NICU to the rest of the hospital:
  - Our patients are undergoing a crucial period of brain development
  - No patient needs their family more – not just emotionally, but biologically
  - Potentially just as life-changing for the family
- The impact on the patient and the family are most profound, most long-lasting of any in the hospital – **we are building brains and families every day!**

Robert D. White, MD

Question:

- If we started the NICU concept today,
  based on what we know now,
  would we consider the optimal environment
  for premature and sick neonates to be:
  - A. The environment used first at a World's Fair exhibit and in chicken-raising factories
  - B. The environment favored by every culture prior to ours – and, as it turns out, by the neonate's brain

Robert D. White, MD

Changing the Paradigm:
Putting a baby in an incubator/warmer is not necessarily optimal care

- *Will babies survive it?*
  - **Sure**
- *Do we sometimes have no other choice?*
  - **Yes**
- *But in no way should it be considered optimal!*
  - **STS is not a risky thing we do for the benefit of the mother; it is a supremely natural thing we do for the great benefit of the baby**

Robert D. White, MD

Challenges and Opportunities

- Challenges
  - Increase understanding of benefits vs risks with very high-risk and critically ill babies
  - More research needed with this group

- Opportunities
  - To expand understanding of benefits
  - Increase participation by wider groups, preemie parents as well as termie parents

Keep Babies Close