

SOOTHE, SENSE, AND STS:

FLORIDA LEADS THE WAY

Robert White, MD
Pediatrix Medical Group
Beacon Children's Hospital
South Bend, IN

DISCLOSURES

I am an employee of Pediatrix Medical Group but have no other conflicts of interest to disclose

Mark Hudak and Joe Neu know more Pediatrics than I ever will but as their Neonatology “attending” in Baltimore, I still have bragging rights



OUTLINE

Kudos

What is our “gold standard”?

Quick review of some pertinent data on the sensory environment

Thoughts about the way forward

- Physical environment
 - Noise
 - Lighting
- Operational
 - Touch, movement, smell
 - STS – earlier and “oftener” – it is the “secret sauce”
 - Benefits
 - Challenges
 - Goals
 - Strategies

Concluding thoughts

WHAT SHOULD BE OUR “GOLD STANDARD”?

*Provide the optimal sensory environment for
every baby, every day*

- Requires parental presence/support, caregiver responsibility, therapists, volunteers
- Consider sensory isolation as important as sensory overload
- Goals – optimal brain development; full family integration

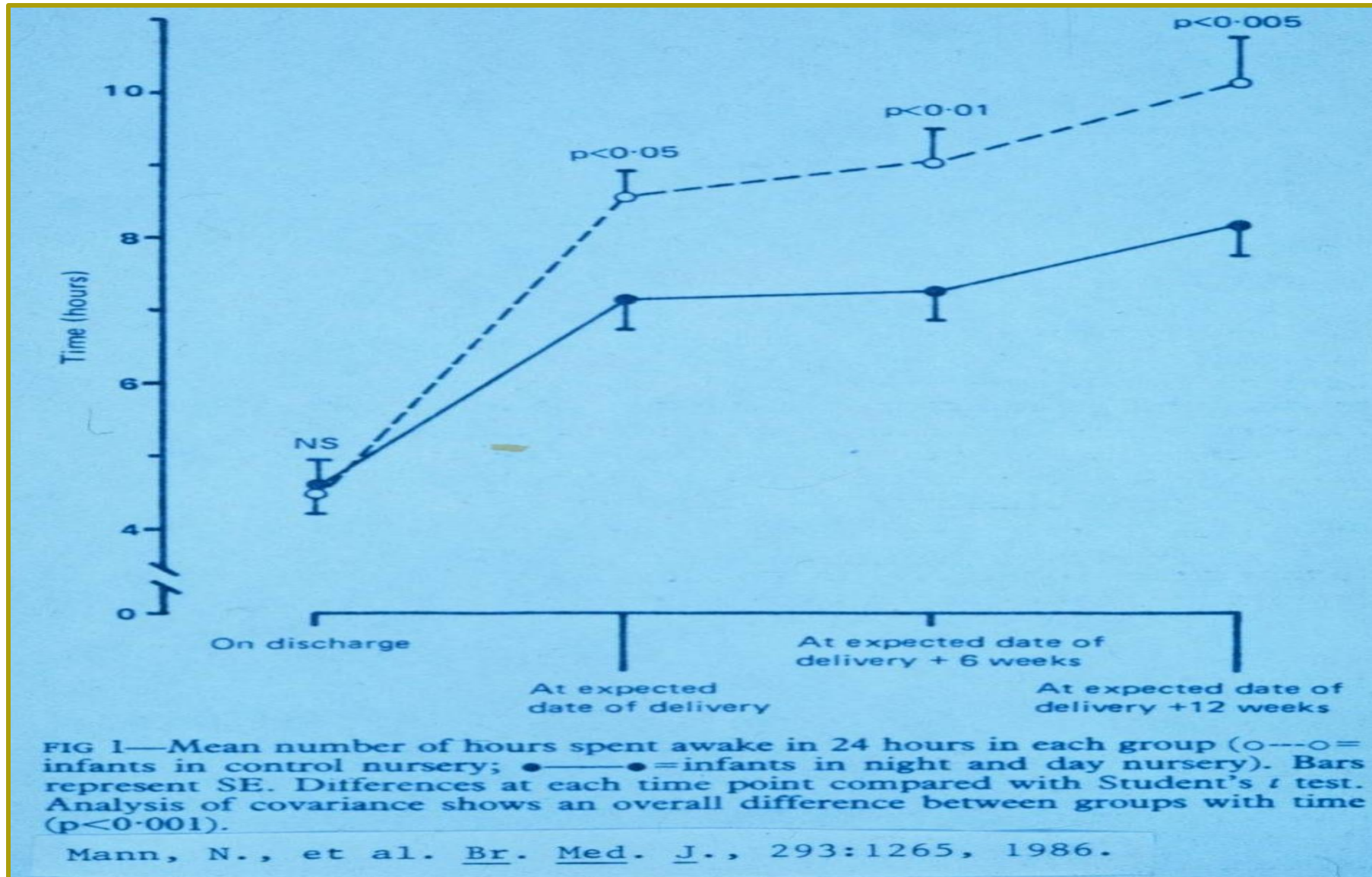
Key Drivers diagram is a good summary of these goals

KEY DRIVER – “PROMOTE A DEVELOPMENTALLY APPROPRIATE LIGHT ENVIRONMENT”

Prior to the 3rd trimester, this is probably continuous dim lighting; most NICUs are very good at that

By the 3rd trimester, though, a circadian stimulus is the biological norm and should therefore be provided

WHY CYCLED LIGHTING?



CIRCADIAN RHYTHMS - BABIES

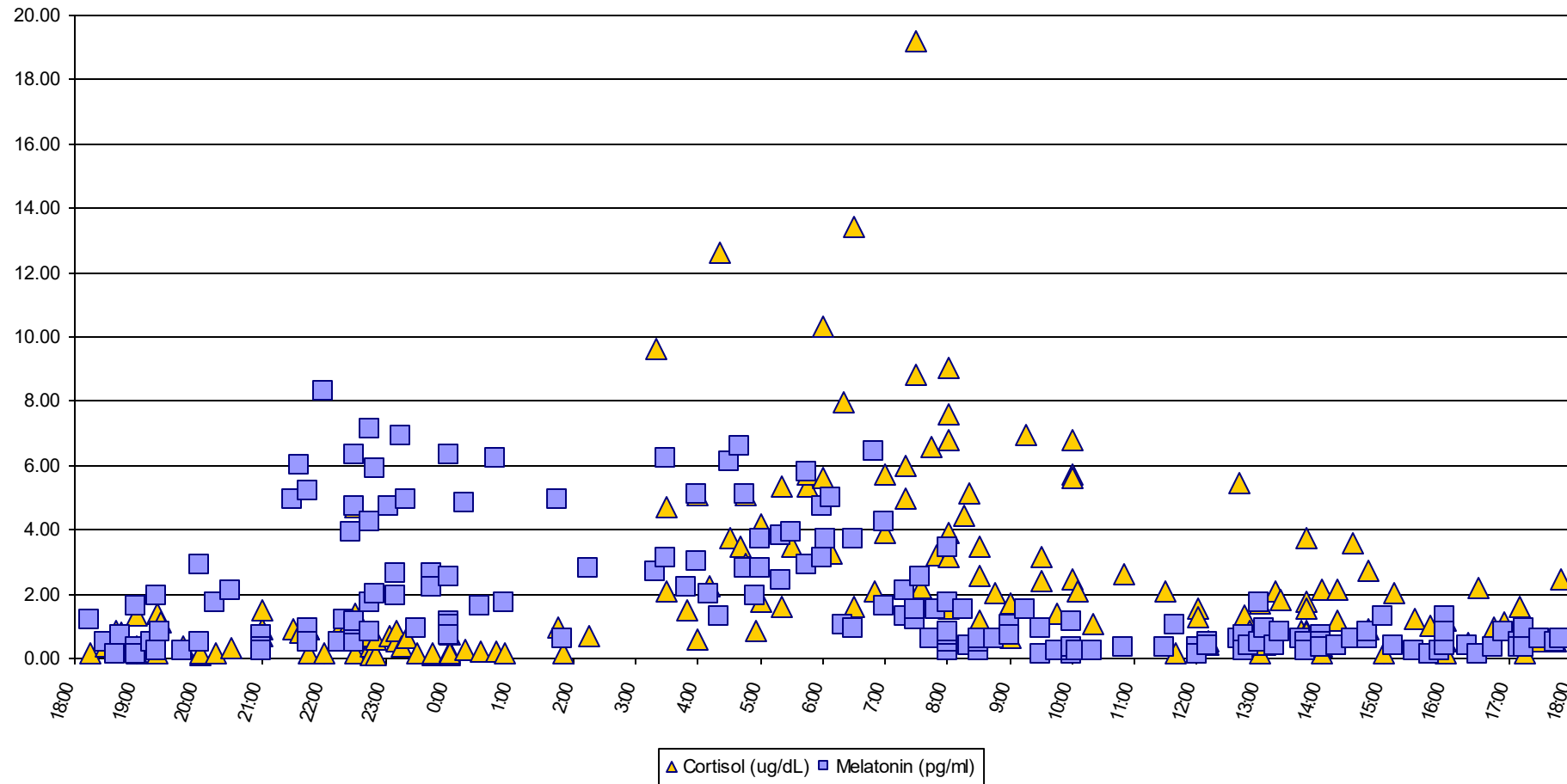
- Biological mechanisms to respond to light as a circadian stimulus are present by ~32 weeks
- Babies are exposed and entrain to circadian stimuli *in utero*
- Day-night cycling shown superior to continuous bright or continuous dim lighting (Cochrane 2011, with additional data in 2012 and 2013)
- No evidence that exposure to moderate amounts of light is harmful to preemies
- So, day-night lighting is important, at least for premature infants >28-32 weeks gestation

CIRCADIAN RHYTHMS - BABIES

But what about infants at <28 weeks? And why do preemies in a cycled-light NICU still have difficulty entraining to light?

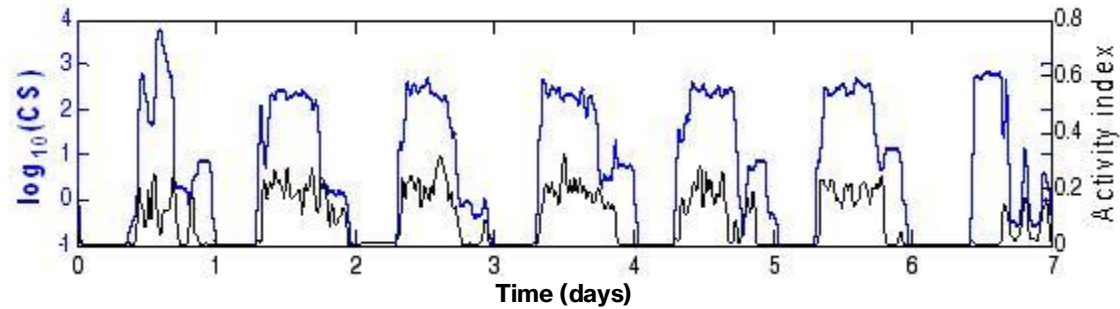
Are there additional *zeitgebers*? – e.g., temp, feedings, activity, melatonin in mother's milk?

Cortisol and Melatonin in Preterm Breast Milk

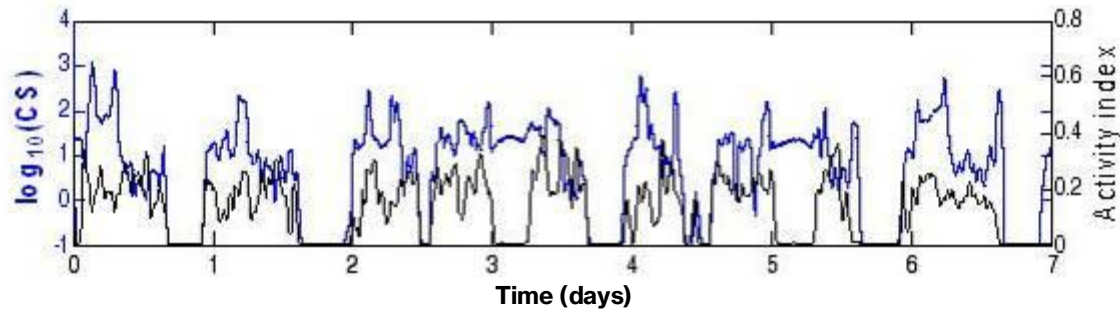


LIGHT AND ACTIVITY FOR SEVEN DAYS (DATA FROM REA, ET AL – RPI)

Day shift nurse



Rotating shift nurse



CIRCADIAN RHYTHMS - STAFF

Bright light exposure at night increases body temperature, alertness, performance, *but*

Night-shift workers are more prone to breast and colon cancer and lymphoma, *so*

Although there are other possible causes for this finding (stress, poor nutrition, etc.), since melatonin has antineoplastic effects, the optimal night-time lighting environment for staff is not yet determined – should we suppress melatonin, optimize it, or supplement it?

HOW MIGHT WE PROMOTE CIRCADIAN RHYTHMICITY IN THE NICU?

- Skin-to-Skin care (more on this later)
- Cycled lighting
- Feed breast milk according to time expressed
- Allow circadian temperature fluctuation
- Chronopharmacology
 - Timing of methylxanthines, corticosteroids
 - Protected sleep times, especially at night
 - Avoid routine labs, X-rays in early AM?

KEY DRIVER – “MODULATE SOUND AND PROVIDE A POSITIVE AUDITORY INPUT IN THE NICU”

Fetal auditory development

- *In utero* – lots of sound, mostly low frequency, transmitted in a liquid or solid medium
- Auditory cortex is in an active and critical phase of development in the third trimester
- A fetus learns to recognize certain sounds from the mother *in utero*, and rapidly after birth

AUDITORY DEVELOPMENT IN THE PRETERM INFANT IN A NICU

Occurs in an environment vastly different from the womb

- Unfamiliar, inconsistent voices and sounds
- Acquired through an air medium
- Multisensory input, often unpleasant
- Sleep often disrupted

SO... IF NOISE IS BAD, WHAT IS GOOD AUDITORY STIMULATION?

Definite

- Parents talking while holding

Probable

- Music

Not so clear...

- Disembodied voices, heart sounds, etc.,
especially if experienced in the context of
painful or noxious stimuli

“THE PRUNING OF SYNAPSES IN THE DEVELOPING BRAIN MIGHT BE COMPARED TO THE CREATION OF A STATUE BY REMOVING MATERIAL FROM THE RAW STONE.”

– KATHARINA BRAUN, CLINICS IN PERINATOLOGY, DEC. 2012

The sensory experience we provide is the sculptor for newborn brains.

Normal development of the brain requires normal stimuli and normal activity – even *in utero*, but especially *ex utero*.

Ear plugs are, at best, a temporary solution – we can do better.



WHAT IF MY NICU IS JUST TOO LOUD?

Reduce ambient noise levels

- New construction/renovation
- Remote transmission of alarms
 - *This technology has been available and proven safe for 10 years but uptake is too slow!*

Auditory protection

- Restricts nurturing sounds as well as the noxious ones – may be the best option in some cases (e.g., jet ventilator), but should be used judiciously

SOOTHE strategies – what is working for you?

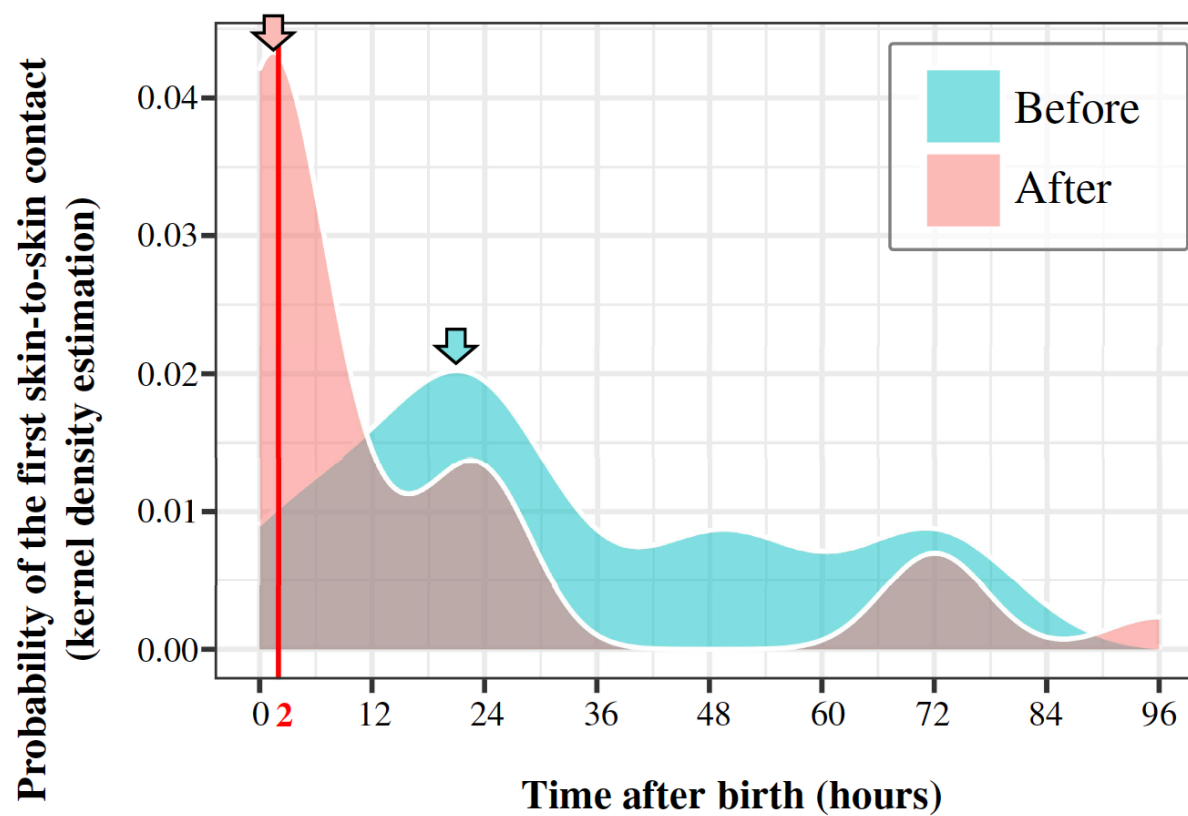
KEY DRIVER – “PROMOTE DEVELOPMENTALLY SUPPORTIVE POSITIVE TOUCH”

Potentially better practice:

“Percentage of infants who receive SSC by family caregiver by DOL 7”

- *This is a key measure - it will have the greatest impact on infant and parental well-being of any of the measures, will positively impact several of the other measures, and will permanently change the character of your NICU.*
- *With the exception of infants who require major surgery or are dependent on extraordinary respiratory support (e.g., HFV, ECMO, or chest tube) or whose parents are absent, I suggest that the following targets are achievable:*
 - **Level II NICU – 90% by DOL 3**
 - **Level III NICU – 90% by DOL 5 (by DOL 3 for babies >28 weeks)**
 - **Level IV NICU – 90% by DOL 7 (by DOL 3 for non-surgical babies >28 wks)**

NEXT THREE SLIDES COURTESY OF LIISA LEHTONEN, TURKU, FINLAND



Effects on immediate SSC

	Before Couplet Care Model	Couplet Care Model
Infants <28 weeks of gestation		
First skin-to-skin contact after birth, median (IQR), hours	72.0 (24.0, 72.0)	72.0 (15.9, 108.0)
First skin-to-skin contact initiated ≤2 hours after birth, n (%)	1 (20.0)	1 (6.7)
Presence, mean (SD), hours/day	12.2 (7.2)	19.7 (4.0)
Overnight stay, mean (SD), nights/week	2.3 (3.6)	5.8 (1.9)
Skin-to-skin contact, mean (SD), hours/day	3.1 (2.0)	3.5 (2.3)
Holding, mean (SD), hours/day	0.1 (0.2)	0.01 (0.04)
Infants ≥28 weeks of gestation		
First skin-to-skin contact after birth, median (IQR), hours	24.0 (16.3, 48.0)	1.0 (0.1, 14.5)
First skin-to-skin contact initiated ≤2 h after birth, n (%)	2 (6.7)	29 (56.9)
Presence, mean (SD), hours/day	10.6 (3.9)	21.6 (2.3)
Overnight stay, mean (SD), nights/week	1.6 (2.1)	6.6 (0.7)
Skin-to-skin contact, mean (SD), hours/day	2.6 (2.0)	3.1 (2.1)
Holding, mean (SD), hours/day	1.4 (1.7)	2.0 (2.3)

Itoshima R, Korhonen K, Axelin A, Ahlqvist-Björkroth S, Hovi A, Lehtonen L.

Effect of couplet care on early parent-infant closeness among preterm infants. Acta Paediatr. 2025;114(5):903-912.

STS IS NOT JUST FOR MOTHERS!

When fathers hold their babies STS -

- Babies benefit
- Fathers benefit
 - Enhanced bonding with baby
 - Reduced stress levels
 - Become more involved with caregiving
- Even mothers benefit
 - Strengthens inter-parental bond

<https://www.scientificamerican.com/article/why-dads-and-their-babies-need-to-go-skin-to-skin1/>

- Great article – give it to all your dads!

Study from Cologne, Germany: mean 29 GA; SSC 60 minutes vs 5 min visual contact with the mother.

SSC reduced gene expression of stress hormone receptors (*CRH R2, NR3C1, SLC6A4*) at discharge (*Hucklenbruch-Rother E, et al. Psychoneuroendocr 2020*); reduced depressive symptoms at 3 d postpartum, improved motor and vocal development of the children, reduced impaired bonding (*Mehler et al. Acta Paediatrica 2020*).

IPISTOSS Study from Stockholm: 28+0 to 32+6 weeks; SSC 6 hours vs routine care, with the father if c/s.

SSC improved physiological stability (*Linnér A, et al. Acta Paediatr 2022*); reduced depressive and anxiety symptoms in mothers and fathers (*Lilliesköld S, et al. J Affect Disord 2025*); improved mother-infant interaction at 4 months (*Lilliesköld S, et al. JAMA Netw Open 2023*). No differences in motor development, cognition, or autism spectrum disorders but language scores better in SSC group (*Lode-Kolz K, et al. Children (Basel) 2025*).

-> Biological and psychological benefits accrue to both babies and parent(s)

BENEFITS OF EARLY STS

In addition to the benefits documented by Dr. Lehtonen and others, early STS enhances several of the other drivers, e.g.,

- Early olfactory and oral sensory experiences
- Developmentally supportive touch
- Promotes family participation

CHALLENGES OF EARLY STS

Fear of doing harm

Inertia

It requires extra effort, patience, and venturing outside our comfort zones – but it can be done safely, so the payoff is worth it!

STRATEGIES TO ACHIEVE EARLY STS

- Identify champions
- Learn from other successful NICUs
- Formalize policies, procedures, and expectations – *make it the expected standard of care*, not just a “nice thing to do”
- Celebrate successes

**You can make this happen –
one baby, one family, one success at a time!**

ADDITIONAL STRATEGIES FOR DEVELOPMENTAL CARE

While parental interaction is the ideal, it is never the complete answer, and in many cases, not even the basic foundation for developmental support, so a formal structure is crucial. The most common programs available are:

- NIDCAP – very comprehensive but requires trained staff to administer
- SENSE – structured program for introduction of developmental supports according to gestational age - <https://chan.usc.edu/nicu/sense>

SENSE AT BEACON

One therapist (PT/OT or ST) is the "Administrator" of the SENSE program for each family/patient. The age and acuity of the patient determines the timing of the initial visit. For our ELBW it maybe 2-3 weeks before implementing SENSE program depending on the acuity of the patient but for the remainder of the patients, the SENSE program is implemented within 1-2 weeks of admission.

PT/OT typically are SENSE "administrators" for the ELBW patients. The therapist assigned to the patient as the SENSE "administrator" will complete a discipline specific evaluation during the initial visit as well as parent education regarding the SENSE program.

During the initial visit, the SENSE QRL code that links to the parent material is introduced (the QRL code links to parent material in various languages and the sign is posted in all the rooms); parents can use their phone to access the QRL code. Also during the initial visit, the age appropriate "week by week guide" is reviewed with parents and examples of age appropriate sensory experiences are provided (i.e. talking, skin to skin, reading, cycled lighting etc.). The therapist also demonstrates appropriate touch for the parent and assist the parent in completing appropriate touch experience (i.e. finger holding, hand hug, etc.) to promote bonding experiences.

Therapists see each baby 1-2x/week to check in with parents and answer any questions. Each week the "administrator" will change the "week by week guide" to provide education about the change in sensory experiences as the baby matures. Additional therapy is introduced as the infant demonstrates improved medical stability and additional therapist support the parents in the appropriate sensory experiences as indicated by the patient's GA and "week by week guide" but the original therapist (i.e. "administrator") continues with the responsibility of changing the "week by week guide" as the baby matures. We do not use parent logs routinely but there are parents who are data driven and like to document the sensory experiences provided. The formal SENSE assessment forms do not translate in our EMR but we do include the information in our documentation.

Overall, the SENSE program has been instrumental in providing parents with concrete ways to bond and interact with their baby and is also helpful in reminding staff that the appropriate level of sensory experience is essential for the baby's optimal development.

Contact info: Angela – agallagher@beaconhealthsystem.org; Jenny – jmark3@beacon...; Jeff – JJASINSKI@beacon...

EVOLUTION OF NICU NEURO CARE

Pre-1980 – save the baby

- Incubators, surfactant, infant ventilators, TPN,

1980 – present – protect and grow the baby

- Precise control of nutrients, oxygenation, perfusion,

From now on – save, protect, AND nurture the baby

- Developmental care
- Family-integrated care
- SOOTHE

YOUR SUCCESS WITH EARLY STS AND DEVELOPMENTAL CARE WILL HAVE AN IMPACT FAR BEYOND SOOTHE, AND FAR BEYOND YOUR NICU!

- Within your NICU - babies, families, and your team will be happier, stronger, and more confident; achieving the key drivers will be easier
- Across the country - other NICUs will learn from you, as people in many European NICUs and some US NICUs have also demonstrated – that early STS can be done safely and is a positive experience for babies, families, and caregivers alike

Kudos again for undertaking this project – please share your successes with the world! (e.g., at the Gravens Conference)

Thanks to all your leaders for their suggestions and encouragement!