TRAUMA-INFORMED NEUROPROTECTIVE IN THE NICU

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CARING ESSENTIALS COLLABORATIVE

BOSTON, MA

Caring Essentials Collaborative

LEARNING OBJECTIVES

- PARTICIPANTS WILL DESCRIBE THE IMPACT OF TOXIC STRESS ON THE DEVELOPING BRAIN
- PARTICIPANTS WILL DEFINE THE 3 'ES' AND 4 'RS' OF TRAUMA-INFORMED CARE
- PARTICIPANTS WILL LIST THE 5 CORE QUALITY MEASURES FOR TRAUMA-INFORMED CARE IN THE NICU
- PARTICIPANTS WILL IDENTIFY AT LEAST 1 EBP FROM THE CORE MEASURES THAT THEY WILL ADOPT IN THEIR NEXT CARING ENCOUNTER

What is Toxic Stress?

ALL STRESS IS NOT BAD!

Positive Stress - brief increase in heart rate, mild elevations in stress hormone levels

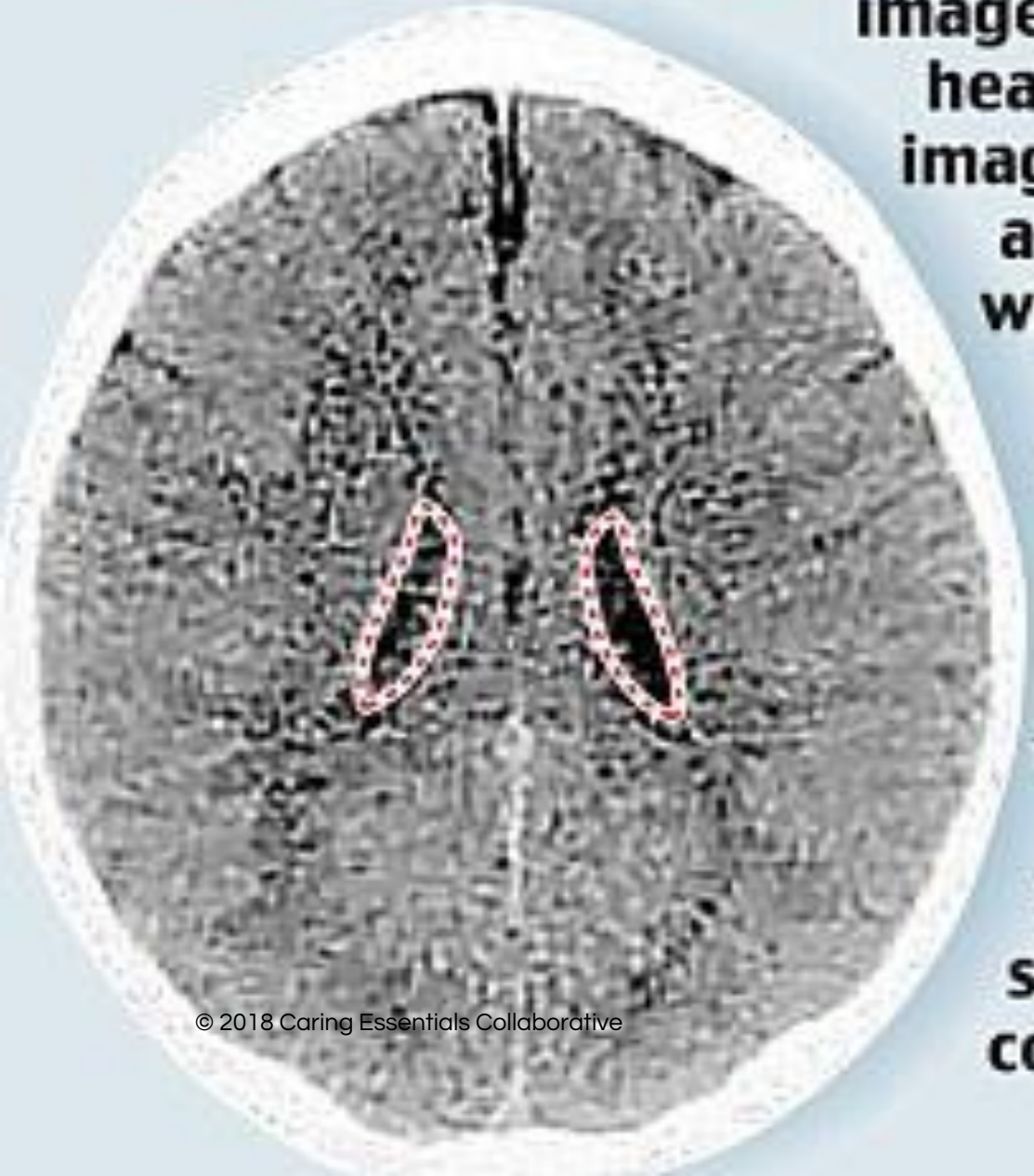
Tolerable Stress - serious, temporary stress responses buffered by supportive relationships

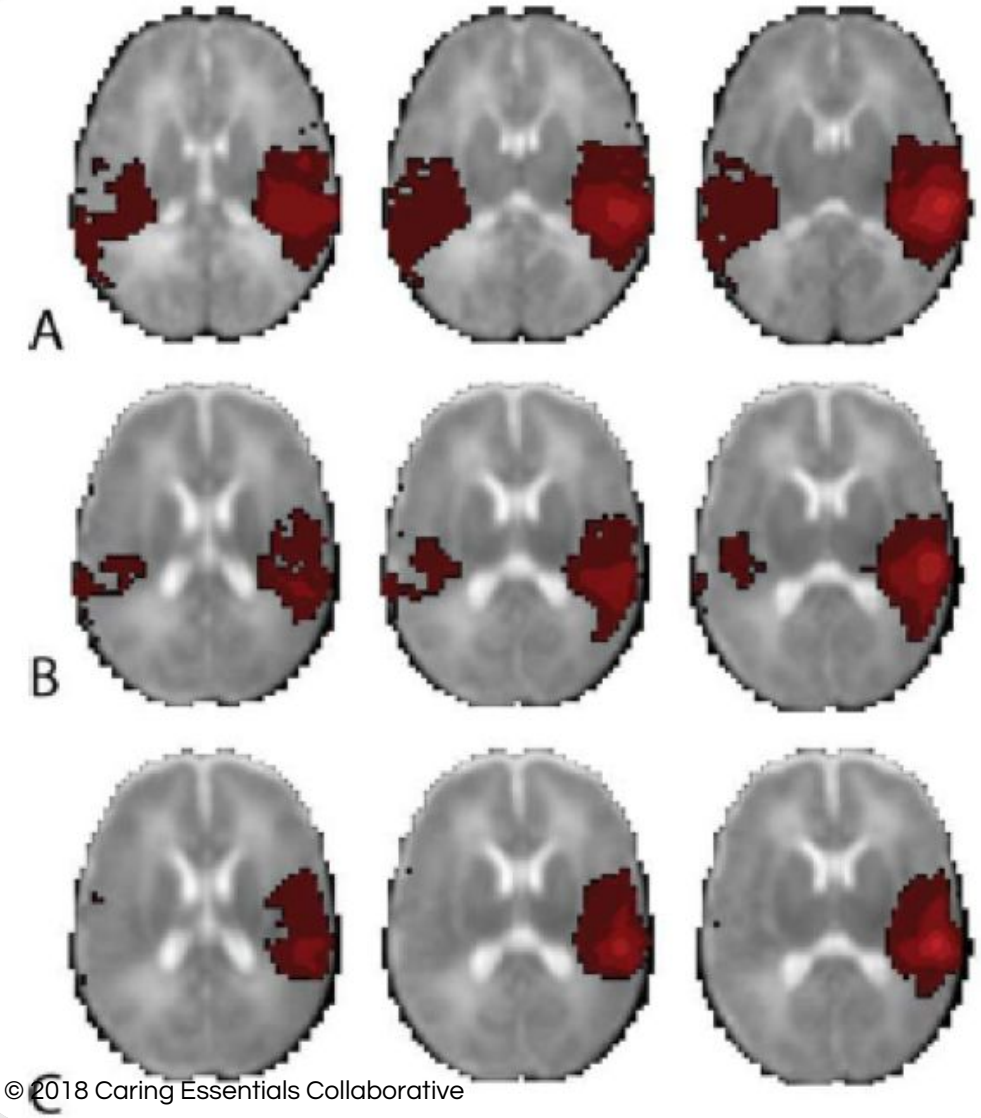
Toxic Stress - prolonged activation of stress response systems in the absence of protective relationships

NORMAL

These are the brains of two three-year-old children. The image on the left is from a healthy child while the image on the right is from a Romanian orphan who suffered severe sensory deprivation. The right brain is smaller and has enlarged ventricles - holes in the centre of the brain. It also shows a shrunken cortex - the brain's outer layer.

EXTREME NEGLECT

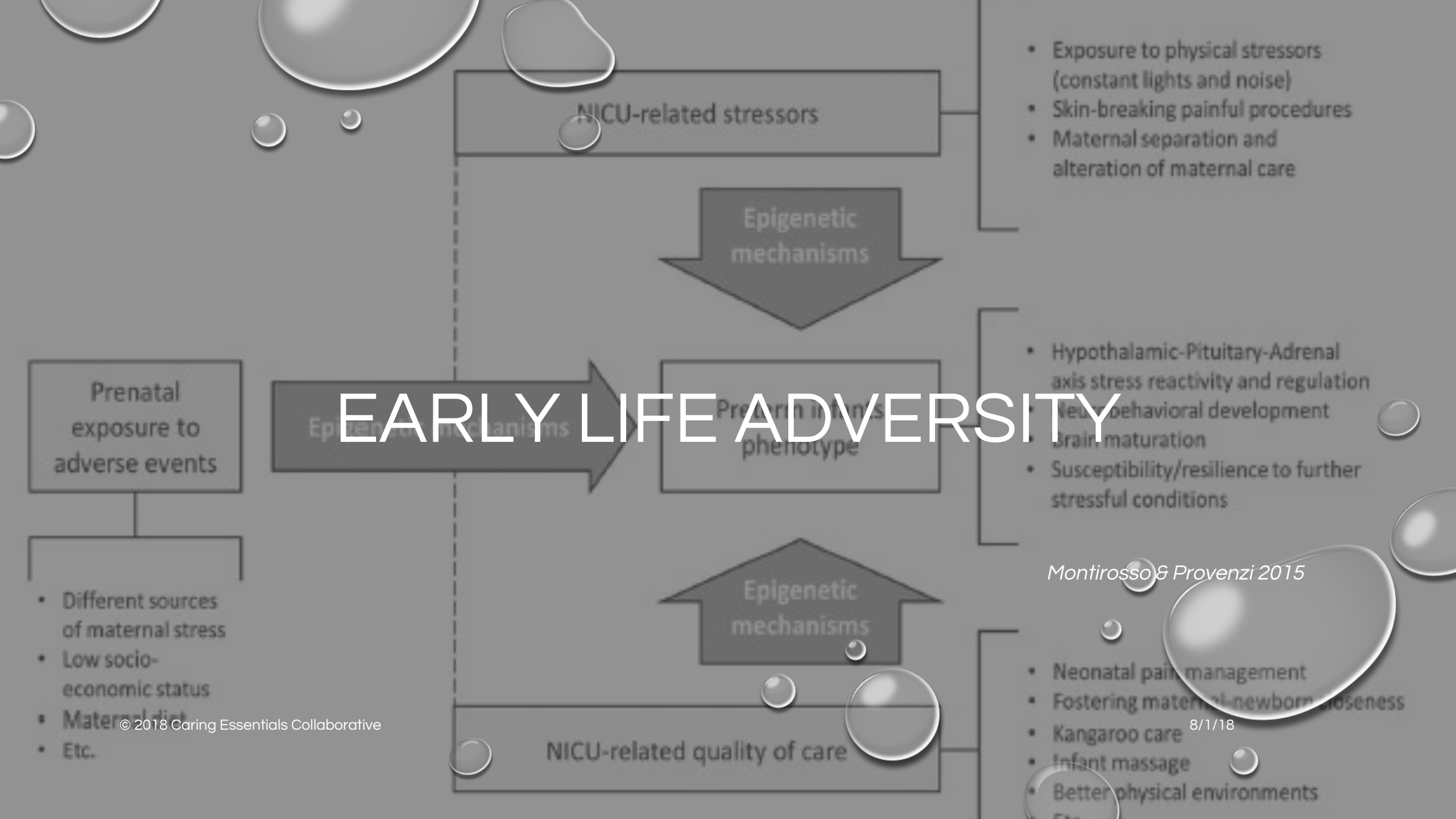




TOXIC STRESS

- *"HIGH STRESS EXPOSURE IS ASSOCIATED WITH DIFFERENCES IN THE BRAIN ON BOTH AN ANATOMIC AND A FUNCTIONAL LEVEL…DATA SUGGEST AN IMPORTANT VULNERABILITY OF THE PRETERM BRAIN TO STRESSFUL EXPOSURES, INDEPENDENT OF MEASURES OF SEVERITY OF ILLNESS,… AND THUS POTENTIALLY AFFECT NEURODEVELOPMENTAL OUTCOMES."*

Smith et al 2011



EARLY LIFE ADVERSITY

Montirosso & Provenzi 2015

ADVERSE CHILDHOOD EXPERIENCE STUDY

ACE CATEGORIES

- ABUSE
  - EMOTIONAL; PHYSICAL; SEXUAL
- HOUSEHOLD DYSFUNCTION
  - MOTHER TREATED VIOLENTLY; HOUSEHOLD SUBSTANCE ABUSE; HOUSEHOLD MENTAL ILLNESS; PARENTAL SEPARATION OR DIVORCE; INCARCERATED HOUSEHOLD MEMBER
- NEGLECT
  - EMOTIONAL; PHYSICAL

Felitti et al 1998; Anda et al 2006

ACE FINDINGS

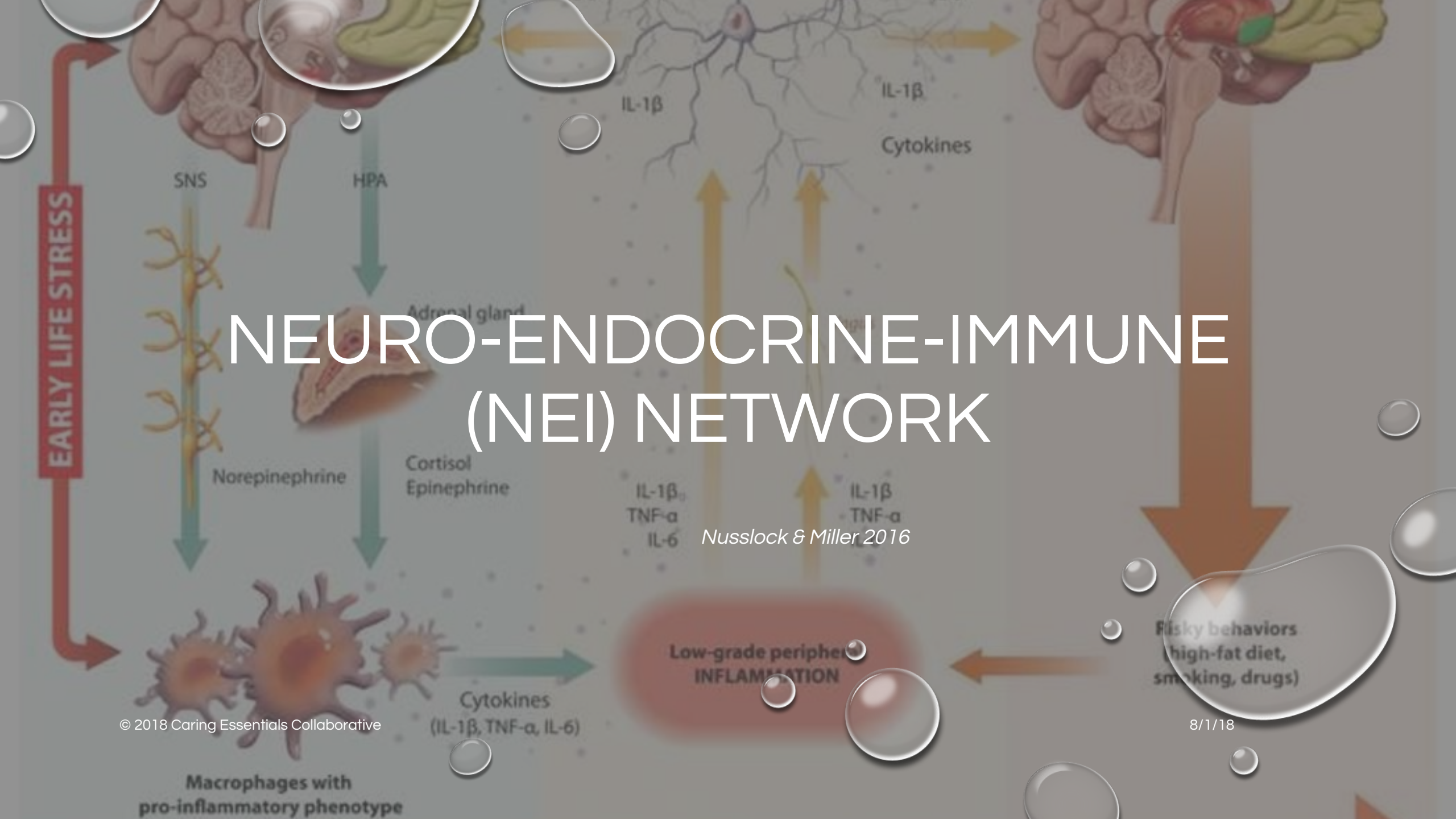
- 2/3 OF 17,000 RESPONDENTS HAD AN ACE SCORE OF AT LEAST 1
- 87% OF THOSE HAD MORE THAN 1
- THE HIGHER YOUR ACE SCORE THE HIGHER YOUR RISK OF HEALTH AND SOCIAL PROBLEMS
- THE LIKELIHOOD OF:
  - CHRONIC PULMONARY LUNG DISEASE INCREASES 390 PERCENT
  - HEPATITIS INCREASES 240 PERCENT
  - DEPRESSION INCREASES 460 PERCENT
  - SUICIDE INCREASE1,220 PERCENT
  - IV DRUG USE INCREASES BY 5000%

https://www.cdc.gov/violenceprevention/acestudy/about.html

STUDY FINDINGS REPEATEDLY REVEAL A GRADED DOSE-RESPONSE RELATIONSHIP BETWEEN ACES AND NEGATIVE HEALTH AND WELL-BEING OUTCOMES ACROSS THE LIFE COURSE.

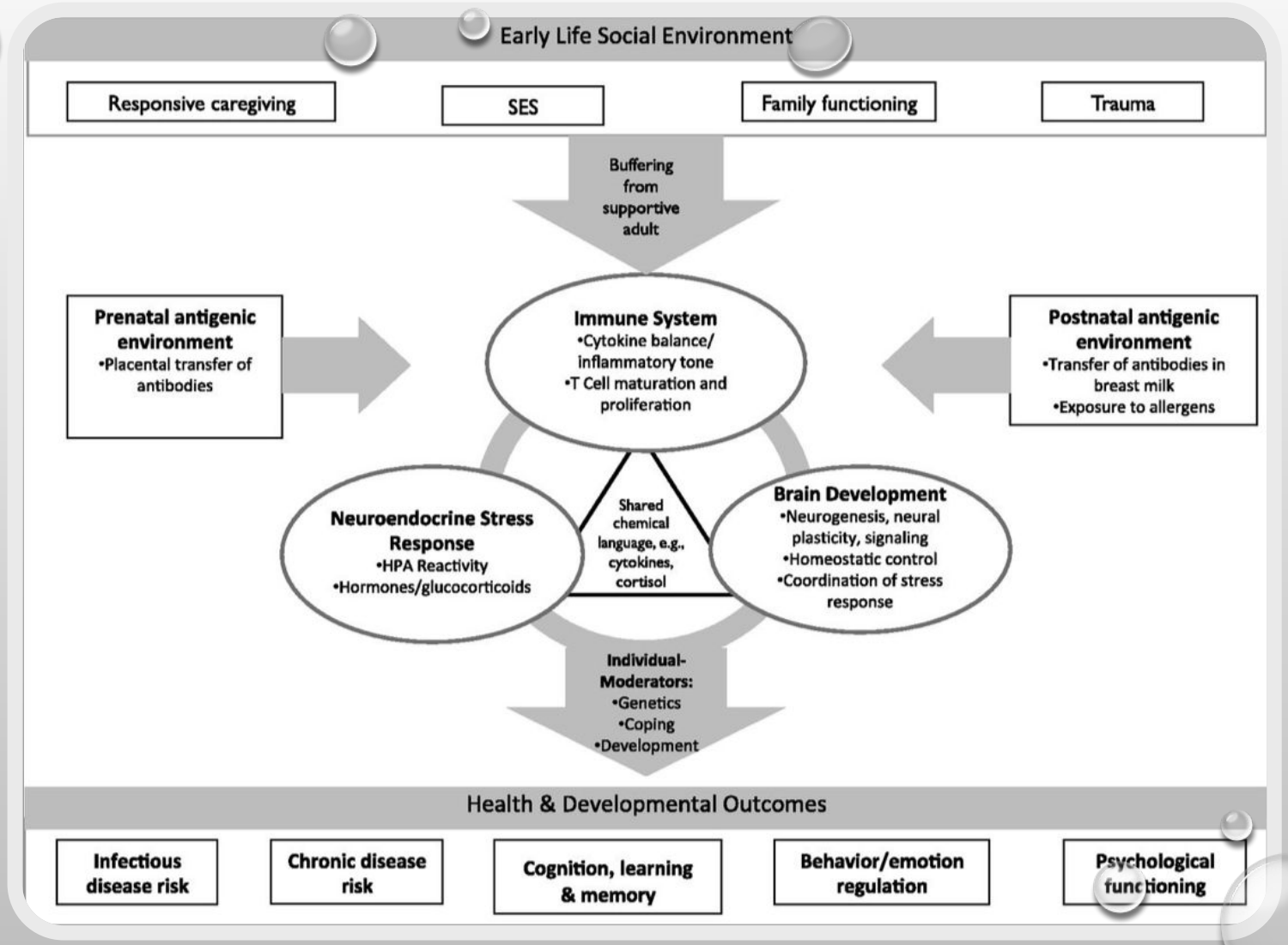
A graded dose-response means that as the dose of the stressor increases the intensity of the outcome also increases.

NEURO-ENDOCRINE-IMMUNE (NEI) NETWORK



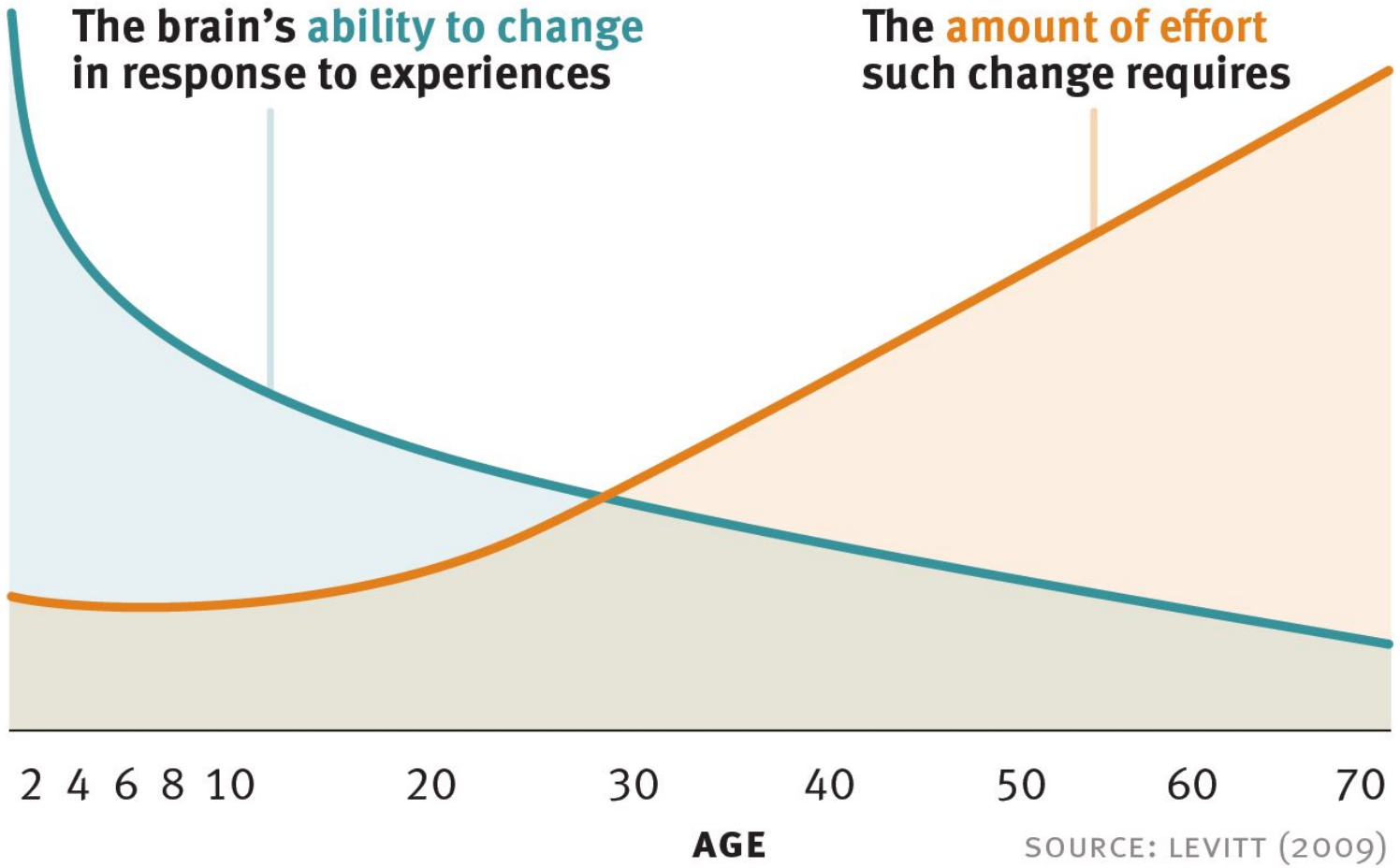
Nusslock & Miller 2016

MEDIATING ROLE OF THE NEI NETWORK IN LINKING EARLY LIFE EXPERIENCES TO INDIVIDUAL DIFFERENCES IN HEALTH AND FUNCTIONING



BRAIN ARCHITECTURE

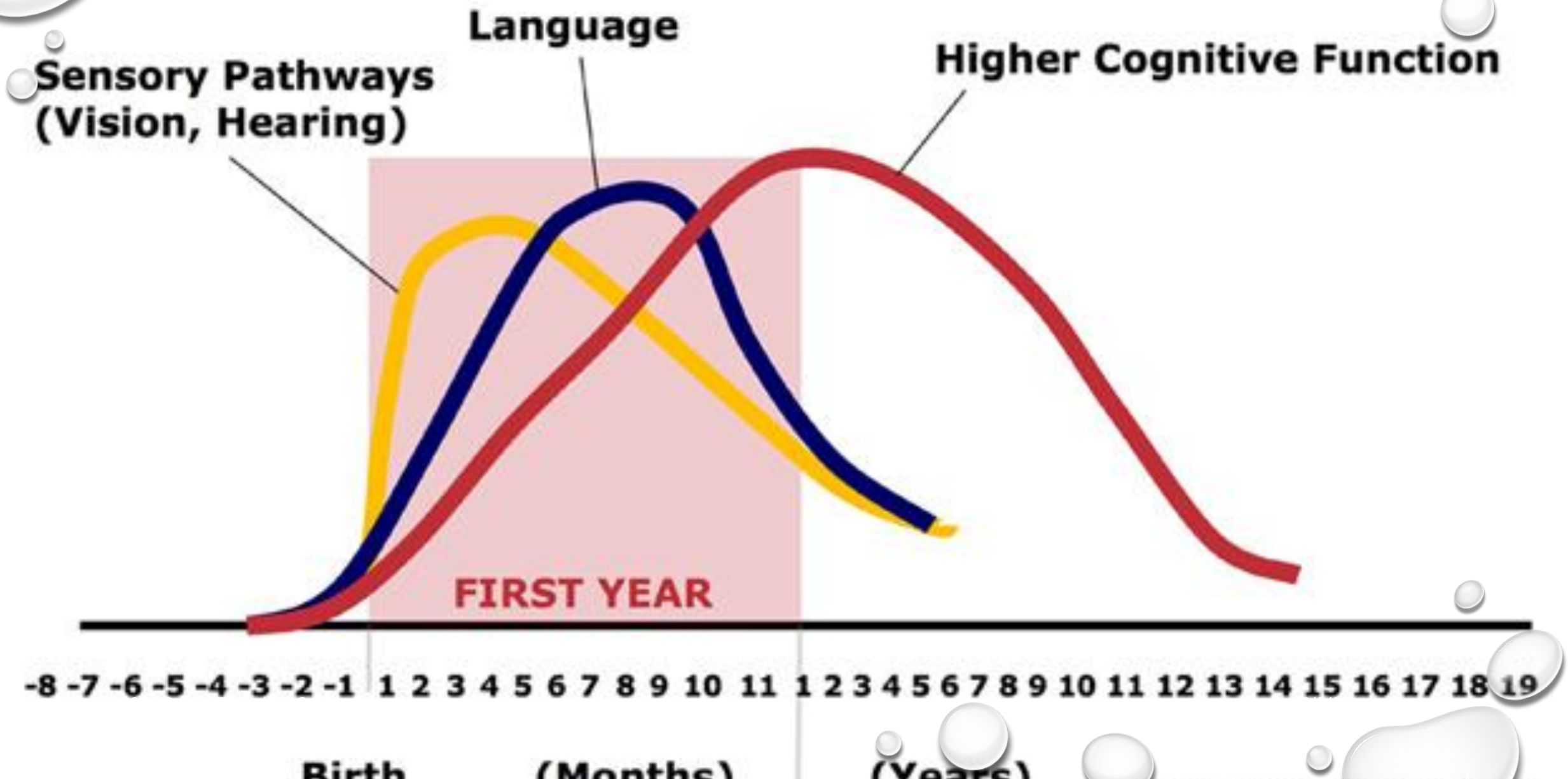
- BRAINS ARE BUILT OVER TIME, FROM THE BOTTOM UP.
- BRAIN ARCHITECTURE IS COMPRISED OF BILLIONS OF CONNECTIONS BETWEEN INDIVIDUAL NEURONS ACROSS DIFFERENT AREAS OF THE BRAIN
- THE INTERACTIONS OF GENES AND EXPERIENCE SHAPE THE DEVELOPING BRAIN
- COGNITIVE, EMOTIONAL, AND SOCIAL CAPACITIES ARE INEXTRICABLY INTERTWINED THROUGHOUT THE LIFE COURSE.
- TOXIC STRESS WEAKENS THE ARCHITECTURE OF THE DEVELOPING BRAIN, WHICH CAN LEAD TO LIFELONG PROBLEMS IN LEARNING, BEHAVIOR, AND PHYSICAL AND MENTAL HEALTH.



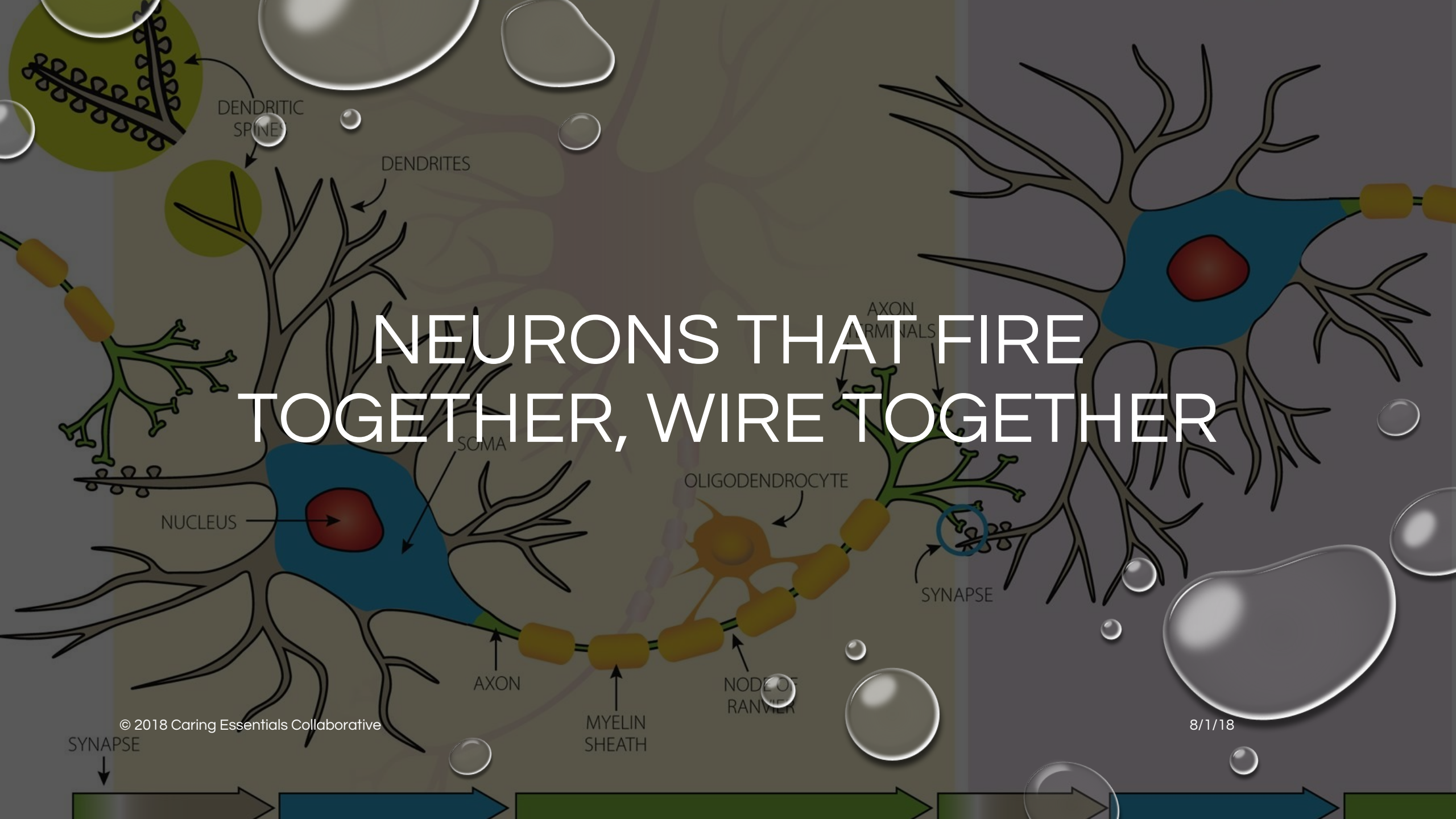
Center on the Developing Child HARVARD UNIVERSITY

www.developingchild.harvard.edu

Neural Connections for Different Functions Develop Sequentially



Source: C.A, Nelson (2000)



NEURONS THAT FIRE TOGETHER, WIRE TOGETHER

"PSYCHOSOCIAL DEPRIVATION WITHIN ANY CAREGIVING ENVIRONMENT DURING EARLY LIFE MUST BE VIEWED WITH AS MUCH CONCERN AS ANY DEBILITATING CHILDHOOD DISEASE."

Johnson & Gunnar 2011

MEETING INFANT NEEDS

- ERIKSON'S PSYCHOSOCIAL STAGES OF DEVELOPMENT
  - YEAR 1: TRUST VERSUS MISTRUST
  - SAFETY, SECURITY & CONNECTEDNESS

Science Helps to Differentiate Four Types of Unresponsive Care

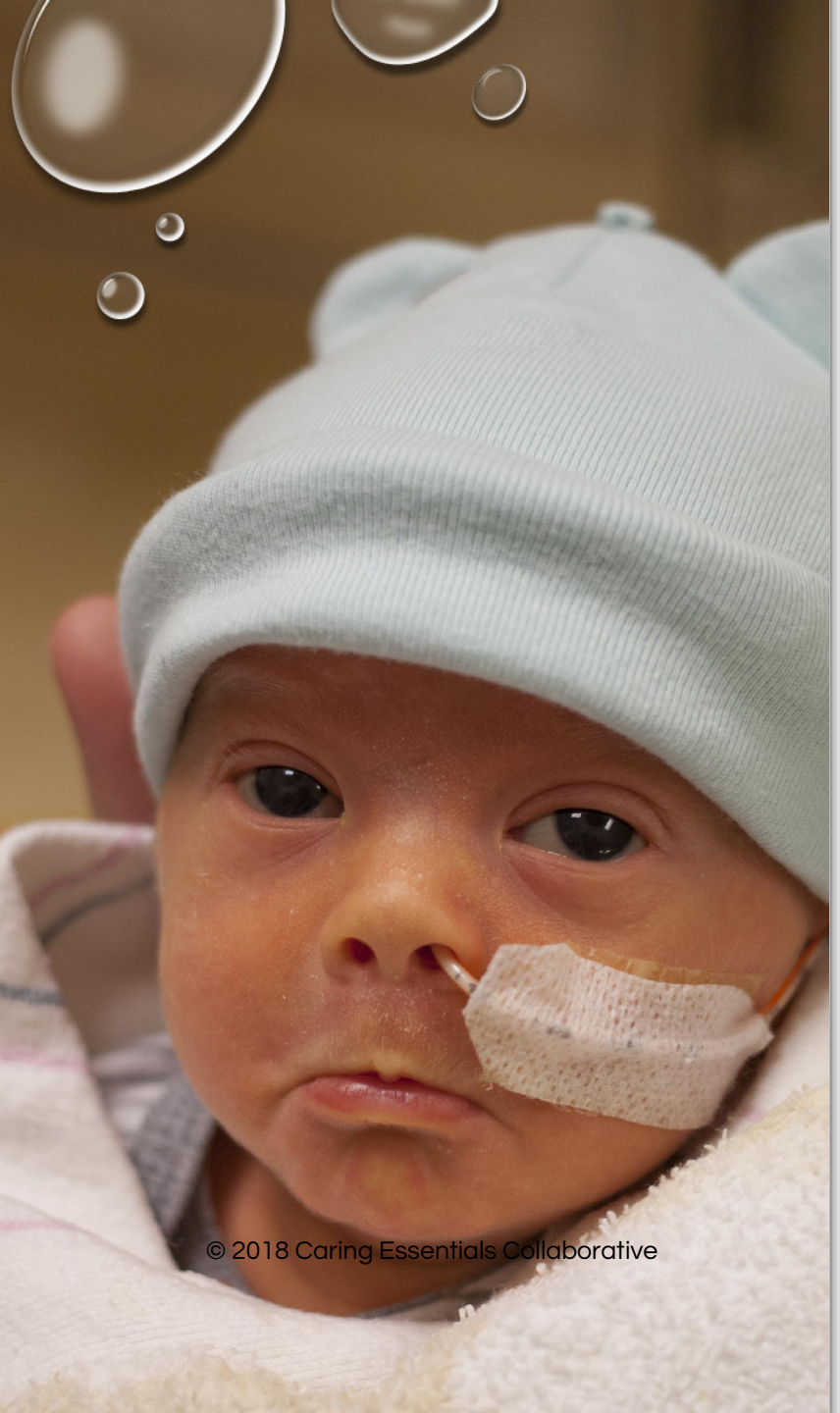
	OCCASIONAL INATTENTION	CHRONIC UNDER-STIMULATION	SEVERE NEGLECT IN A FAMILY CONTEXT	SEVERE NEGLECT IN AN INSTITUTIONAL SETTING
Features	Intermittent, diminished attention in an otherwise responsive environment	Ongoing, diminished level of child-focused responsiveness and developmental enrichment	Significant, ongoing absence of serve and return interaction, often associated with failure to provide for basic needs	"Warehouse-like" conditions with many children, few caregivers, and no individualized adult-child relationships that are reliably responsive
Effects	Can be growth-promoting under caring conditions	Often leads to developmental delays and may be caused by a variety of factors	Wide range of adverse impacts, from significant developmental impairments to immediate threat to health or survival	Basic survival needs may be met, but lack of individualized adult responsiveness can lead to severe impairments in cognitive, physical, and psychosocial development
Action	No intervention needed	Interventions that address the needs of caregivers combined with access to high-quality early care and education for children can be effective	Intervention to assure caregiver responsiveness and address the developmental needs of the child required as soon as possible	Intervention and removal to a stable, caring, and socially responsive environment required as soon as possible

NSCDC 2012

UNRESPONSIVE CARE AS CHILD MALTREATMENT

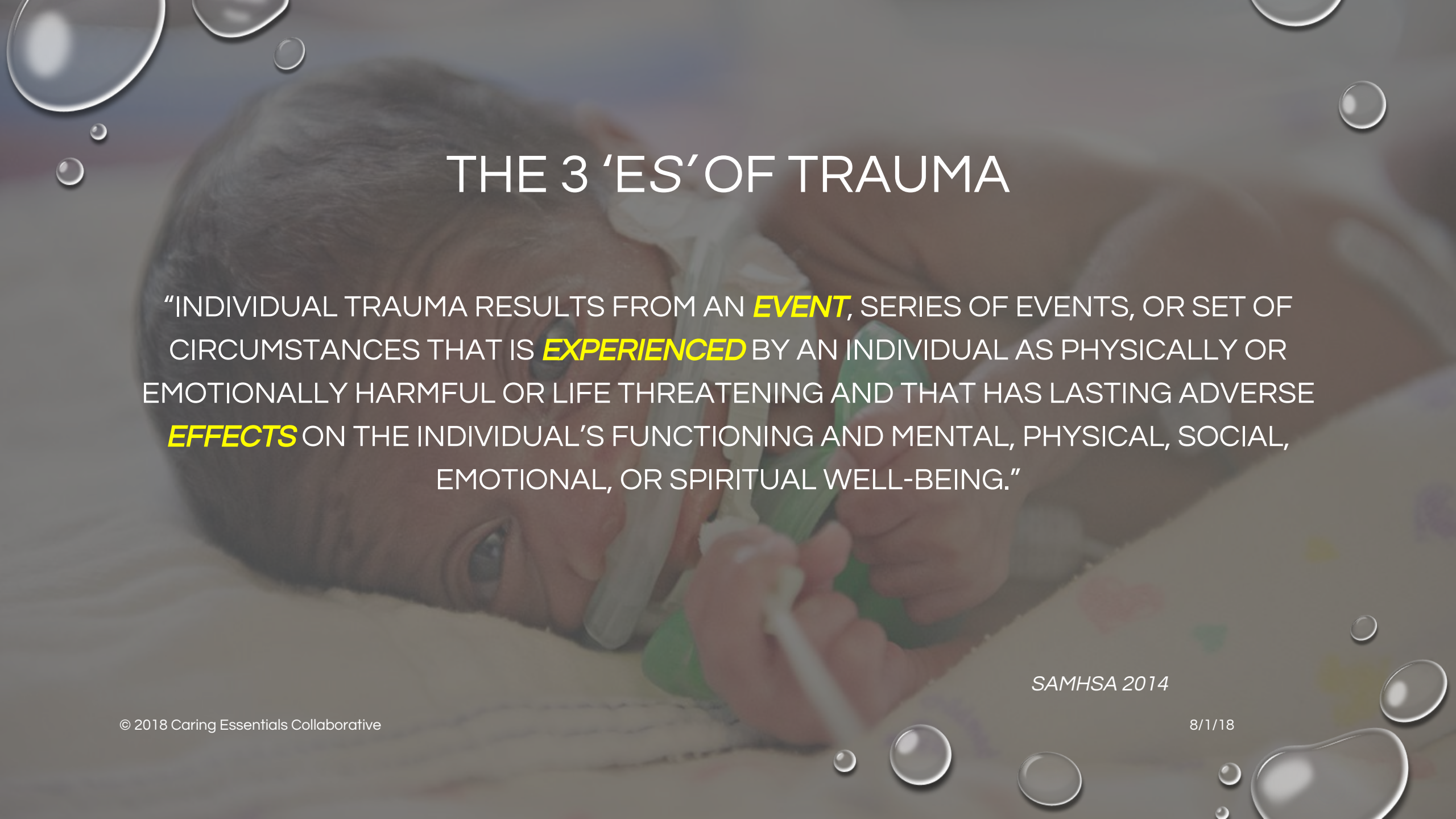
- CHILD MALTREATMENT IS ANY ACT OR SERIES OF ACTS OF COMMISSION OR OMISSION BY A PARENT OR OTHER CAREGIVER THAT RESULTS IN HARM, POTENTIAL FOR HARM, OR THREAT OF HARM TO A CHILD.
- ACTS OF OMISSION ARE THE FAILURE TO PROVIDE FOR A CHILD'S BASIC NEEDS OR TO PROTECT A CHILD FROM HARM OR POTENTIAL HARM *EVEN THOUGH HARM MIGHT NOT BE THE INTENDED CONSEQUENCE.*

https://www.cdc.gov/violenceprevention/childabuseandneglect/definitions.html



WHAT IS TRAUMA?

- *A TRAUMATIC EVENT IS AN EXPERIENCE THAT CAUSES PHYSICAL, EMOTIONAL, PSYCHOLOGICAL DISTRESS, OR HARM. IT IS AN EVENT THAT IS PERCEIVED AND EXPERIENCED AS A THREAT TO ONE'S SAFETY OR TO THE STABILITY OF ONE'S WORLD. IT INVOLVES A SINGLE EXPERIENCE, OR AN ENDURING OR REPEATING EVENT(S) THAT COMPLETELY OVERWHELM THE INDIVIDUAL'S ABILITY TO COPE OR INTEGRATE THE IDEAS AND EMOTIONS INVOLVED WITH THAT EXPERIENCE.*
- *TRAUMATIC EXPERIENCES CAN BE DEHUMANIZING, SHOCKING OR TERRIFYING, SINGULAR OR MULTIPLE COMPOUNDING EVENTS OVER TIME, AND OFTEN INCLUDE BETRAYAL OF A TRUSTED PERSON OR INSTITUTION AND A LOSS OF SAFETY. TRAUMA CAN RESULT FROM EXPERIENCES THAT INDUCE POWERLESSNESS, FEAR, RECURRENT HOPELESSNESS, AND A CONSTANT STATE OF ALERT.*



THE 3 'ES' OF TRAUMA

"INDIVIDUAL TRAUMA RESULTS FROM AN ***EVENT***, SERIES OF EVENTS, OR SET OF CIRCUMSTANCES THAT IS ***EXPERIENCED*** BY AN INDIVIDUAL AS PHYSICALLY OR EMOTIONALLY HARMFUL OR LIFE THREATENING AND THAT HAS LASTING ADVERSE ***EFFECTS*** ON THE INDIVIDUAL'S FUNCTIONING AND MENTAL, PHYSICAL, SOCIAL, EMOTIONAL, OR SPIRITUAL WELL-BEING."

SAMHSA 2014

EXAMPLES OF INFANT TRAUMA IN THE NICU

- Maternal deprivation / separation
- Unmanaged / undermanaged pain
- Social isolation
- Overriding behavioral expressions of distress
- Sleep fragmentation / deprivation

INFANT OUTCOMES ASSOCIATED WITH TOXIC STRESS

- IT IS ESTIMATED THAT 50-70% OF INFANTS BORN PRETERM DEVELOP BEHAVIOR PROBLEMS INCLUDING INTERNALIZING AND EXTERNALIZING PROBLEMS AND SYMPTOMS OF ATTENTION DEFICIT/HYPERACTIVITY DISORDER (ADHD)
- INFANTS HOSPITALIZED FOR CHD INCREASE THEIR RISK FOR NEURODEVELOPMENTAL COMPROMISE IF THEIR POSTOP LOS IS > 2 WEEKS

Vanderbilt & Gleason 2011; Marino et al 2012

- ↑ RISK OF VIOLENT SUICIDE ATTEMPTS PATIENTS BORN PREMATURELY (OR [95%] = 2.38 [1.12–5.08] *Blasco-Fontcella et al 2012*
- ↑ RISK OF CARDIOVASCULAR DISEASE, OBESITY, AND METABOLIC SYNDROMES *Posod et al 2016; Tinnion et al 2014*
- ↑ RISK OF FIBROMYALGIA AND CENTRAL SENSITIZING SYNDROMES

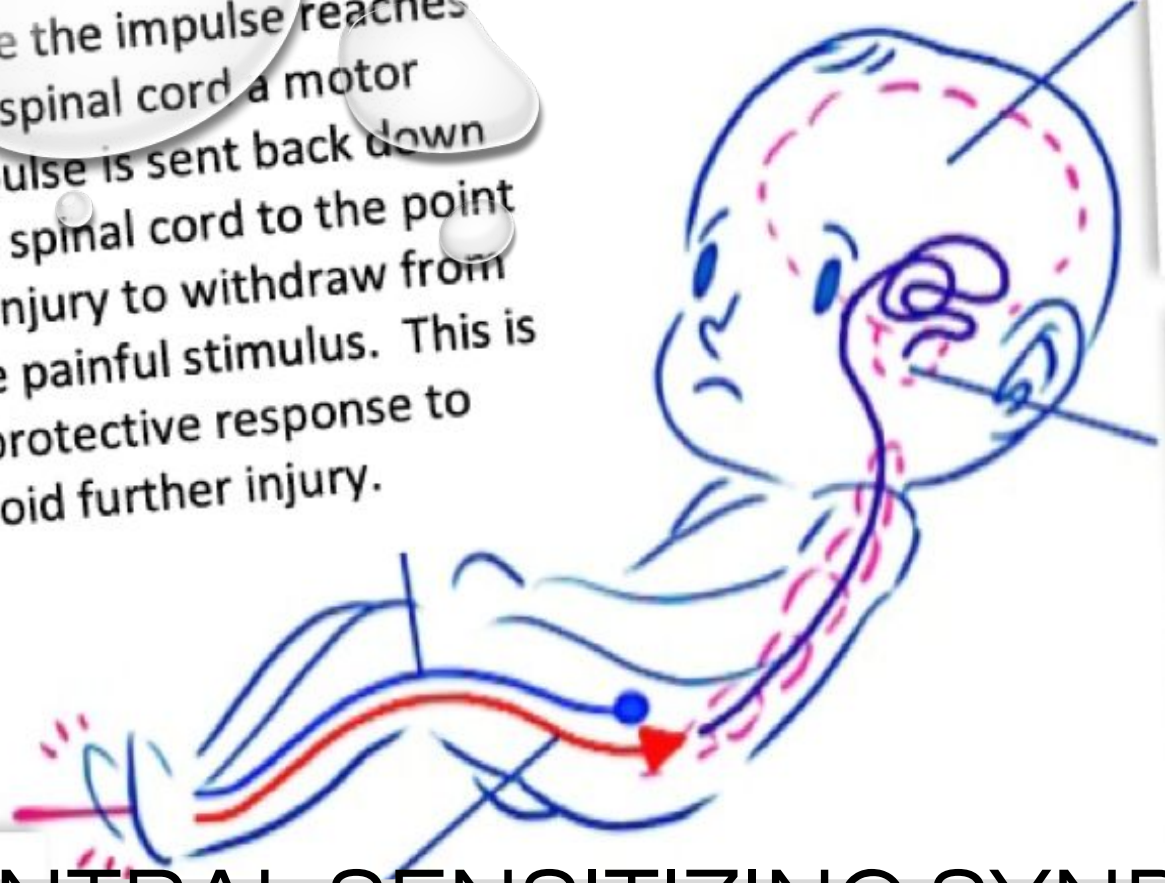
Basch et al 2015; Low & Schweinhardt 2012; Maneyapanda & Venkatasubramanian 2005

COMPARED WITH TERM BIRTHS:

- INFANTS BORN 32-36 WEEKS WERE:
  - 1.6 X MORE LIKELY TO HAVE NONAFFECTIVE PSYCHOSIS (SCHIZOPHRENIA)
  - 1.3 X MORE LIKELY TO HAVE DEPRESSIVE DISORDER
  - 2.7 X MORE LIKELY TO HAVE BIPOLAR DISORDER
- INFANT'S BORN < 32 WEEKS WERE:
  - 2.5 X MORE LIKELY TO HAVE NONAFFECTIVE PSYCHOSIS (SCHIZOPHRENIA)
  - 2.9 X MORE LIKELY TO HAVE DEPRESSIVE DISORDER
  - 7.4 X MORE LIKELY TO HAVE BIPOLAR DISORDER

Nosarti et al 2012

3. Once the impulse reaches the spinal cord a motor impulse is sent back down the spinal cord to the point of injury to withdraw from the painful stimulus. This is a protective response to avoid further injury.



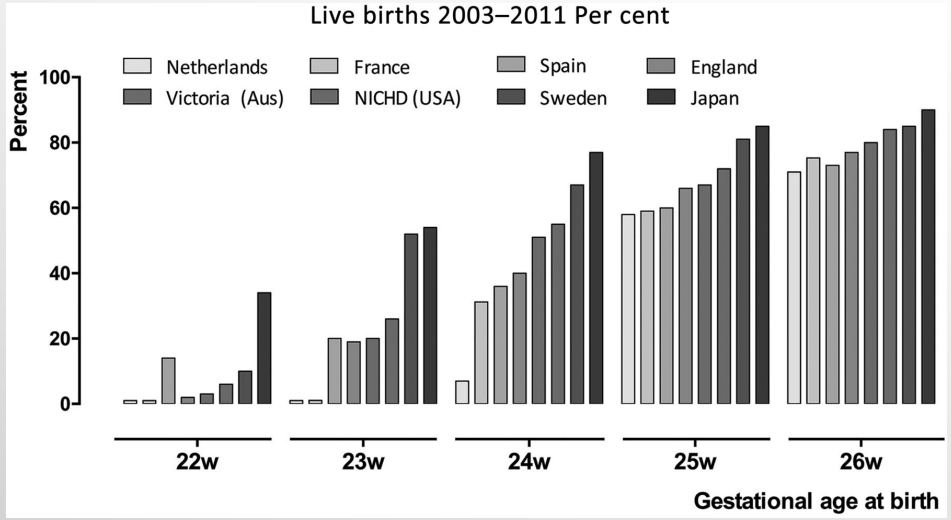
undermanaged painful experiences which effects learning, behavior and health across the lifespan.

4. Pain and stress cause an emotional response, usually fear, when appropriate pain prevention actions are not used before beginning a painful procedure. Overtime, undermanaged or unmanaged painful

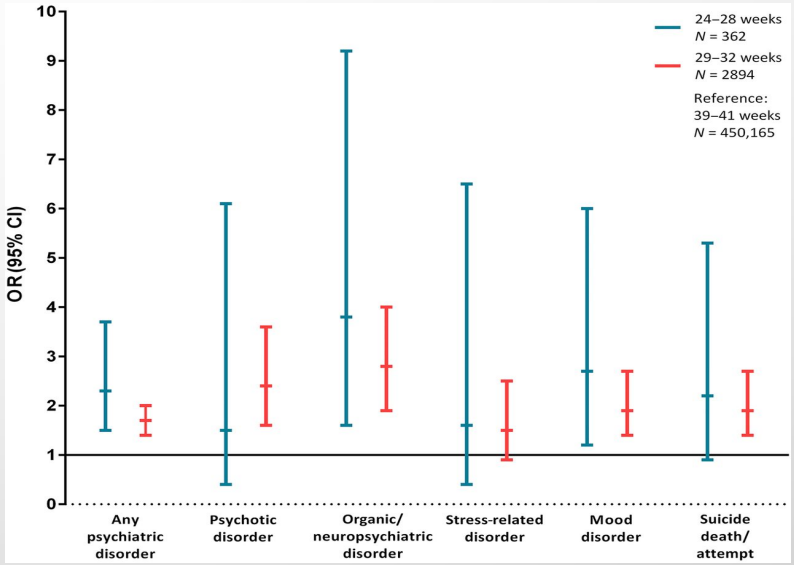
CENTRAL SENSITIZING SYNDROMES - DISTURBANCES IN PAIN PROCESSING – FEAR?

McKillop & Banez 2016

THE CASE FOR CHANGE …



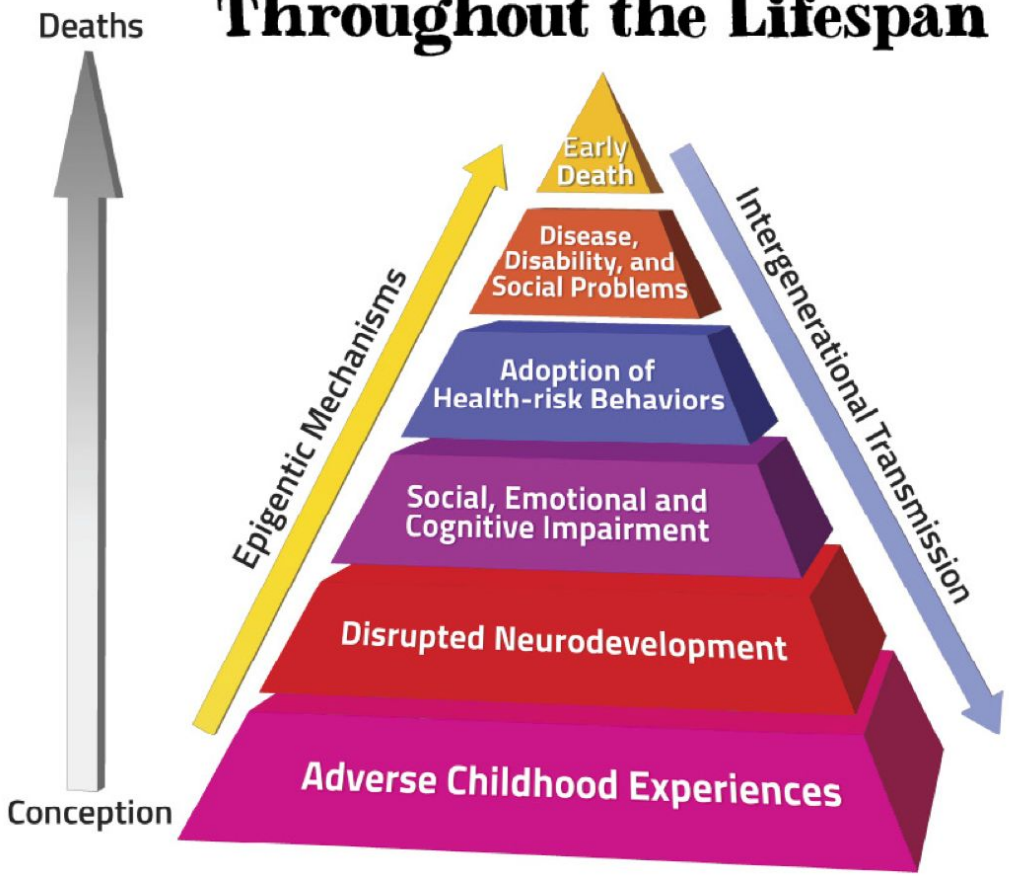
Survival of live births in large population-based studies 2003–2011.



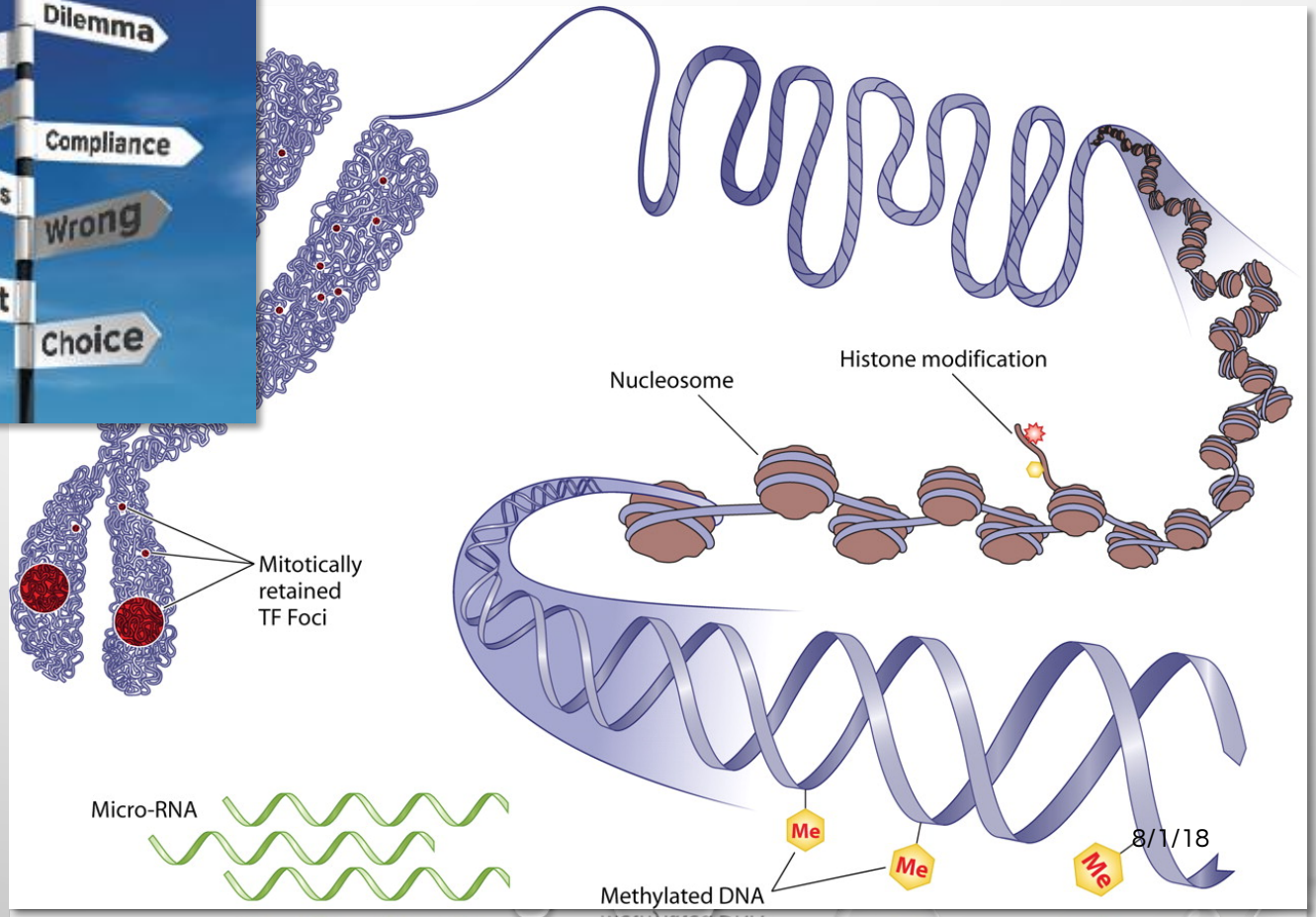
Psychiatric morbidity in adolescents and young adults born very preterm (figure created using data from Lindstrom et al64).

Samantha Johnson, and Neil Marlow Arch Dis Child 2017;102:97-102

Mechanisms by which Adverse Childhood Experiences Influence Health and Well-being Throughout the Lifespan



‘EPIGENETHICS’



Provenzi & Montirosso 2015

Rule #1

Do No Harm

American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

TECHNICAL REPORT

The Lifelong Effects of Early Childhood Adversity and Toxic Stress

THE OFFICIAL NEWSMAGAZINE OF THE AMERICAN ACADEMY OF PEDIATRICS

AAP News

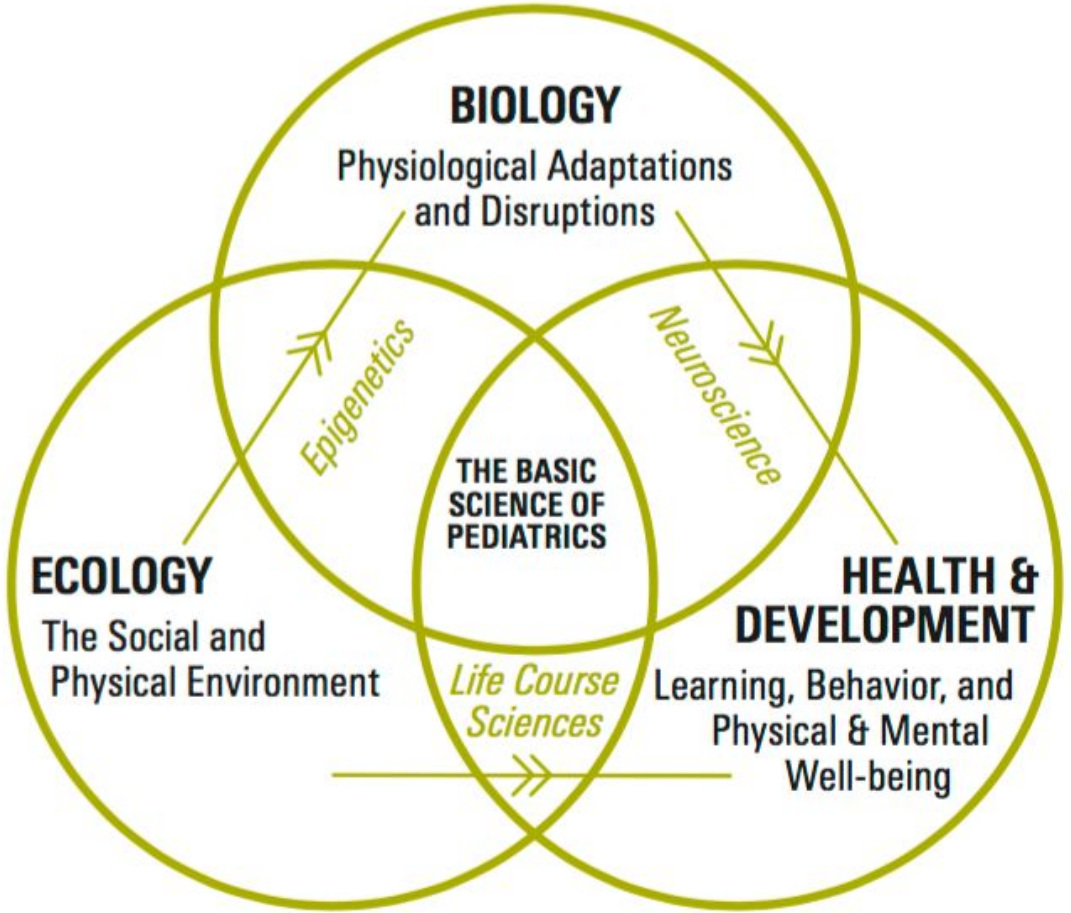
Mitigate 'toxic' stress

A new science of early childhood reveals urgency of protecting developing brains

Andrew S. Garner and Jack P. Shonkoff

AAP News 2012;33;29

DOI: 10.1542/aapnews.2012331-29



THE NEGATIVE CONSEQUENCES OF SEVERE NEGLECT CAN BE REDUCED OR REVERSED THROUGH APPROPRIATE AND TIMELY INTERVENTIONS

NSCDC 2012

8/1/18

THE THERAPEUTIC VALUE OF YOU

TRAUMA-INFORMED NEUROPROTECTION (THE 5 RS)

- ***REALIZES*** THAT TRAUMATIC EXPERIENCES INFLUENCE BIOLOGY
- ***RECOGNIZES*** THE SIGNS AND SYMPTOMS OF TRAUMA IN PATIENTS, FAMILIES AND COLLEAGUES
- ***RESPONDS*** BY FULLY INTEGRATING KNOWLEDGE AND BEST PRACTICES ABOUT TRAUMA INTO POLICIES, PROCEDURES AND PRACTICES
- ***RESISTS*** RE-TRAUMATIZATION.

SAMHSA 2014; Coughlin 2017

"IT IS AN ABSOLUTE HUMAN CERTAINTY THAT NO ONE CAN KNOW HIS OWN BEAUTY OR PERCEIVE A SENSE OF HIS OWN WORTH UNTIL IT HAS BEEN REFLECTED BACK TO HIM IN THE MIRROR OF ANOTHER LOVING, CARING HUMAN BEING."*John Joseph Powell*

OUTCOMES OF PRETERM INFANTS WHO RECEIVED HIGH QUALITY DEVELOPMENTAL CARE

- PRETERM INFANTS NURSED IN NICUS WITH HIGH INFANT CENTERED CARE PRACTICES DEMONSTRATED HIGHER ATTENTION AND REGULATION, LESS EXCITABILITY AND HYPOTONICITY AND LOWER STRESS/ABSTINENCE NNNS SCORES
- PRETERM INFANTS NURSED IN NICUS WITH HIGH INFANT PAIN MANAGEMENT PRACTICES DEMONSTRATED HIGHER ATTENTION AND AROUSAL, LOWER LETHARGY AND NONOPTIMAL REFLEXES NNNS SCORES
- VPT INFANTS WHO RECEIVED LOW QUALITY INFANT PAIN MANAGEMENT IN THE NICU DEMONSTRATED HIGHER SCORES FOR INTERNALIZING PROBLEMS AT 18 MONTHS OF AGE.
- VPT CHILDREN AT 36 MONTHS OF AGE WHO RECEIVED HIGH QUALITY DEVELOPMENTAL CARE HAD LANGUAGE TASK PERFORMANCE EQUIVALENT TO FULL-TERM CHILDREN
- VPT CHILDREN AT 60 MONTHS OF AGE WHO RECEIVED HIGH QUALITY DEVELOPMENTAL CARE HAD A BETTER HRQOL SCORE THAN INFANTS WHO RECEIVED LOW QUALITY OF DEVELOPMENTAL CARE IN THE NICU. MEAN SCORES FOR THE PHYSICAL-EMOTIONAL COMPONENT AND THE LIVELINESS COMPONENT OF THE HEALTH-RELATED QUALITY OF LIFE ASSESSMENT DEMONSTRATED STATISTICAL SIGNIFICANCE (P = 0.01, P = 0.003 RESPECTIVELY).

Montirosso et al 2012; Montirosso et al 2016; Montirosso et al 2016; Montirosso et al 2016

CORE QUALITY MEASURES FOR TRAUMA-INFORMED NEUROPROTECTIVE CARE

Coughlin et al 2009; Coughlin 2011; Coughlin 214; Coughlin 2016

PROTECTED SLEEP

1. PRACTICES THAT PROTECT SLEEP INTEGRITY AND SUPPORT CIRCADIAN/DIURNAL RHYTHMICITY ARE INTEGRATED INTO THE CULTURE OF CARE.
2. CARE STRATEGIES THAT SUPPORT INFANT SLEEP ARE IMPLEMENTED IN PARTNERSHIP WITH THE FAMILY.
3. STAFF ROLE-MODEL COMPLIANCE WITH RECOMMENDED BACK TO SLEEP SAFETY PRACTICES FOR ELIGIBLE INFANTS.

Coughlin 2016

WHAT'S THE EVIDENCE SAY?

- NICU NURSES HAVE A LOW LEVEL OF KNOWLEDGE ABOUT NEONATAL SLEEP AND SLEEP STATES
- HANDS-ON CARE IS PROVIDED REGARDLESS OF INFANT SLEEP STATE
- SAFE SLEEP PRACTICES IN THE HOSPITAL SETTING ARE INCONSISTENT AT BEST

Barsman et al 2015; Levy et al 2017; Mahmoodi et al 2015; Patton et al 2015

FAMILY COLLABORATIVE CARE

1. PARENTS ARE INTEGRAL TO THE COMPREHENSIVE CARE OF THEIR HOSPITALIZED INFANT(S).
2. ASSESSING AND SUPPORTING THE EMOTIONAL WELL-BEING OF PARENTS IS AN EXPRESSED PRIORITY.
3. COMPETENCE AND CONFIDENCE IN PARENTING SKILLS ARE MENTORED, SUPPORTED AND VALIDATED OVER THE HOSPITAL STAY.

Coughlin 2016

WHAT'S THE EVIDENCE SAY?

- PARENTS HAVE A DESIRE AND EXPECTATION TO PARTICIPATE IN THEIR CHILD'S CARE
- PARENTS LOOK TO THE CLINICIAN FOR GUIDANCE AND SUPPORT IN CARING FOR THEIR INFANT
- PARENT PRESENCE ON ROUNDS DOES NOT INCREASE NICU-RELATED STRESS
- NICU PARENTS NEED PSYCHOSOCIAL AND EMOTIONAL SUPPORT

Abdel-Latif et al 2015; Davidson 2013; Grzyb et al 2014; Purdy et al 2016

ADLS (POSTURE, FEEDING, SKIN CARE)

1. AGE-APPROPRIATE POSTURAL ALIGNMENT ENSURES COMFORT, SAFETY, PHYSIOLOGIC STABILITY AND SUPPORTS OPTIMAL NEUROMOTOR DEVELOPMENT.
2. AGE-APPROPRIATE FEEDING EXPERIENCES WILL BE PAIN & STRESS FREE, INDIVIDUALIZED, INFANT DRIVEN, AND NURTURING.
3. AGE-APPROPRIATE SKIN CARE ROUTINES AND SKIN PROTECTIVE MEASURES PRESERVE BARRIER FUNCTION AND TISSUE INTEGRITY.

Coughlin 2016

WHAT'S THE EVIDENCE SAY?

- PRONE POSITION APPEARS TO COMPROMISE CO, PERFUSION AND INCREASE SVR.
- CHANGING POSITION A QUARTER TURN FROM PRONE IMPROVES RESPIRATORY FUNCTION.
- MISSING ORAL FEEDING ENCOUNTERS WHEN INFANTS EXHIBIT FEEDING READINESS BEHAVIORS EXTENDS LOS AND DAYS TO FULL FEEDS.
- BEST PRACTICES IN ORAL FEEDING PROGRESSION IS TO INTRODUCE ORAL FEEDINGS AT 34 WEEKS AND OFFER ORAL FEEDINGS WITH EACH FEEDING ENCOUNTER
- SWADDLED BATHING IS SIGNIFICANTLY LESS STRESSFUL AND PROVIDES BETTER THERMAL STABILITY THAN CONVENTIONAL BATHING
- PROVIDING ORAL CARE WITH MOTHER'S OWN MILK HAS BEEN ASSOCIATED WITH DECREASED INFECTION AND INCIDENCE OF SEPSIS AS WELL AS AN INCREASE IN WEIGHT GAIN.

Ma et al 2015; Montgomery et al 2014; Tubbs-Cooley et al 2015; Edraki et al 2014; Gephart & Weller 2014

PAIN & STRESS

1. PREVENTION OF PAIN & STRESS IS AN EXPRESSED GOAL IN THE DAILY MANAGEMENT OF THE HOSPITALIZED INFANT.
2. PAIN AND/OR STRESS IS ASSESSED, MANAGED, AND REASSESSED BEFORE, DURING, AND AFTER ALL PROCEDURES UNTIL THE INFANT RETURNS TO HIS OR HER BASELINE LEVEL OF COMFORT; INTERVENTIONS AND INFANT RESPONSES TO STRESS-RELIEVING AND PAIN-MANAGEMENT INTERVENTIONS ARE DOCUMENTED
3. FAMILY IS INVOLVED, INFORMED AND PARTICIPATES IN THE PAIN AND STRESS MANAGEMENT OF THEIR HOSPITALIZED INFANT(S); ALL PARTICIPATION AND OBSERVATIONS ARE DOCUMENTED

Coughlin 2016

WHAT'S THE EVIDENCE SAY?

- UNMANAGED / UNDERMANAGED PAIN IN THE NEONATAL POPULATION IMPACT THE PHYSIOLOGIC, BEHAVIORAL, AND COGNITIVE INTEGRITY OF THE DEVELOPING HUMAN
- AVERAGE NUMBER OF PAINFUL PROCEDURES PER DAY IN THE NICU RANGES BETWEEN 7.5 AND 17.3 AND 50-100% OF THESE ARE UNMANAGED!
- PARENTS WANT INFORMATION ABOUT NEONATAL PAIN AND PAIN MANAGEMENT IN THE NICU SOONER THAN LATER IN THE NICU.

Cruz et al 2016; Hall & Anand 2014; Franck et al 2012

THE HEALING ENVIRONMENT

1. THE PHYSICAL ENVIRONMENT IS A SOOTHING, SPACIOUS, AND AESTHETICALLY PLEASING SPACE THAT IS CONDUCIVE TO REST, HEALING, AND ESTABLISHING THERAPEUTIC RELATIONSHIPS.
2. THE HUMAN ENVIRONMENT EMANATES TEAMWORK, MINDFULNESS, AND CARING.
3. THE ORGANIZATIONAL ENVIRONMENT REFLECTS A JUST CULTURE* COMMITTED TO SAFETY.

**THE JUST CULTURE IS A LEARNING CULTURE THAT IS CONSTANTLY IMPROVING AND ORIENTED TOWARD PATIENT SAFETY.*

Coughlin 2016

(BOYSEN 2013)

WHAT'S THE EVIDENCE SAY?

- HOSPITAL BASED ENVIRONMENTAL EXPOSURES THREATENS THE NEURODEVELOPMENTAL AND HEALTH OUTCOMES OF THE INDIVIDUALS SERVED IN THE NICU.
- INTERPROFESSIONAL COLLABORATION IMPROVES PATIENT OUTCOMES.
- STANDARDS OF CARE MAINTAIN CONSISTENCY IN PRACTICE AND SET EXPECTATIONS FOR PERFORMANCE GUIDED BY EVIDENCE.

Santos et al 2015 Martin et al 2010; Golec 2009

"TO THE WORLD YOU MAY BE ONE PERSON; BUT TO ONE PERSON YOU MAY BE THE WORLD"

- Dr. Seuss

REFERENCES

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