The Problem: Postpartum Depression

Mother:
- Substance Abuse
- Loss of Employment
- Divorce
- Risk for Development of Later Psychopathology
- Suicide and Infanticide

Dysregulated Mother-Child Interaction

Child:
- Less optimal cognitive development
- Decreased social engagement
- Disrupted behavioral and stress regulation
- Altered brain development
- Psychopathology
Early detection of those at risk for PPD is essential

Focus on prenatal endocrine predictors

Role of lactation and breastfeeding
Study Design

Participants: 205 mothers, >18, English-speaking, non-smoking, singleton pregnancy, absence of medical condition that deregulates neuroendocrine function, 70% White, 15% Latina, 10% Asian

Measures: CES-D in pregnancy, EPDS postpartum; breastfeeding frequency, breastfeeding vs. breast-pumping

Analyses: Multilevel Modeling

Covariates: Depression in pregnancy, age, income, work outside the home, marital status, Latina ethnicity, preterm birth, social support

Hahn-Holbrook, Haselton, Dunkel Schetter, & Glynn (2013) Archives of Women’s Mental Health
Depression

Less Breastfeeding?
Prenatal Depression Predicts Breastfeeding

Prenatal depression predicted less breastfeeding at 3 months postpartum

Hahn-Holbrook, Haselton, Dunkel Schetter, & Glynn (2013) *Archives of Women’s Mental Health*
Prenatal Depression Predicts Breastfeeding

A similar effect emerged for breastfeeding frequency

Hahn-Holbrook, Haselton, Dunkel Schetter, & Glynn (2013) *Archives of Women’s Mental Health*
Breastfeeding → Less Depression?
Breastfeeding Frequency at 3-months Predicts Depressive Symptoms

Hahn-Holbrook, Haselton, Dunkel Schetter, & Glynn (2013) Archives of Women’s Mental Health
Breastfeeding Frequency at 3-months Predicts Depressive Symptoms

Hahn-Holbrook, Haselton, Dunkel Schetter, & Glynn (2013) Archives of Women’s Mental Health
Mode of Breast Milk Expression

Lower Rates of Depression 1 & 2 years after Birth

Hahn-Holbrook, Haselton, Dunkel Schetter, & Glynn (2013) Archives of Women’s Mental Health
Bidirectional Relationship

Depression
Breastfeeding
Potential Mediators

• Direct Pathways
  – Less stress (Mezzacappa, 2004)
  – Breastfeeding hormones?
  – Maternal programming? (Glynn, 2010)
  – Maternal bonding
  – Maternal physical health (see Bernier, Plu-Bureau, Bossard, Ayzac, & Thalabard, 2000; Rea, 2004, Stuebe & Rich-Edwards, 2009, for reviews)

• Indirect Infant-Mediated Pathways
  – Breastfeeding improves infant health (see Kramer et al., 2008; Kramer et al., 2001, for reviews)
  – “Easier” infant temperaments? (Jones, McFall, & Diego, 2004)
Birth Phenotype Predicts Disease in Adulthood

- Coronary artery disease
- Hypertension
- Diabetes
- Impaired pulmonary function/Asthma
- Endocrine cancers
- Osteoporosis
- Obesity
Birth Phenotype Predicts Child and Adult Psychopathology

- Autism
- ADHD
- Affective disorders/Suicide
- Schizophrenia
Fetal Programming

- Prenatal environment
- Birth phenotype
- Child and adult health/disease
Does milk serve to extend the endocrine communication between mother and offspring into the postpartum period?
Benefits of Breastfeeding

- ↓ infectious diseases
- ↓ type 1 and type 2 diabetes
- ↓ certain cancers
- ↓ overweight and obesity
- ↓ asthma
- ↓ SIDS
- ↓ postneonatal infant mortality
- ↑ cognitive development

From the American Academy of Pediatrics Policy Statement on Breastfeeding
Benefits of Breastfeeding

❖ Human milk may serve as a means of biochemical communication between mother and infant

❖ Breast milk contains a wide variety of biologically active hormones, including glucocorticoids (GCs)
Glucocorticoids in Milk

- GCs in milk aid in the maturation of the intestinal barrier
- Other possible effects?
Rodent Models of GC Exposure in Milk

- GC levels in nursing dams were increased by the addition of labeled corticosterone in the drinking water
- Increased GC levels in the milk
- Labeled GC’s readily absorbed by the sucklings
  - Gastric content
  - Plasma
  - Brain
- Exposure to the GCs in drinking water did not affect maternal behavior

Angelucci, et al., 1985, Neurobehavioral Toxicology and Teratology
Rodent Models of GC Exposure in Milk

- GC-nursed offspring:
  - ↑ Spatial learning
  - ↑ Conditioned-avoidance learning
  - ↓ Fear behavior
  - ↓ Corticosterone response to stress
  - ↑ Hippocampal GC receptor density

*Catalani et al., 1993, Brain Research*
*Casolini et al., 1997, Neuroscience*
*Catalani et al., 2000, Neuroscience*
What is the relation between milk cortisol and infant temperament?
Milk GCs and Infant Temperament

Participants

- Group 1: 187 breastfed 2-month-old infants and their mothers.
- Group 2: 75 formula-fed 2-month-old infants and their mothers.

Procedure

- Mothers completed the fear subscale of the Infant Behavior Questionnaire (IBQ).
- Blood was drawn from the mother to determine cortisol levels.
- Plasma cortisol was used as a proxy measure for cortisol levels in breast milk.
- Plasma cortisol levels are correlated in the .6 to .7 range with breast milk cortisol (Patacchioli et al., 1992).
Negative Affectivity

- **Sadness**: “Did the baby seem sad when the caregiver was gone for an unusually long period of time?”
- **Distress to Limitations**: “When placed on his/her back, how often did the baby fuss or protest?”
- **Fear**: “How often during the last week did the baby startle to a sudden or loud noise?”
- **Falling Reactivity/Recovery from Distress**: “When frustrated with something, how often did the baby calm down within 5 minutes?”
Do cortisol levels predict infant fear in the breastfed, but not in the formula-fed infants?
Milk GCs and Infant Temperament

- Among the breastfed infants, maternal report of increased infant fear was associated with higher maternal cortisol ($r = .2$, $p < .05$).

- No relation was found in the formula-fed infants ($r = -.04$, $p = .67$).

- Using the null hypothesis test for the difference between two correlations (Cohen et al. 2003), the correlations were confirmed to be significantly different ($z = 3.08; p < .05$).

- The size of the relation was unaffected and remained statistically significant after adjusting for concurrent ratings of maternal depression, state anxiety and perceived stress.

Glynn et al., 2008, Early Human Development
Milk GCs and Infant Temperament

Participants

- 73 three-month-old infants and their mothers.
  - 48 breastfed and 25 formula-fed

Procedure

- Milk was collected from the breastfeeding mothers and assayed to determine cortisol levels.
- Saliva was collected from all mothers and assayed to determine cortisol levels.
- The mothers completed the IBQ to assess temperament.

Grey et al., 2013, Psychoneuroendocrinology
Milk GCs and Infant Temperament

- The Negative Affectivity dimension of the IBQ was positively associated with breast milk cortisol levels.

- No relation was found between cortisol levels and the Orienting/Regulation or Surgency/Extraversion dimensions of the IBQ (both p’s > .15).

- No relation was found between maternal cortisol and any of the dimensions of the IBQ among formula-fed infants (all p’s > .41).

Grey et al., 2013, *Psychoneuroendocrinology*
Milk GCs and Obesity Risk

- Nearly 17% of the children in the US are obese before the age of 9

- GCs play a central role in programming and maintenance of metabolic processes

- Non-human primate models suggest that GCs may be involved in regulating postnatal growth
Milk GCs and Obesity Risk

- 51 breastfeeding mothers and their children (all born full term)
- Milk samples collected at 3 months postpartum
- Infant length and weight collected at 3, 6, 12 and 24 months of age
- Child BMI percentiles calculated using WHO standards

Hahn-Holbrook et al., 2011, Under Review
Milk GCs and Obesity Risk

Milk Cortisol Predicts BMI Percentile

Hahn-Holbrook et al., 2011, *Under Review*
Biochemical components in breast milk may represent one avenue through which the mother shapes the development of the human infant during the postnatal period.

The physiological communication during the prenatal period may be extended into the postpartum period through biological messages contained in breast milk.
Biological Components of Milk: The Big Question