

Why Breastfeeding Prevents Maternal Metabolic Syndrome and CVD

The Psychoneuroimmunology of Human Lactation



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Schwartz et al., *Obstet Gyn* 2009;
113: 974-982

- Study of 139,681 postmenopausal women (Mean age=63)
- Lifetime history of lactation of more than 12 months related to lower
 - Hypertension
 - Diabetes
 - Hyperlipidemia
 - Cardiovascular disease

- 20-year longitudinal study of 704 women enrolled during their first pregnancy (CARDIA study)
- Women without gestational diabetes who had breastfed for at least one month had a 56% reduced risk for metabolic syndrome
- 86% reduction in risk for women with GDM



Gunderson et al.
Diabetes 2010; 59: 495-504

- Cohort analysis of 2,516 parous, midlife women (SWAN study)
- Increased breastfeeding duration lowered prevalence of metabolic syndrome in a dose-response way



Ram et al., *Am J Obstet Gynecol*
2008; 198:268e1-268e6

- Duration of lactation inversely correlated with:
 - Current BMI
 - Waist circumference
 - Blood pressure
 - Fasting glucose
 - Insulin
 - Triglycerides
 - Total and LDL cholesterol



Ram et al., *Am J Obstet Gynecol*
2008; 198:268e1-268e6

- 85,585 and 73,418 parous women (Nurses' Health Study I & II; Mean age=50)
- Longer duration of lactation reduced risk of Type-2 diabetes
- Each additional year decreased risk by 15%
 - Independent of BMI, diet, exercise or smoking
- Did not decrease risk for women with gestational diabetes

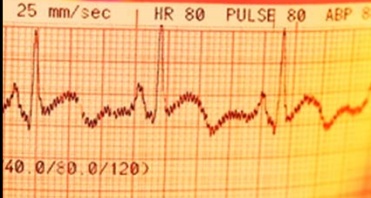


Stuebe et al., *JAMA* 2005; 294:2601-2610




- Exclusive breastfeeding associated with greatest reduction in risk
- Longer duration per pregnancy resulted in greater benefit

Stuebe et al., JAMA 2005; 294:2601-2610




- Sustained lactation-associated metabolic changes have may profound effects on diabetes risk
 - May induce long-term changes in the HPA axis

Stuebe et al., JAMA 2005; 294:2601-2610



- Metabolic syndrome is the precursor syndrome to Type-2 diabetes
- Cluster of symptoms
 - Insulin resistance
 - High LDL and VLDL cholesterol
 - High triglycerides
 - Visceral obesity
- These symptoms also increase the risk of cardiovascular disease


Haffner & Taegtmeier, *Circulation* 2003; 108: 1541-1545




- 12-year cohort study of women who gave birth 1994-1998, Ontario, Canada
- Women with either gestational diabetes or an abnormal glucose tolerance test had increased cardiovascular risk

Retnakaran & Shah, *CMAJ* 2009; 181: 371-376

- Why would breastfeeding lower risk?
 - Some proposed mechanisms



- Lactation creates "metabolic drain" that alters energy homeostasis
 - Increases HDL levels
 - Decreases triglycerides
 - Improves insulin sensitivity




Ram et al., *Am J Obstet Gynecol* 2008; 198:268e1-268e6



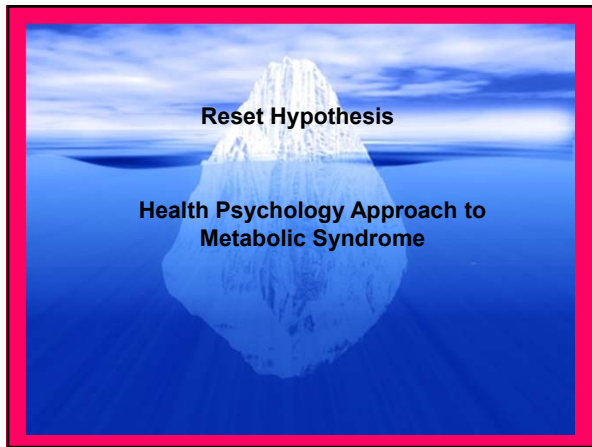
- **Reset hypothesis**
- **During gestation**
 - Visceral fat accumulates
 - Insulin resistance increases
 - Lipid and triglyceride levels increase
- **Breastfeeding helps reverse, or reset, these changes**
- **For maternal metabolism, pregnancy ends with weaning, not birth**

Stuebe & Rich-Edwards, *Am J Perinatol* 2009; 26: 81-88



- **“Lactation may prime the metabolic system by making it a more energy-efficient machine”**

Ram et al., *Am J Obstet Gynecol* 2008; 198:268e1-268e6



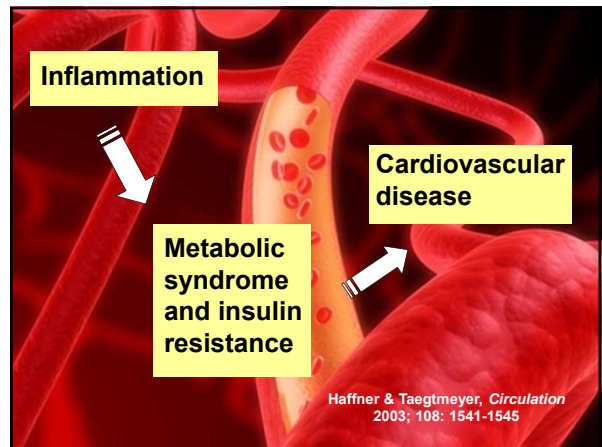
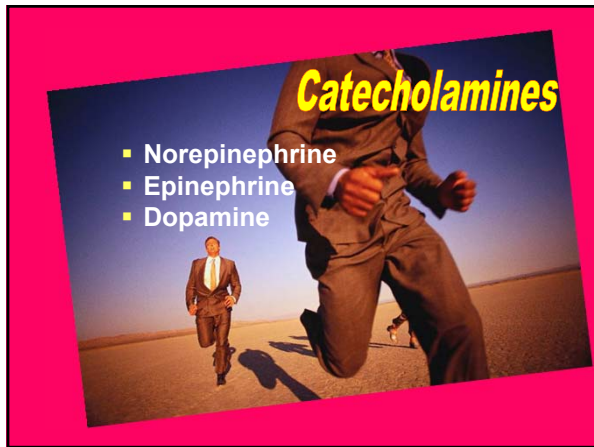
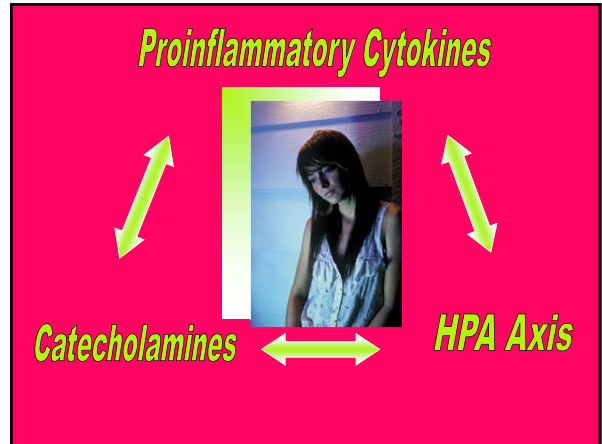
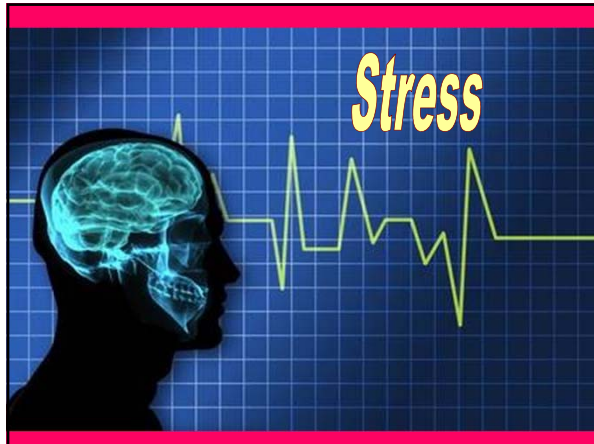
Reset Hypothesis

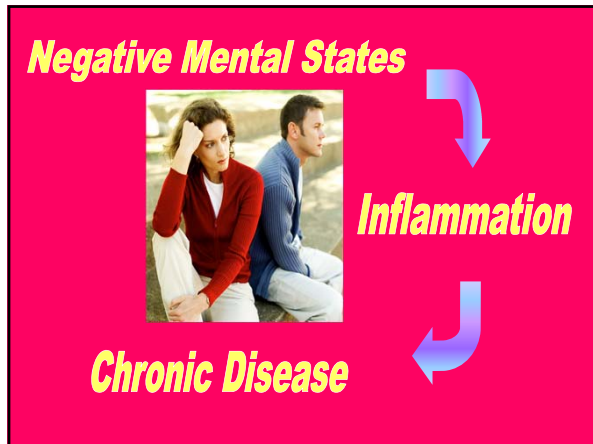
Health Psychology Approach to Metabolic Syndrome



Psychoneuroimmunology (PNI)





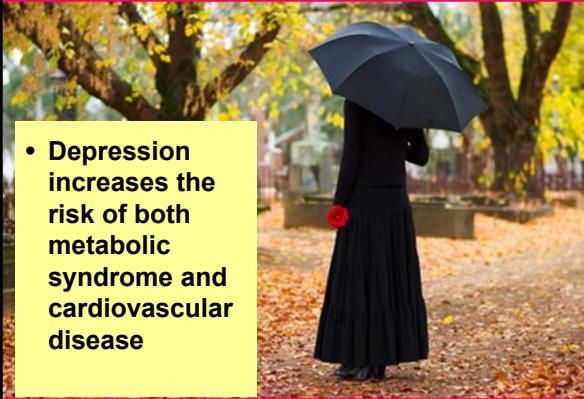

- Chronic stress, depression and hostility increases the risk of:
 - Coronary heart disease
 - Myocardial infarction
 - Metabolic syndrome and diabetes
 - Neurodegenerative diseases

Kiecolt-Glaser et al., *Arch Gen Psychiatry* 2005, 62, 1377-1384;
Wilson et al., *J Am Geriatrics Soc* 2002, 50, 2041-2056




Negative mental states upregulate stress

- Depression
- Hostility
- Perceived low social status



- Depression increases the risk of both metabolic syndrome and cardiovascular disease



- 921 men and women from Finland
- In women, depressive symptoms associated with increased risk of metabolic syndrome
- Metabolic syndrome in childhood predicted higher depressive symptoms in adulthood

Pulkki-Raback et al., *Health Psychol* 2009; 28; 108-116




- Hostility also increases risk of metabolic syndrome and heart disease

- Hostile people are more prone to ischemia and constriction of coronary arteries when under stress
- Trait hostility predicted new coronary events
- And sped up the progression of CHD in patients who already have it




- 3-year study of 134 white and African American teens
- Hostility at T1 predicted at least 2 risk factors for metabolic syndrome at 75th percentile for age, gender and race
 - BMI, insulin resistance, ratio of triglycerides to HDL cholesterol, and arterial blood pressure




Raikkonen et al. *Health Psych* 2003; 22: 279-286.

- Prospective study of 135 patients with no symptoms of diabetes (75 men, 60 women)
- Women with higher levels of depression and hostility had higher fasting insulin, glucose & insulin resistance
 - Independent of BMI, age, fasting triglycerides, exercise, or ethnicity



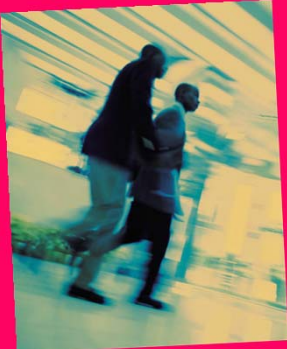
Suarez, *Health Psych* 2006; 25: 484-492.

- Marital hostility increased systemic inflammation
- Hostility also impaired wound healing
 - High-hostile couples had 60% slower wound healing



Kiecolt-Glaser et al., *Arch Gen Psychiatry* 2005, 62: 1377-1384

- Women in unsatisfying marriages had an increase in cardiovascular risk over 13-year study
 - Related to low HDL, high triglycerides, BMI, blood pressure, depression and anger



Gallo et al., *Health Psych* 2003, 22: 453-463

Social stress

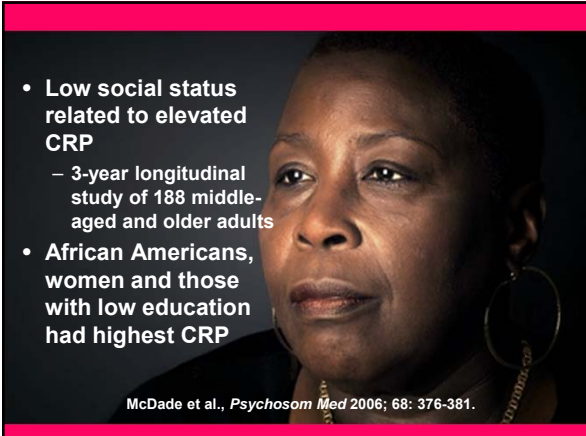


- **Low social status related to vascular inflammation**
 - ET-1, sICAM
- **Effects independent of hypertension status or ethnicity**




Hong et al., *Psychosom Med* 2006; 68: 517-523.

- **Low social status related to elevated CRP**
 - 3-year longitudinal study of 188 middle-aged and older adults
- **African Americans, women and those with low education had highest CRP**



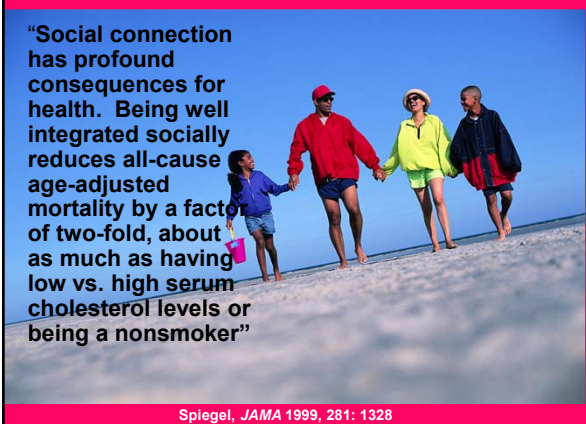
McDade et al., *Psychosom Med* 2006; 68: 376-381.

- **Low parental education predicted metabolic and CVD risk factors in high school students**
 - Higher insulin levels
 - Higher glucose
 - Greater insulin resistance
 - Higher-LDL, lower HDL
 - Higher waist circumference
 - Higher BMI



Goodman et al., *Psychosom Med* 2005; 67: 9-15.

“Social connection has profound consequences for health. Being well integrated socially reduces all-cause age-adjusted mortality by a factor of two-fold, about as much as having low vs. high serum cholesterol levels or being a nonsmoker”




Spiegel, *JAMA* 1999, 281: 1328

Sleep



- **Sleep problems increase the risk of metabolic syndrome and heart disease**

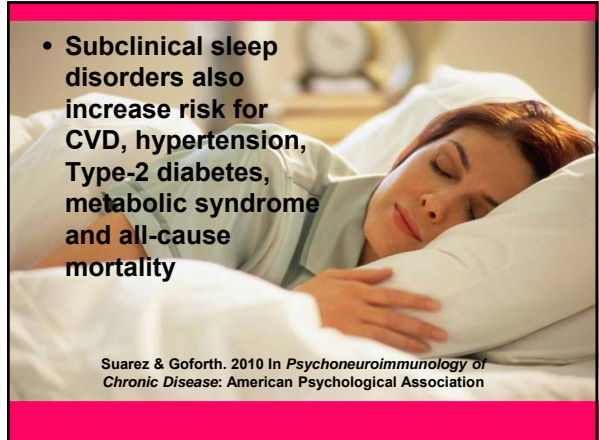


- Sleep disorders, such as primary insomnia and obstructive sleep apnea, increase inflammatory markers, such as CRP, IL-6 and TNF- α



Suarez & Goforth. 2010 In *Psychoneuroimmunology of Chronic Disease*: American Psychological Association

- Subclinical sleep disorders also increase risk for CVD, hypertension, Type-2 diabetes, metabolic syndrome and all-cause mortality



Suarez & Goforth. 2010 In *Psychoneuroimmunology of Chronic Disease*: American Psychological Association

- Even short periods of sleep deprivation can elevate cortisol and glucose levels, and increase insulin resistance



McEwen, *Biological Psychiatry* 2003; 54: 200-207.

- Disturbed sleep also increases the risk of depression and obesity



- Sleep parameters
 - Sleep latency (minutes it takes to get to sleep)
 - Sleep efficiency (time spent sleeping minus total time in bed)
 - REM latency (time it takes to enter REM from sleep onset)
 - Minutes or percentage of low-wave sleep (SWS)

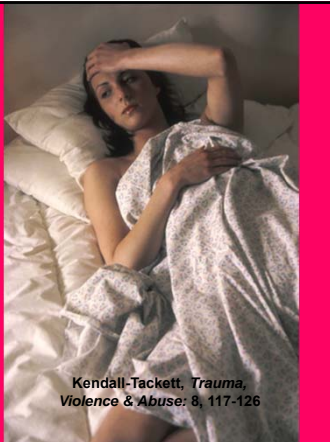


- Meta-analysis of sleep duration and obesity (36 studies, N=634,511)
- Children and adults
- Short sleep duration (< 5 hours) related to obesity worldwide



Cappuccio et al. *Sleep* 2008: 31; 619-626

- Poor sleep quality and depression are mutually maintaining



Kendall-Tackett, *Trauma, Violence & Abuse*; 8, 117-126

- Insomnia significantly increases the risk for new-onset depression and anxiety disorders
- Sleep disturbances are among the most common symptoms of psychiatric disorders



Ross et al. *J Neurosci Psychiatry* 2005; 30: 247-256

- General population study in Japan (N=24,686)
- Sleep duration <6 hours or >8 had highest rates of depression
- Sleep duration 6-8 hours had lowest rates



Kaneita et al. *J Clin Psychiatry* 2006; 67: 196-203

- Sleep of <4 hours between midnight and 6 a.m. and daytime naps <60 min associated with depression at 3 months
- Problems falling asleep and excessive daytime sleepiness strongest predictors



Goyal et al., *Arch Womens Ment Health* 2009; 12: 229-237

Trauma



JAMA®

Neuroscience, Molecular Biology, and the Childhood Roots of Health Disparities: Building a New Framework for Health Promotion and Disease Prevention

Jack P. Shonkoff; W. Thomas Boyce; Bruce S. McEwen *JAMA*. 2009;301(21):2252-2259

“Adult disease prevention begins with reducing early toxic stress”



“An increasing amount of research in neuroscience, social epidemiology, and the behavioral sciences suggests that a reduction in the number and severity of early adverse experiences will lead to a decrease in the prevalence of a wide range of health problems.”



Adverse Childhood Experiences (ACE) include:

- Child Sexual Abuse
- Child Physical Abuse
- Child Emotional Abuse
- Witnessing Intimate Partner Violence
- Parental substance abuse
- Parental criminal activity
- Parental mental illness
- Parental divorce



Adverse Childhood Experiences (ACEs) are related to the leading causes of premature mortality and preventable death in adults

Felitti et al., *Am J Prev Med* 1998

Patients with 4 or more ACEs had higher rates of:


- Ischemic heart disease
- Cancer
- Stroke
- Chronic bronchitis
- Emphysema
- Diabetes
- Skeletal fractures
- Hepatitis



- **Nine-fold increase in risk of cardiovascular disease in women maltreated as children in the National Comorbidity Study**




Batten et al. *J of Clinical Psychiatry* 2004, 65: 249-254



- Dunedin Multidisciplinary Health and Development Study (N=1,037)
- Independent effect of childhood maltreatment on C-reactive protein 20 years later
- White blood cell count and fibrinogen also elevated
- Dose-response effect of severity of abuse on inflammation


Danese et al., *Proc Nat Acad Sci U S A* 2007;104(4), 1319-1324



- Dunedin Multidisciplinary Health and Development (N=1,037)
- At 32 years, those who experienced adverse childhood experiences (low SES, maltreatment or social isolation) had higher rates of:
 - Major depression
 - Systemic inflammation
 - Having at least 3 metabolic risk markers

Danese et al. *Arch Ped Adolesc Med* 2009; 163: 1135-1143.

- Study of 4,641 middle-aged women (Mean age=52 years)
- Childhood physical and sexual abuse doubled the odds of both depression and obesity



Rohde et al., *Child Abuse Negl* 2008; 32; 878-887

Survey of Mothers' Sleep and Fatigue

Kendall-Tackett & Hale

- Online survey of 6,410 mothers with infants aged 0-12 months (Mean infant age=6.96 months)



Survey of Mothers' Sleep and Fatigue Full Sample (N=6,410)

- Hit or slapped hard enough to leave a mark 34%
- Raped as teen or adult 13%
- Contact child sexual abuse 25%
- Parent depressed 36%
- Parent hit, bitten or kicked 16%
- Parental substance abuse 32%

Comparison of three groups

- 0: No rape as a child (CSA) or as teen or adult (N=5044)
- 1: 1-type: CSA or teen/adult rape (N=857)
- 2: 2-types: Child sexual abuse and rape (N=137)

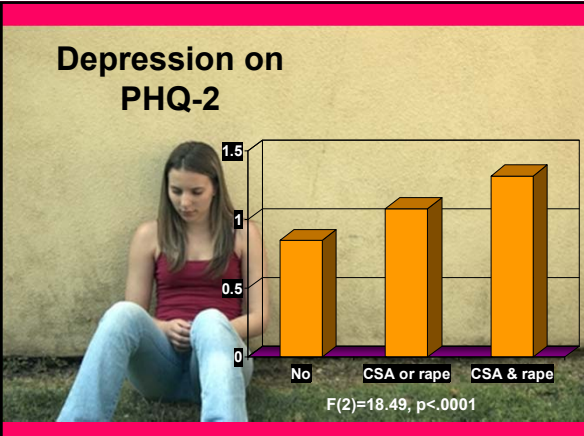


Mental Health Effects

- Abuse history increases the risk of depression
- Abuse survivors are more likely to have:
 - Severe depression
 - A higher number of episodes



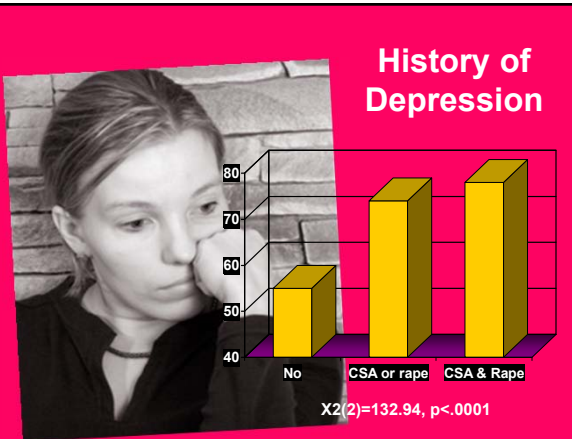
Depression on PHQ-2



Group	PHQ-2 Score (approx.)
No	0.8
CSA or rape	1.1
CSA & rape	1.3

$F(2)=18.49, p<.0001$

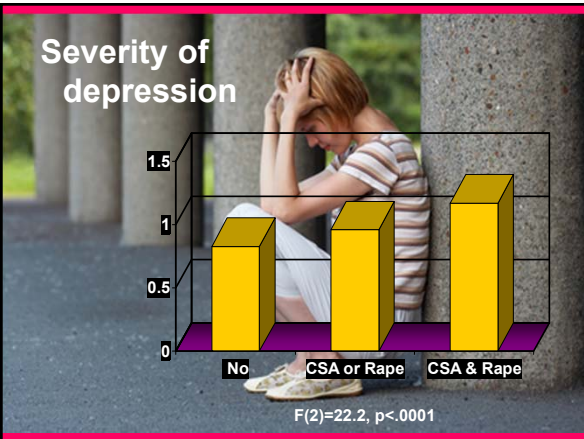
History of Depression



Group	History of Depression (%) (approx.)
No	55
CSA or rape	75
CSA & Rape	80

$X^2(2)=132.94, p<.0001$

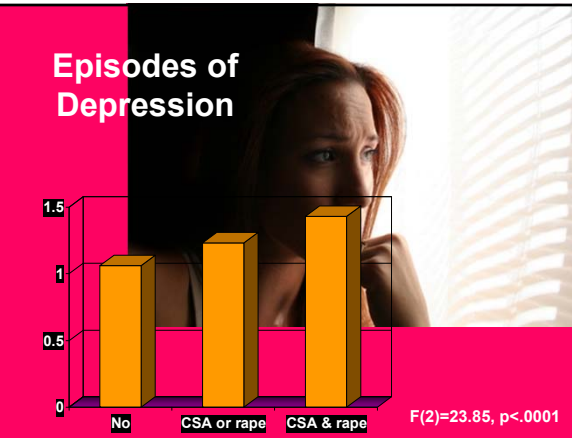
Severity of depression



Group	Severity of Depression (approx.)
No	0.8
CSA or Rape	1.0
CSA & Rape	1.3

$F(2)=22.2, p<.0001$

Episodes of Depression

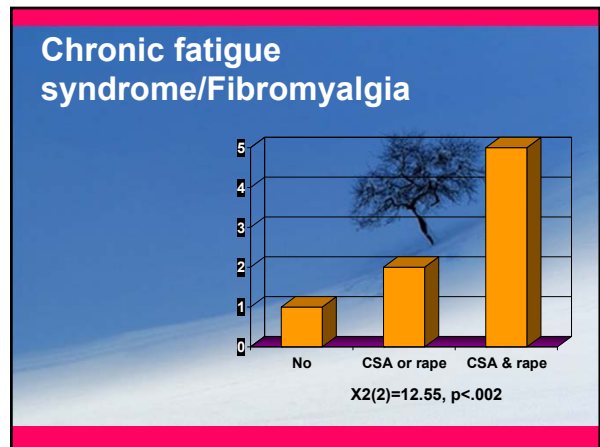
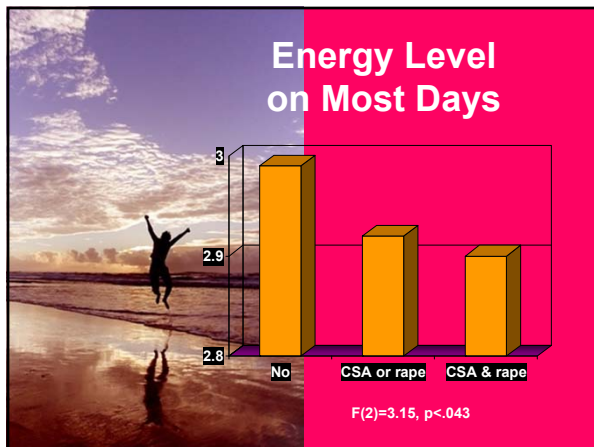
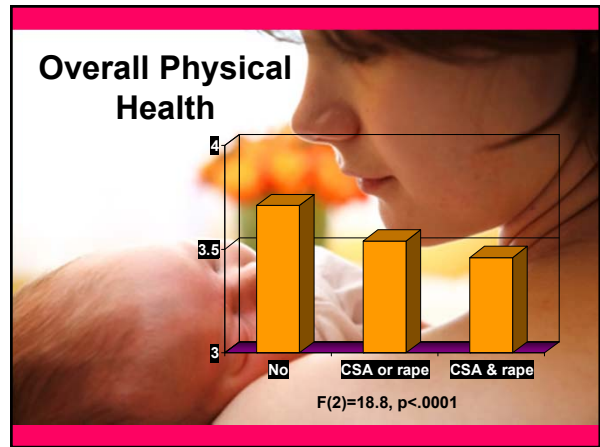
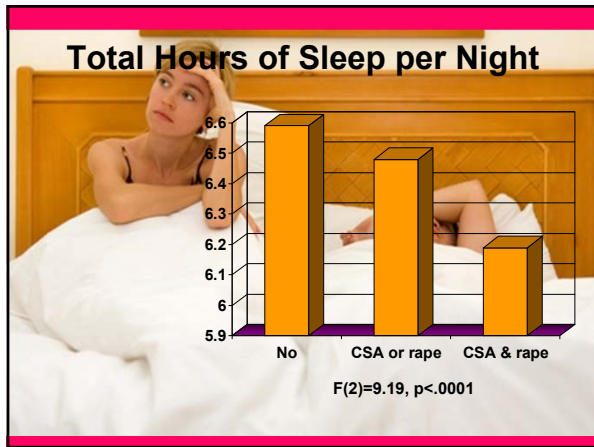
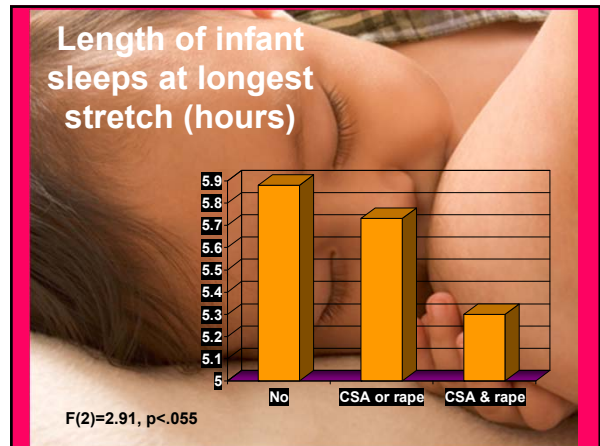


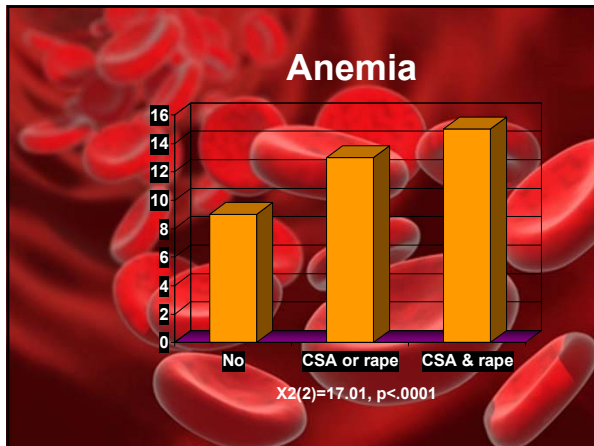
Group	Episodes of Depression (approx.)
No	1.0
CSA or rape	1.2
CSA & rape	1.4

$F(2)=23.85, p<.0001$

- Sexual assault also impacts sleep and fatigue in some specific ways







- Why does breastfeeding help?

Breastfeeding

- Downregulates stress
- Improves mood
- Decreases risk of depression
- Decreases hostility
- Improves mother-infant bond

- Breastfeeding decreased ACTH & cortisol
- Lower stress response to induced stressor
- Suckling provided short-term lessening of stress response

Heinrichs et al., J Clin Endo Metabol 2001, 86: 4798-4804

- Breastfeeding downregulates the stress response
- Directs mother toward milk production, conservation of energy and nurturing behaviors

Groër et al., JOGNN 2002, 31: 411-417

Oxytocin Response

- Well-being
- Affiliation
- Bonding

Stress Response


- Depression & anxiety
- Alienation
- Hostility & interpersonal strife

- Review of 49 studies on breastfeeding and depression
- Bottle feeding increases the risk of depression
- Breastfeeding decreases risk of depression




Dennis & McQueen *Pediatrics* 2009; 123: e376-e751

- 15-year cohort study of 7,223 Australian mother-infant pairs
- 512 substantiated maltreatment reports (4.3% of cohort)
- Breastfeeding decreased risk of maternal-perpetrated child maltreatment
 - OR=2.6 for non-breastfed
 - OR=1.1 for breastfed



Strathearn et al. *Pediatrics* 2009; 123: 483-493

- Risk of neglect decreased with breastfeeding duration
 - OR=1.0 >4month
 - OR=2.3 for <4 months
 - OR=3.8 for non-breastfed



Strathearn et al. *Pediatrics* 2009; 123: 483-493

- Abuse-lowering effects of breastfeeding may be due to oxytocin release, which:
 - Reduces anxiety
 - Elevates mood
 - Increases maternal responsiveness
 - Lowers maternal stress
 - Increases attachment



Strathearn et al. *Pediatrics* 2009; 123: 483-493

- Breastfeeding also improves maternal sleep



- Study of 2830 women at 7 weeks postpartum
- Poor sleep was an independent risk factor for depression
- Factors associated with poor sleep
 - Depression
 - Previous sleep problems
 - Primiparity
 - Not exclusively breastfeeding
 - Younger or male infant




Dorheim et al. *Sleep* 2009; 32: 847-855



- “For new mothers, a complaint of trouble falling asleep may be the most relevant screening question in relation to their risk for postpartum depression”


Goyal et al. *J Perinat Neonat Nurs* 2007; 21: 123-129

- Study of 133 new mothers & fathers (3 mos postpartum)
 - Questionnaire and actigraphy data
- 67% EBF, 23% mixed, 10% formula
- EBF mothers slept 40 minutes longer than mixed-feeding mothers




Doan et al. *J Perinat Neonat Nurs* 2007; 21: 200-206

- Slow-Wave Sleep
 - 12 exclusively breastfeeding women
 - 12 age-matched control women
 - 7 women exclusively bottle feeding
- Minutes in SWS
 - Exclusive breastfeeding (M=182 minutes)
 - Control group (M=86 minutes)
 - Exclusively bottle-feeding (M=63 minutes)

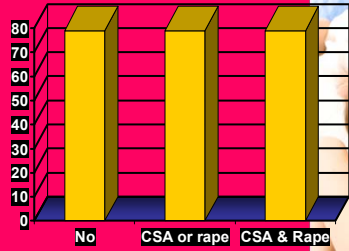


Blyton et al., *J Sleep Res* 2002;11(4): 297-303.




- Does breastfeeding help trauma survivors decrease risk of metabolic syndrome and cardiovascular disease?

Percentage who are breastfeeding

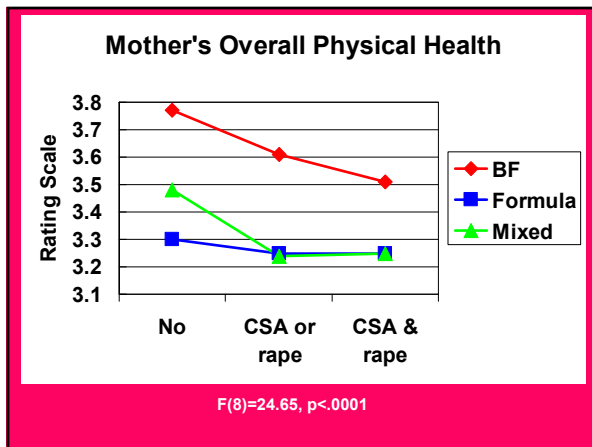
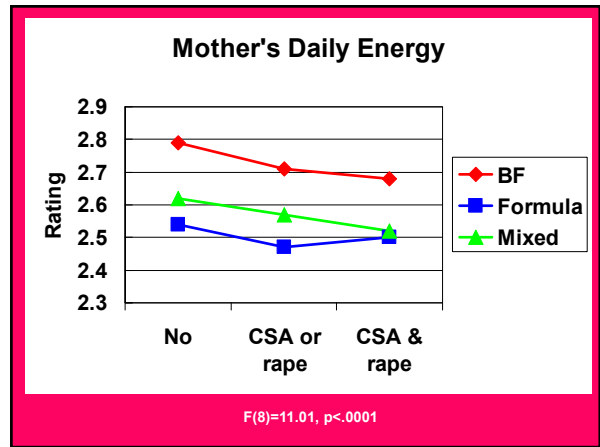
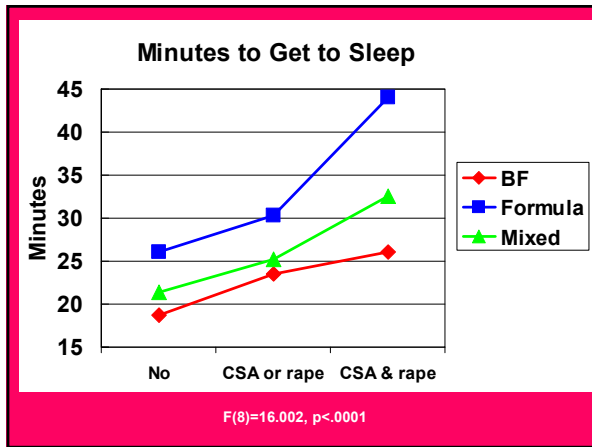
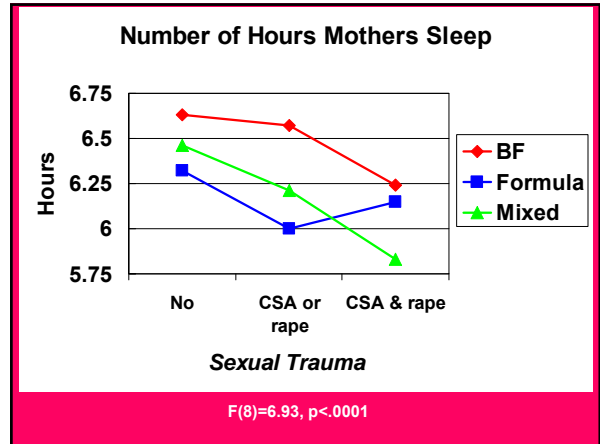
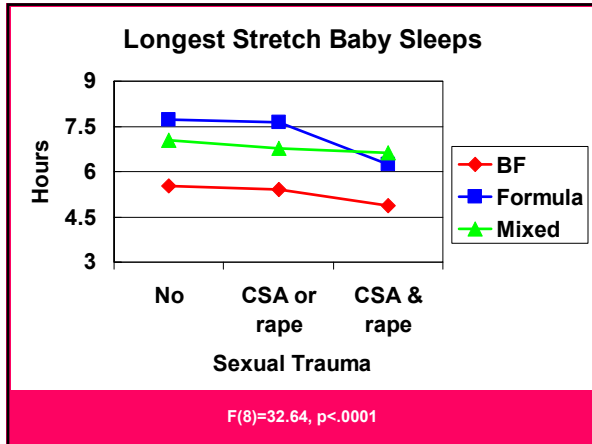


Group	Percentage
No	~75%
CSA or rape	~70%
CSA & Rape	~65%

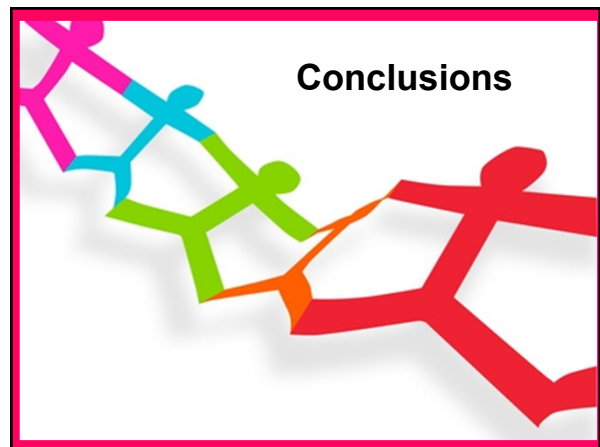
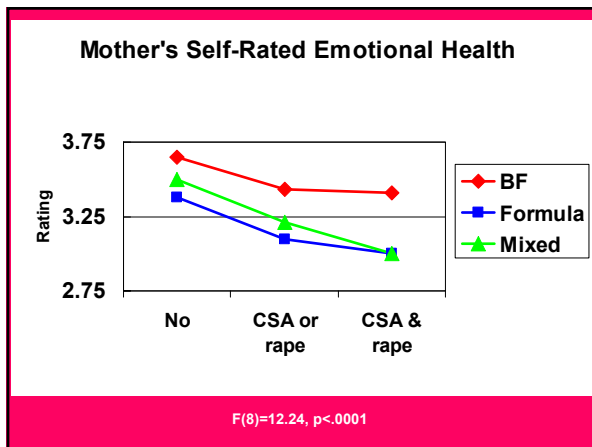
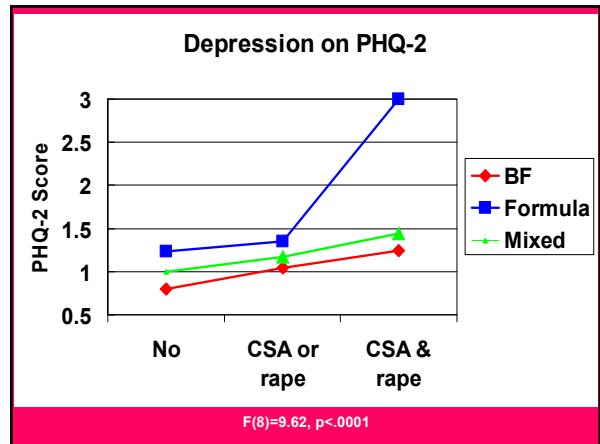
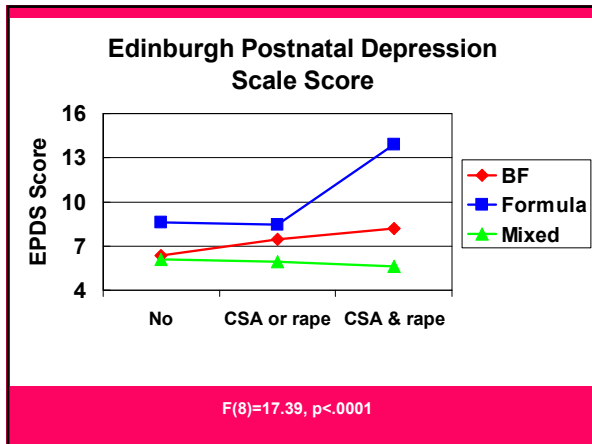


Impact of breastfeeding on maternal sleep





- Impact of breastfeeding on maternal mental health



- **Breastfeeding lowers risk of metabolic syndrome and CVD by**
 - Decreasing depression and hostility
 - Increasing mother-infant bond

- **Breastfeeding also**
 - Improves sleep quality
 - Total sleep hours
 - Minutes to fall asleep
 - Attenuates the effects of trauma
 - Decreasing trauma-related sleep problems
 - Improving maternal well-being



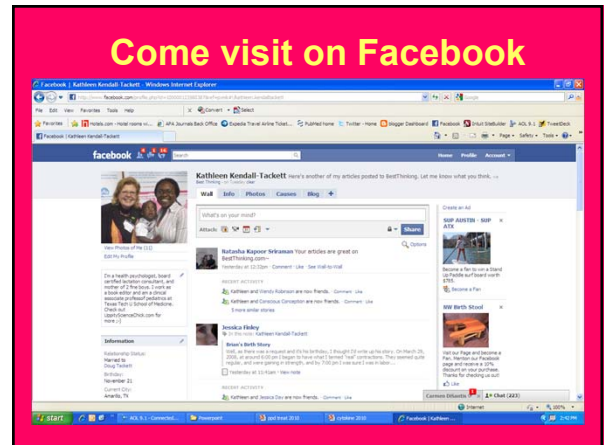
- Breastfeeding--particularly exclusive breastfeeding—protects women’s physical and mental well-being
- These effects persist long past the perinatal period



For more information on inflammation, depression and disease

806-352-2519

InfantRisk Center
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