

# Pulmonary Susceptibility to Environmental Exposures and Social Stressors

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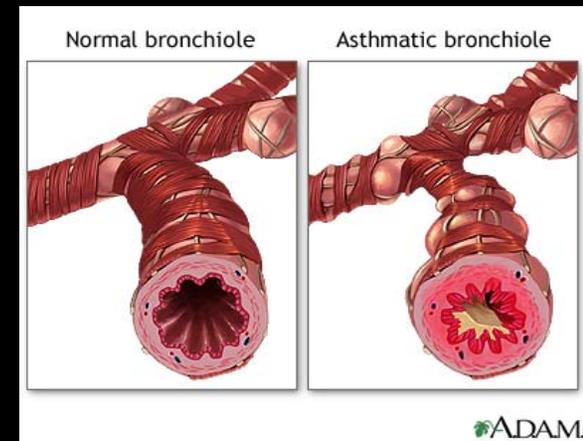
**BRIGHAM AND  
WOMEN'S HOSPITAL**



**HARVARD  
MEDICAL SCHOOL**

# Key Concepts in Asthma

- Chronic inflammatory disorder of the airways
- Disrupted immunity
- Developmental disorder
  - 30% diagnosed by age 3 yrs
  - 80% diagnosed by age 5 yrs
- Pregnancy & early childhood = critical periods
- Asthma disparities among U.S. children
  - Low-income populations
  - Minorities



# Risk Factors

- **Risk factors:**

- Heredity, family history
- Low birth weight, prematurity
- Maternal smoking during pregnancy/ETS
- Ambient air pollution
- Indoor allergens

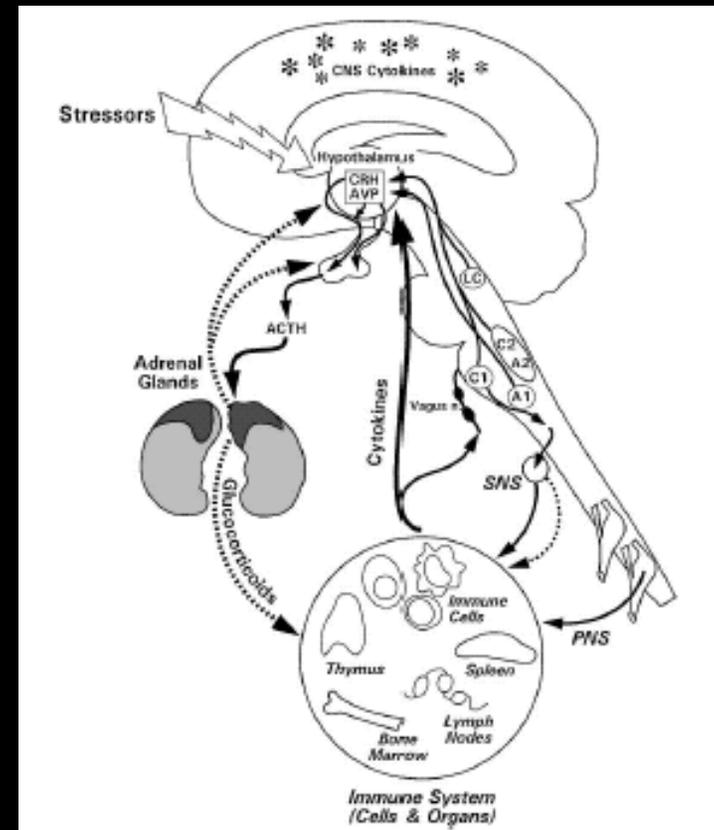
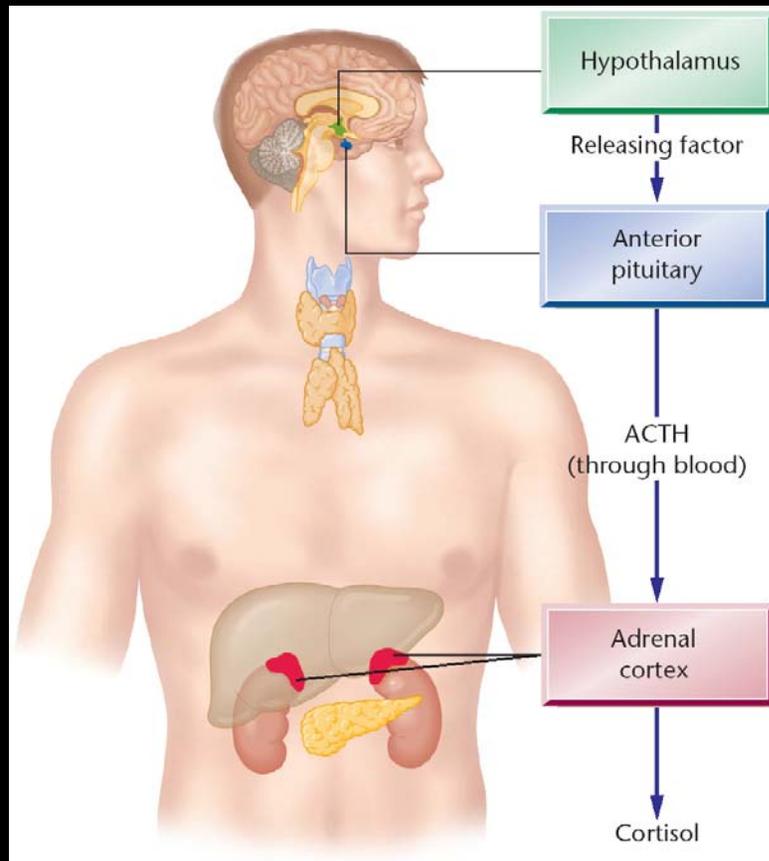
- Low SES
- Race/ethnicity

Differential exposure to environmental factors - physical or social/psychological exposures?

Potential role of social/psychological factors (e.g, stress) in these communities?

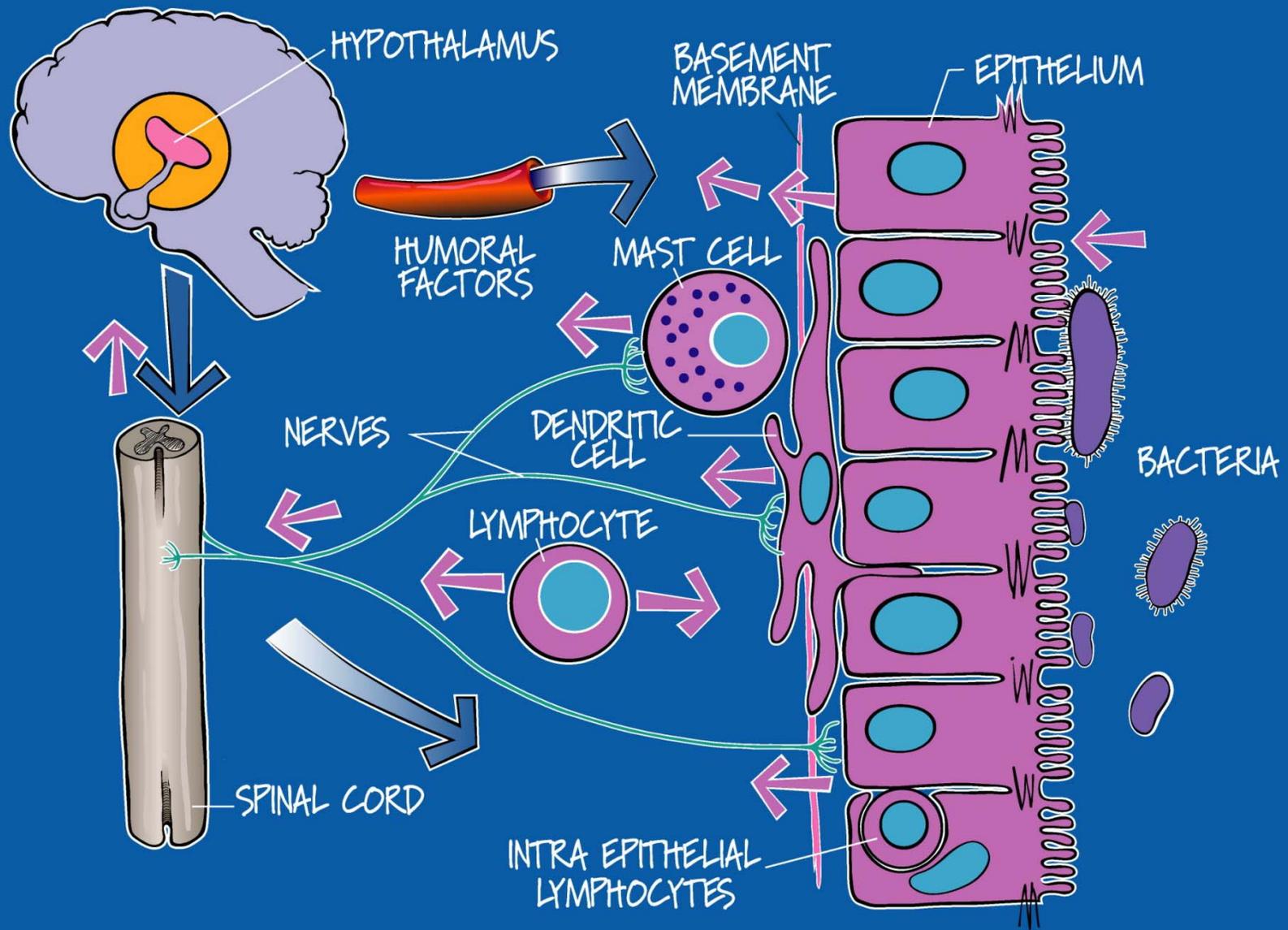


# Neuroendocrine - Immune Interactions



- Sympathetic-Adrenomedullary (SAM) System
- Hypothalamic-Pituitary-Adrenocortical (HPA) System

**These systems are regulated in the brain**



Wright et al., Thorax 1998; 53:1066-74

Wright et al., JACI 2005; 5:23-9.

Wright RJ, Bio Psychol 2010; 84:46-56.

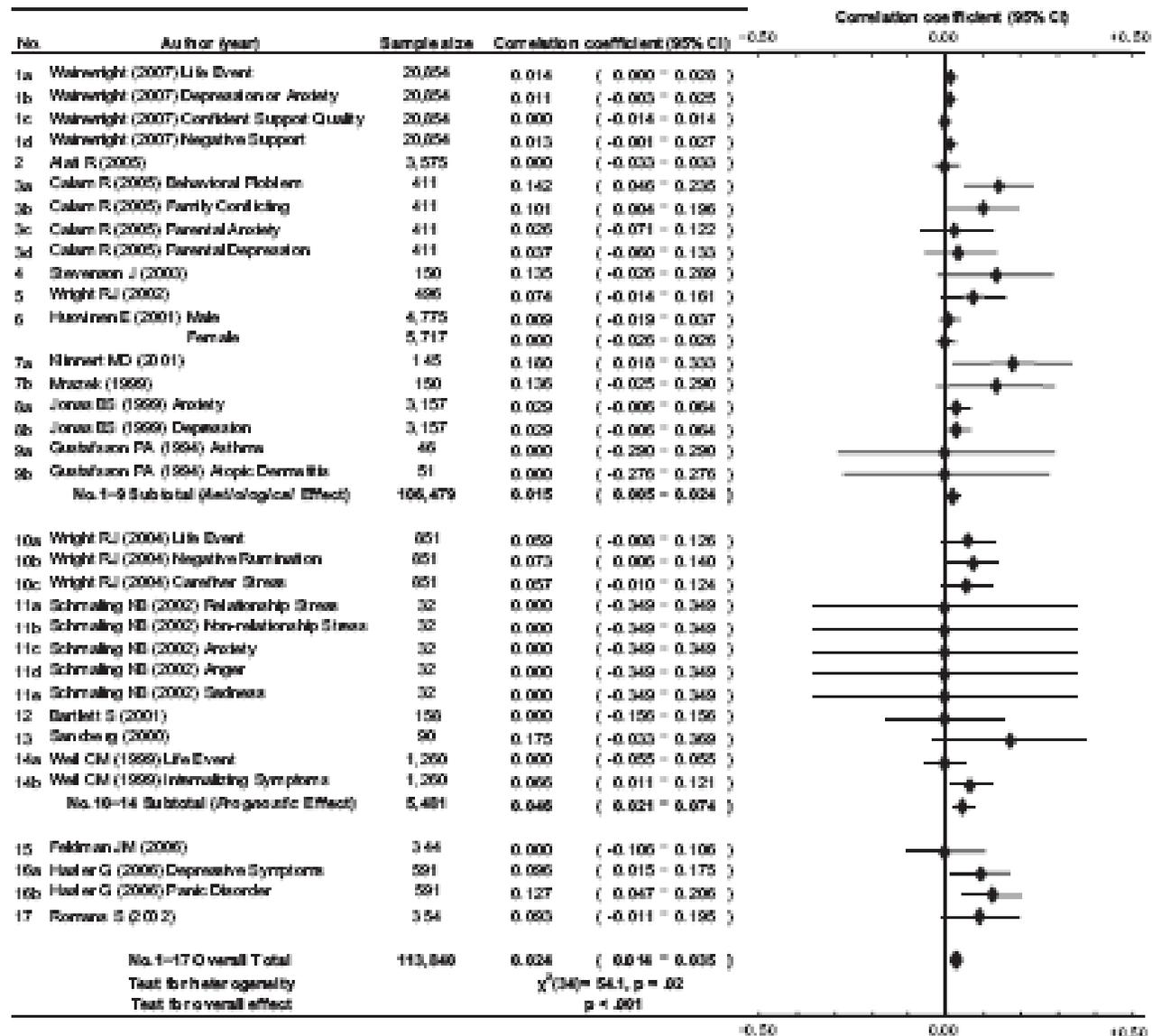


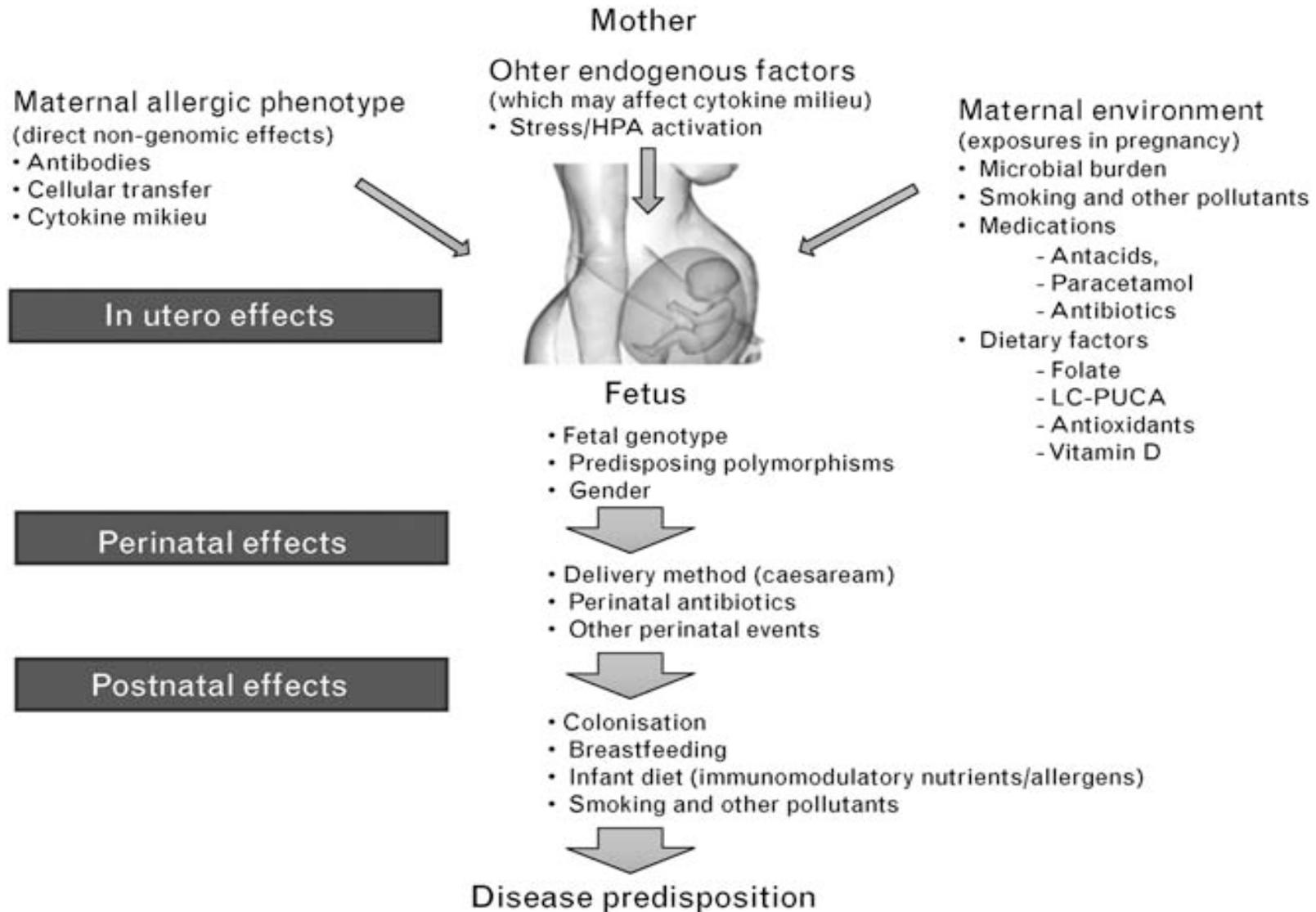
Figure 2. Meta-analysis about the effect of stress on atopic disorders. Higher positive correlation coefficients ( $r$ ) indicate a more detrimental role of stress in atopic disease.

Chida, Hamer and Steptoe *Psychosom Med* (2008)

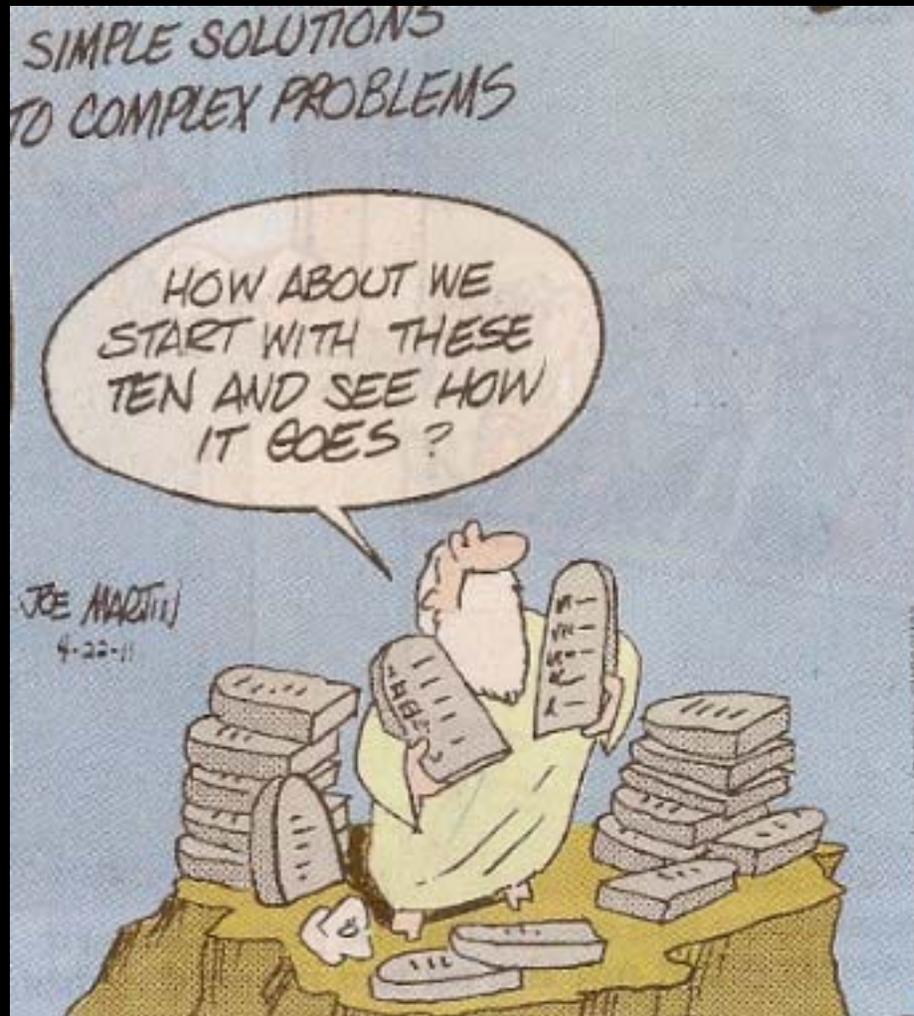


By Mark Knight, reprinted with permission of the Herald and Weekly Times, Melbourne, Australia.

## Materno-fetal interaction in pregnancy



# How to measure stress in poverty?





**Air  
Pollution**

**Tobacco  
Smoke**



**Stress**

**Allergens**

NIEHS, NICHD, NHLBI, NIMH

*Wright RJ, et al. Ciencia & Salude Coletiva 2008; 13:1729-42*

# Study Population



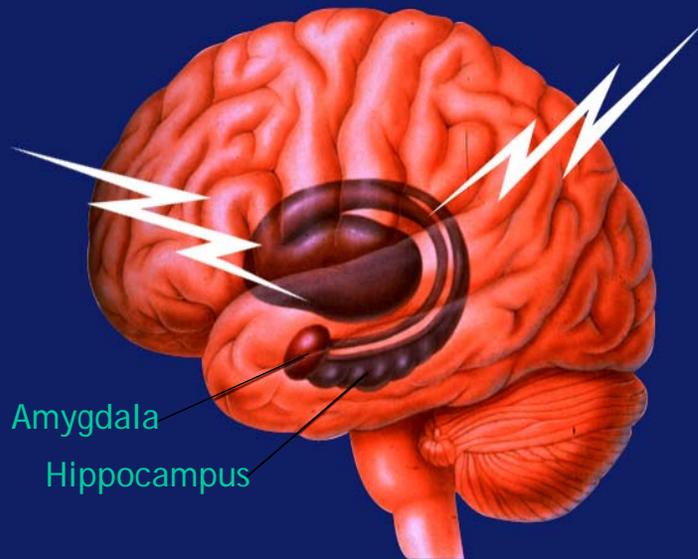
- **ACCESS (Asthma Coalition on Community, Environment, and Social Stress) Project**
  - Pregnant women receiving prenatal care at Boston area
    - Brigham & Women's Hospital
    - Boston Medical Center
    - 3 community health centers
  - English- or Spanish- speaking
  - 989 mother-child pairs
  - 955 gave birth and continued follow-up
  - Predominantly Hispanics (55%) and African Americans (29%)

# Stress Domains

- Financial strain
- Racism/discrimination
- Interpersonal violence
- Community violence
- Other negative life events (housing, landlords, fear of eviction, etc.)

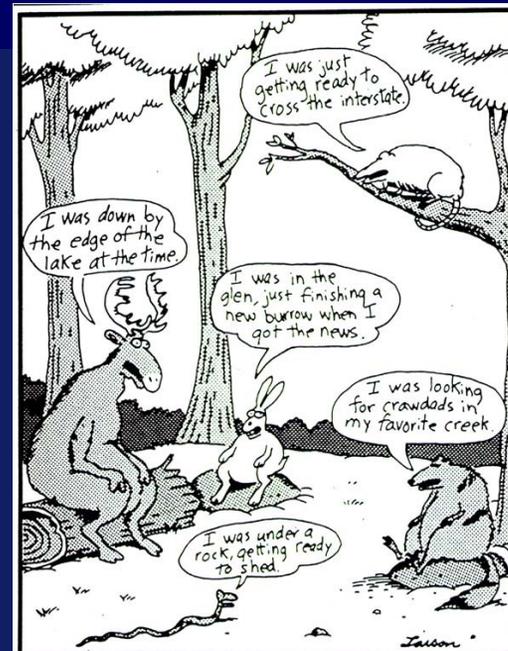
# Trauma – Candidate Stressor

## Memory - Strong Emotions



Amygdala

Hippocampus



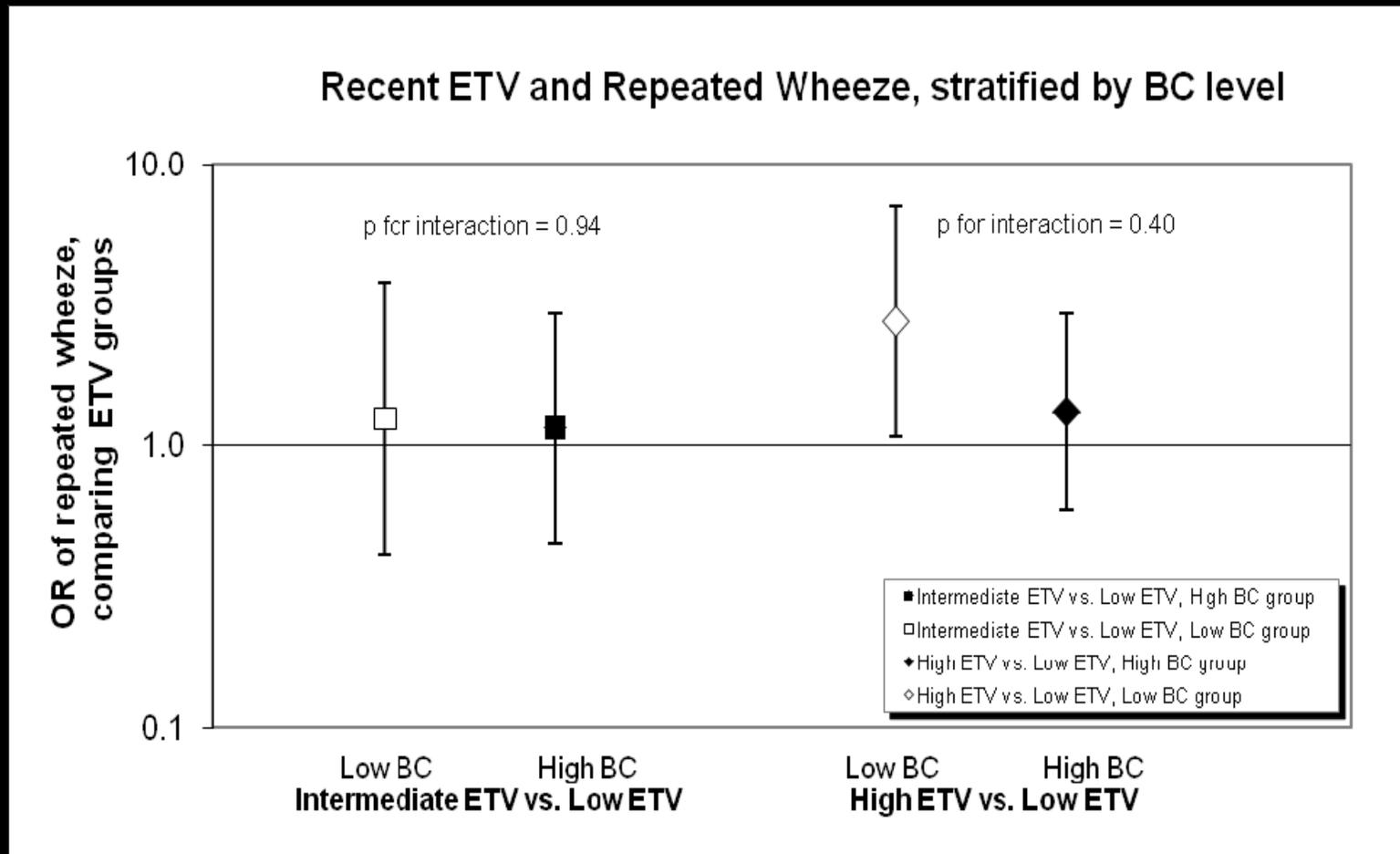
More facts of nature: All forest animals, to this very day, remember exactly where they were and what they were doing when they heard that Bambi's mother had been shot.

# Results – ETV and Repeated Wheeze

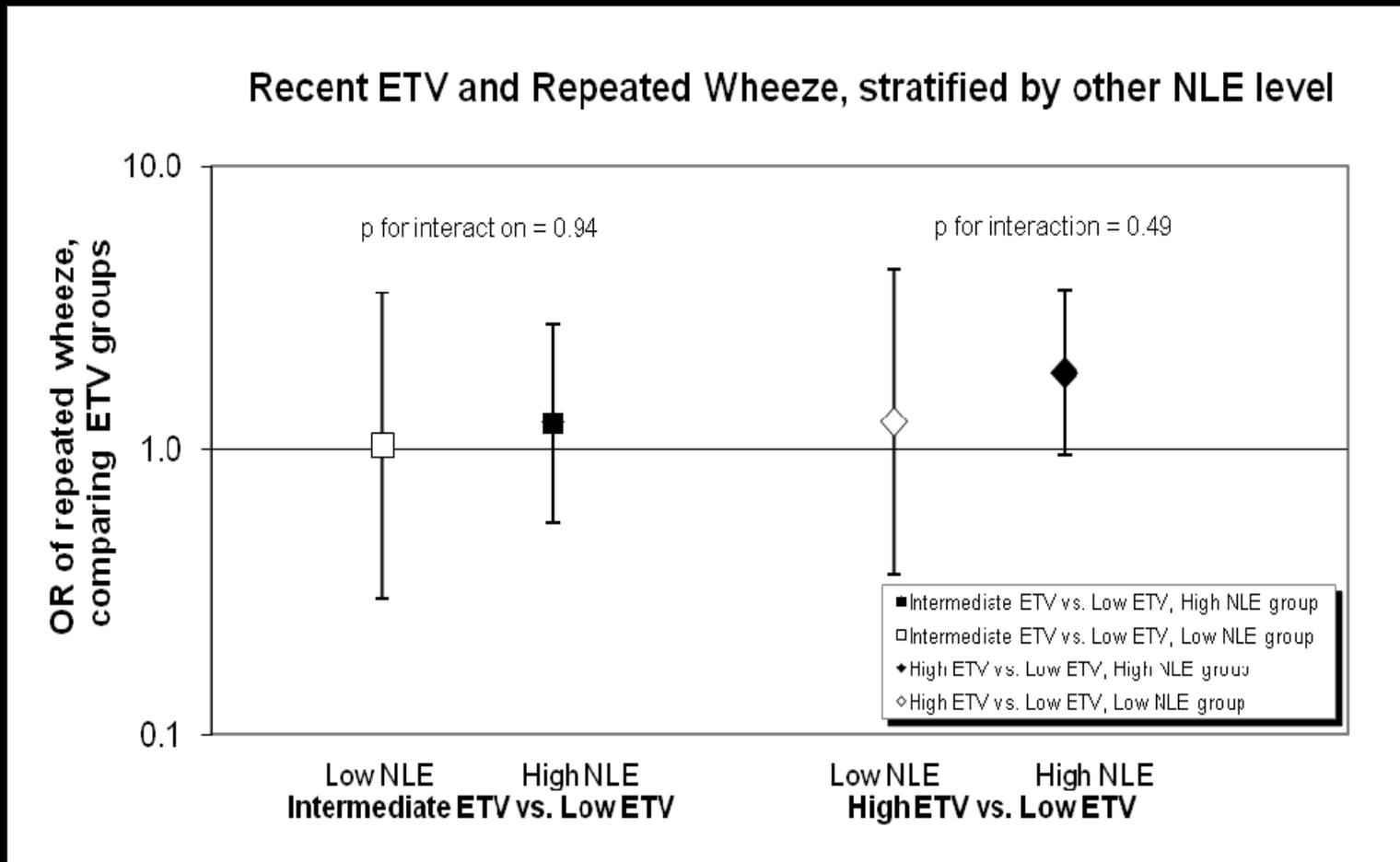
- Model 1: gender, maternal education, race, season of birth, maternal atopy
- Model 2: Model 1 + BC level
- Model 3: Model 1 + BC level + other NLE

	Univariate			Model 1			Model 2			Model 3		
	OR	95%CI		OR	95%CI		OR	95%CI		OR	95%CI	
<b><u>Community Violence</u></b>												
Low	Ref	--	--	Ref	--	--	Ref	--	--	Ref	--	--
Intermediate	1.44	0.79	2.62	1.32	0.70	2.47	1.33	0.70	2.1	1.25	0.66	2.37
High	2.08	1.25	3.46	2.03	1.18	3.48	1.94	1.13	3,34	1.66	0.94	2.95
<b><u>BC Exposure</u></b>												
Low (<=median)	Ref	--	--				Ref	--	--	Ref	--	--
High (>median)	1.61	0.98	2.66				1.84	1.04	3.00	1.70	1.00	2.91
<b><u>Individual-level NLEs</u></b>												
Summarized score (scaled 0-7)	1.28	1.13	1.45							1.23	1.06	1.42

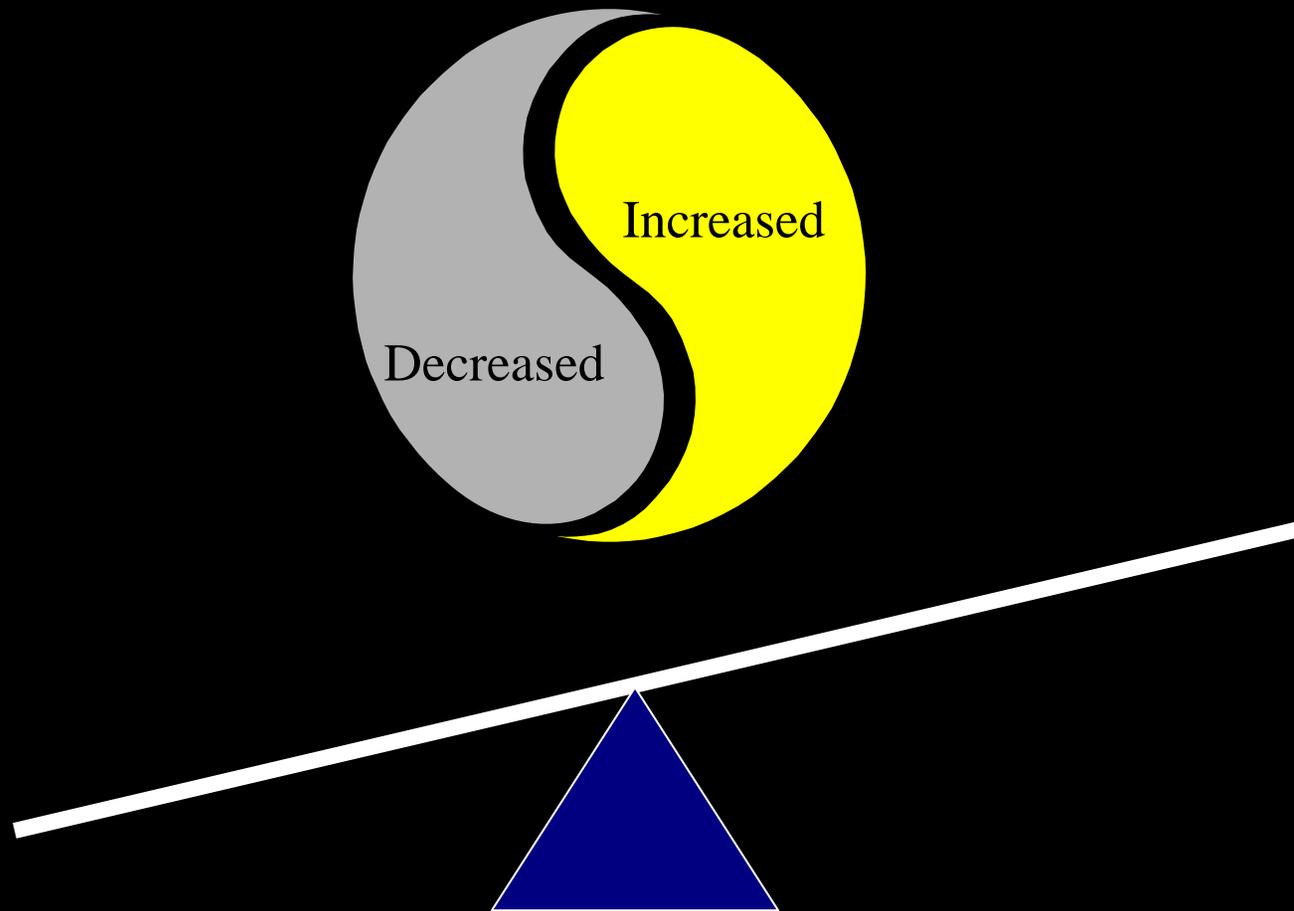
# Results Stratified by BC Level



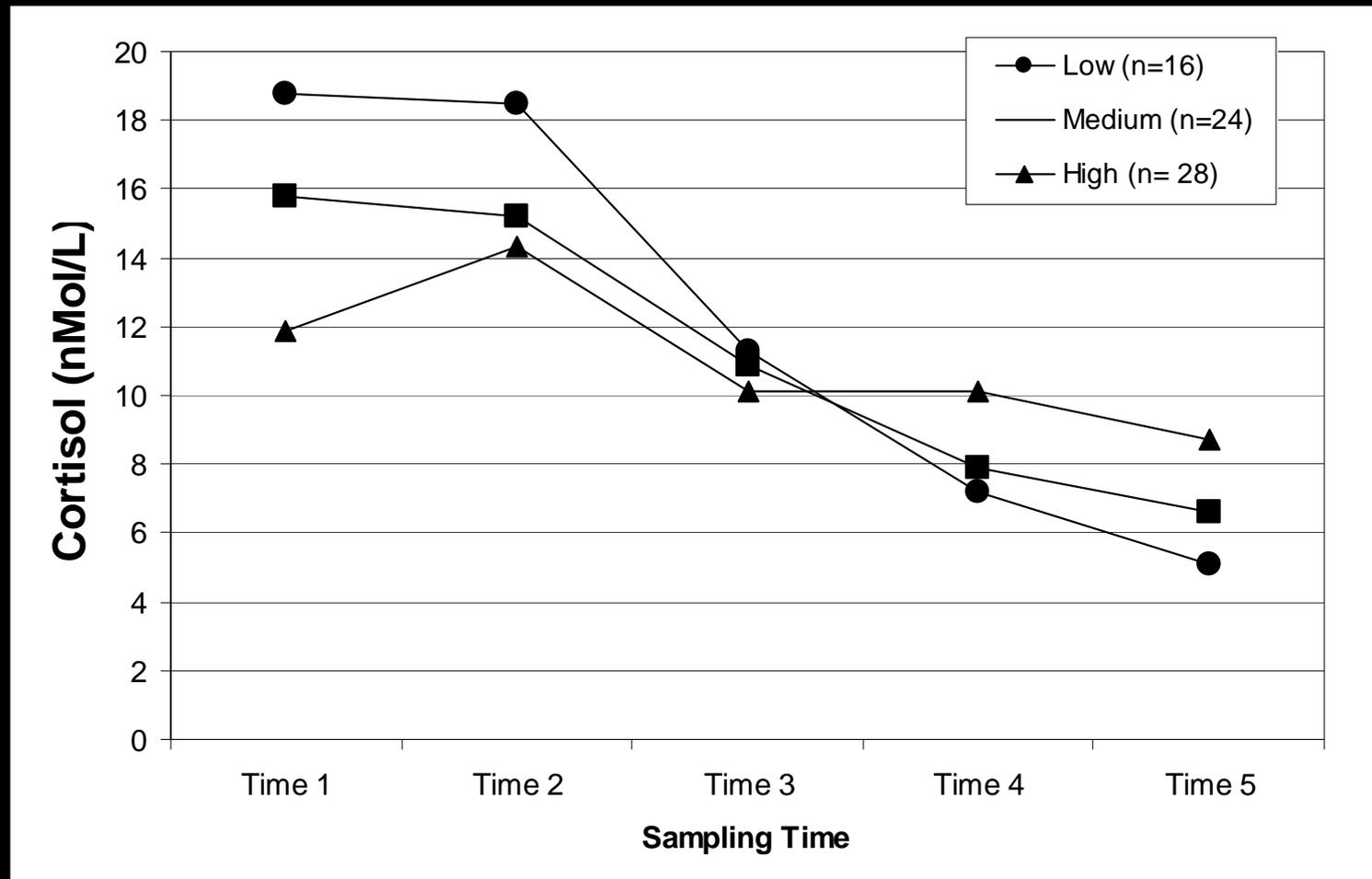
# Results Stratified by Other NLE



# Cortisol in Health and Disease



# Prenatal Stress and Maternal Diurnal Cortisol Rhythms

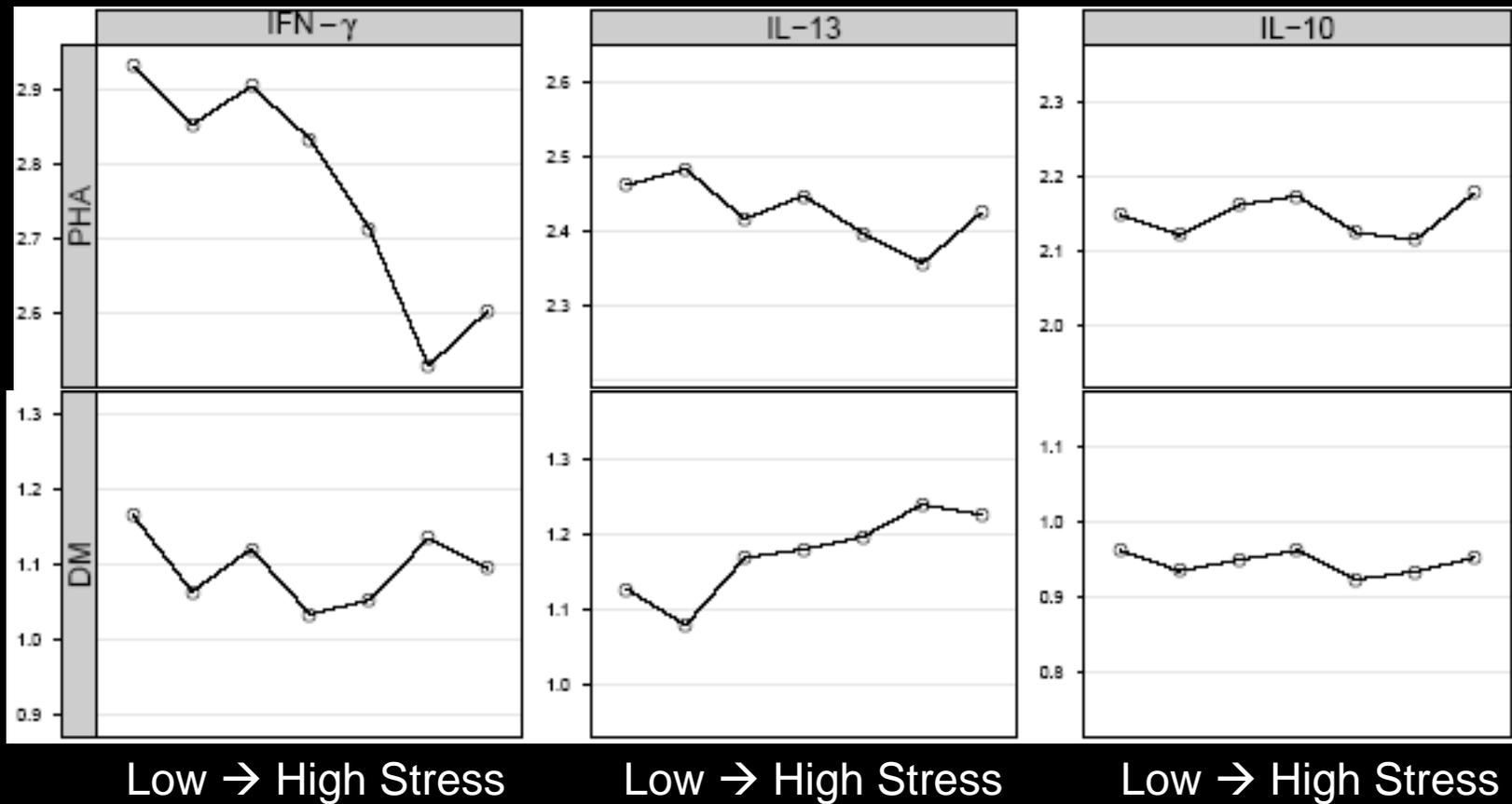


*Suglia SF et al., Psychol Trauma 2010; 12:326-34.*

# Maternal prenatal cortisol trajectory by child's wheeze status: Stratified by prenatal maternal obesity



# Relationship of composite stress score and cytokine responses (average log-transformed values): Adaptive Panel

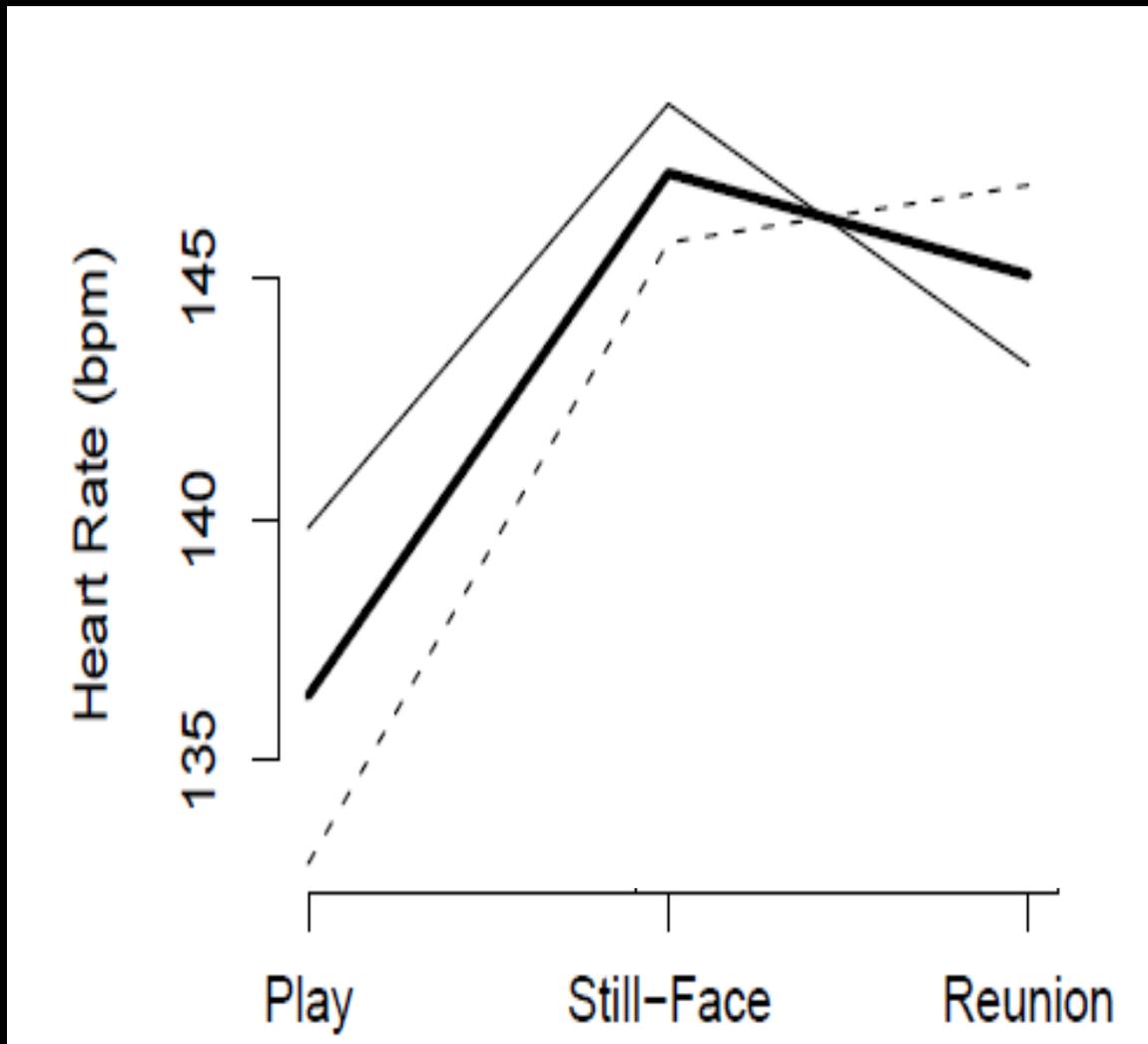


*Wright RJ et al., AJRCCM 2010; 182:25-33.*

# LifeShirt System: Autonomic Reactivity



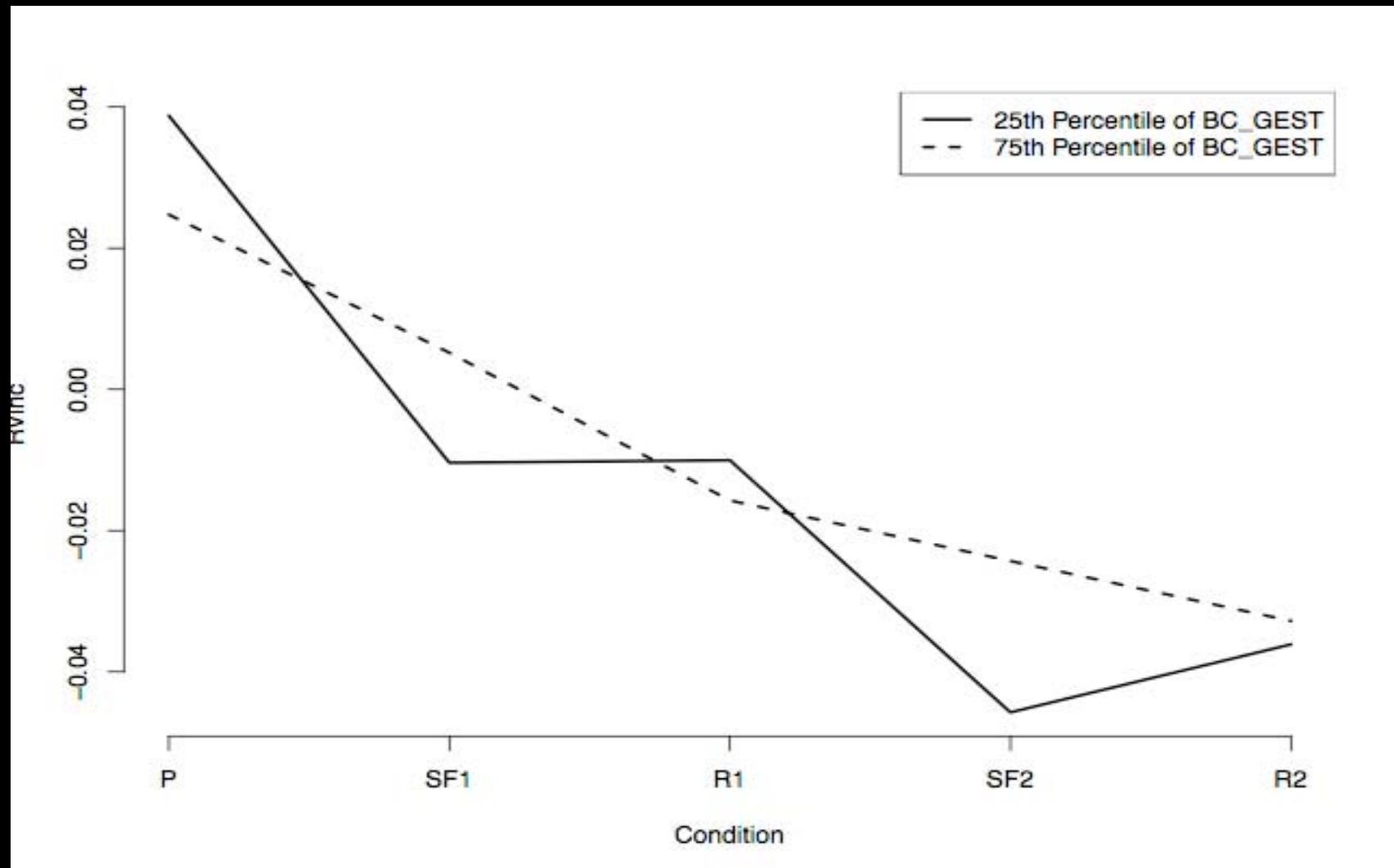
# SFP: Infant ANS Regulation



Maternal Lifetime Trauma Exposure

- High Exposure
- Moderate Exposure
- Low Exposure

# Prenatal traffic-related air pollution exposure predicts reduced stress-related RSA in 6-month-olds

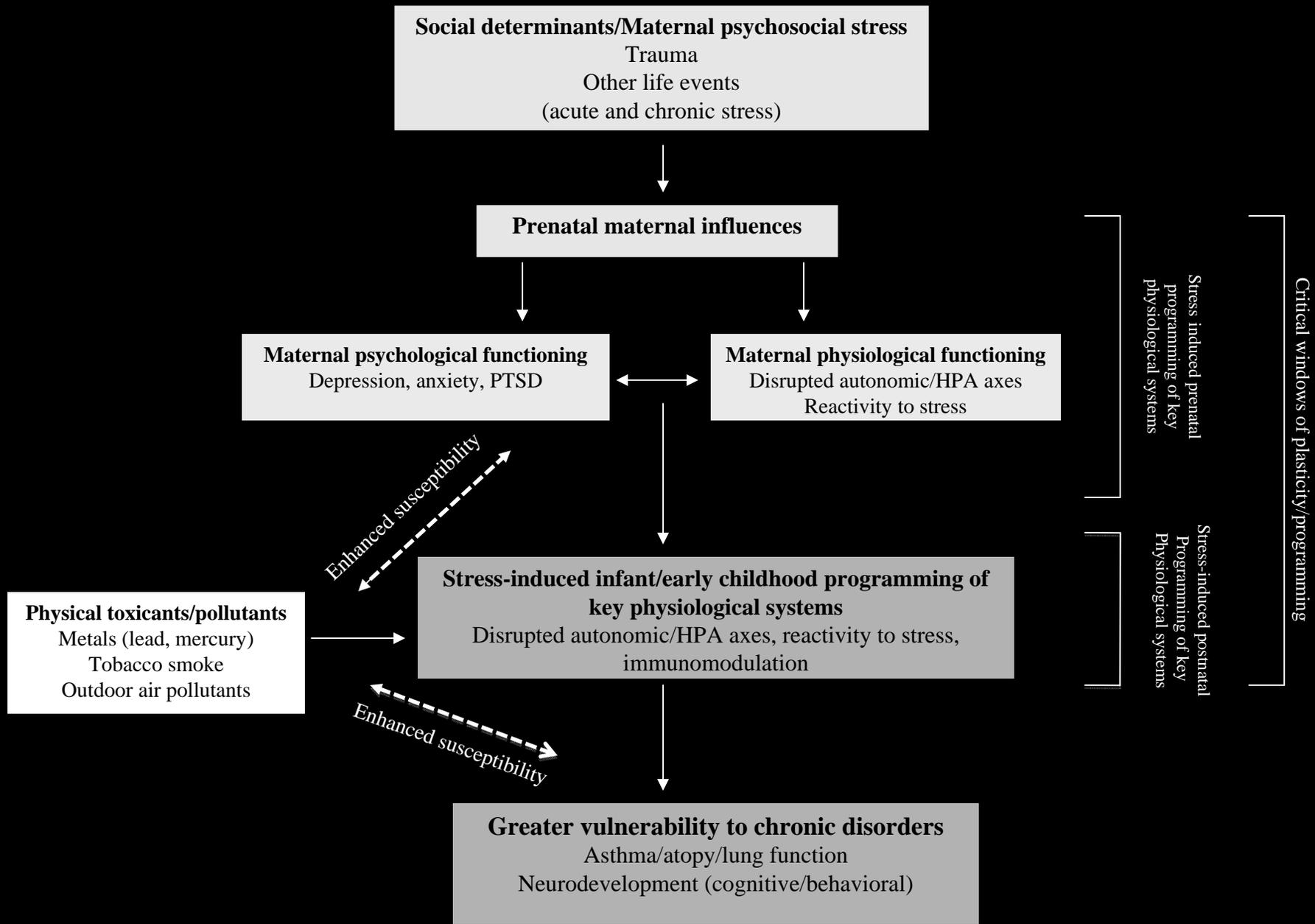


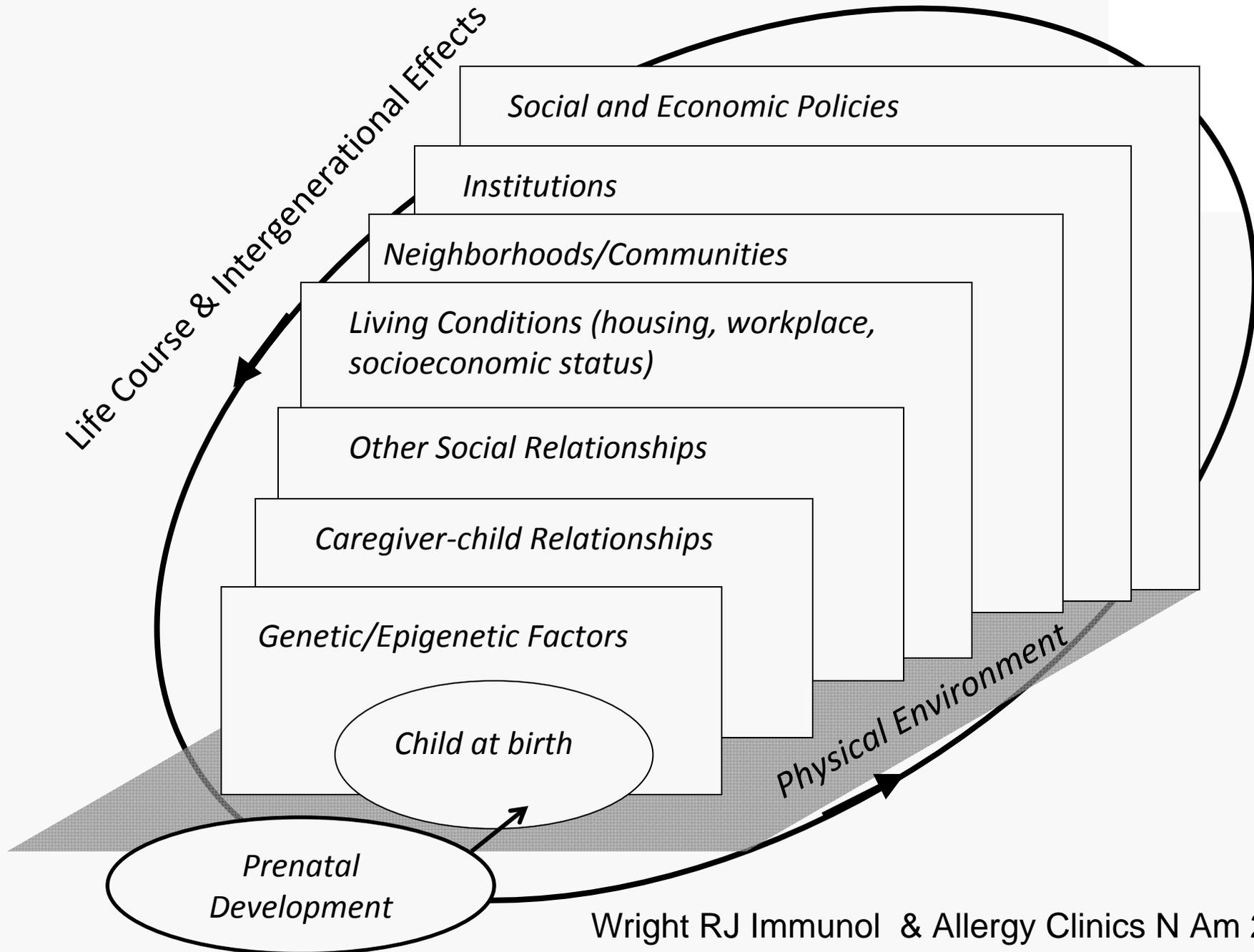
THE ROANOKE TIMES  
Monday, September 20, 2004



STEPHANIE KLEIN-DAVIS | The Roanoke Times  
[REDACTED] a Bullitt Avenue resident, worries about the  
effect on her unborn child from the sound of jackhammers.

**TRAFFIC:** Official says  
wait for end result





# URECA Study: Stress Domains

	Factor1	Factor2	Factor3
Difficult life circumstances	25	8	46 *
Neighborhood problems	72 *	32	20
Violence	65 *	14	25
Rating of home	18	65 *	26
Rating of neighborhood	49 *	55 *	13
Housing problems	33	48 *	46 *
Hardship	8	24	48 *

*Wright RJ et al., AJRCCM 2010; 182:25-33.*