



## Children's Health and the Environment

Ted Schettler MD, MPH

Oct. 1, 2009

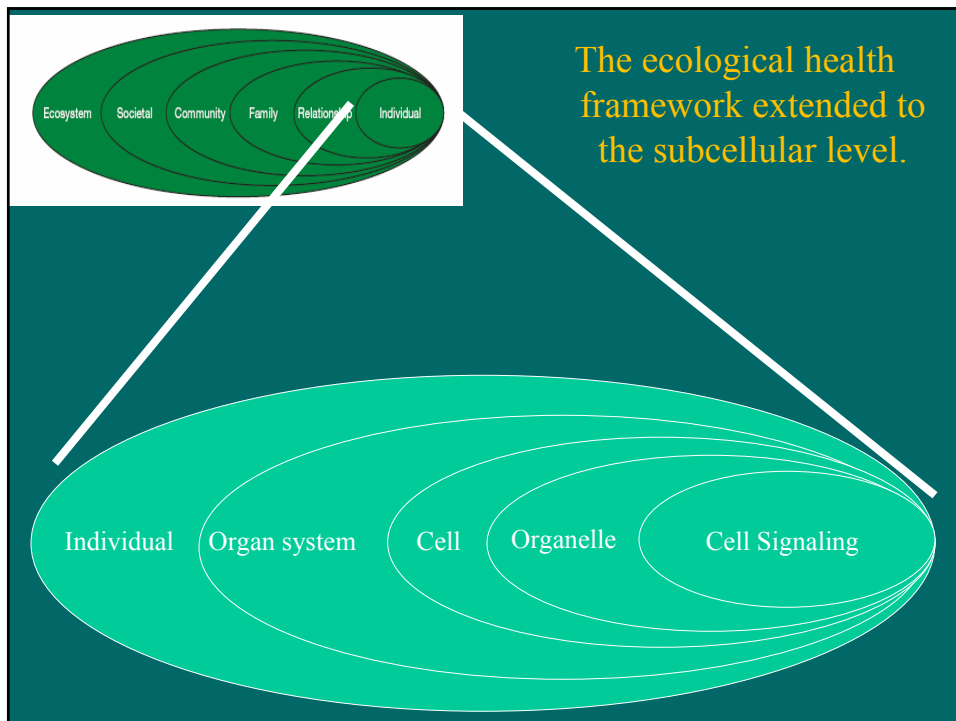
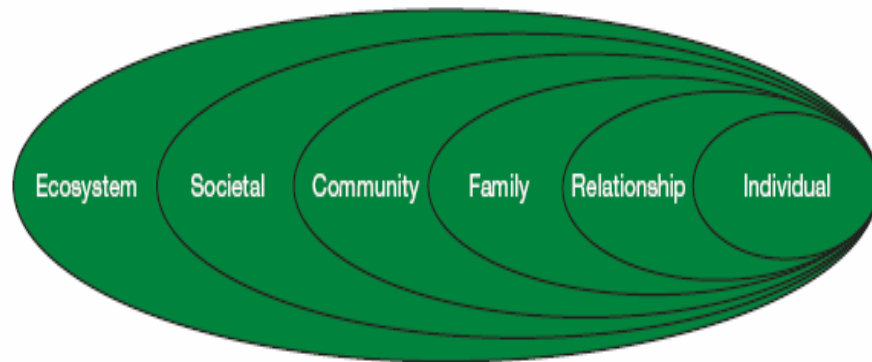
Northwest Children's  
Environmental Health Forum

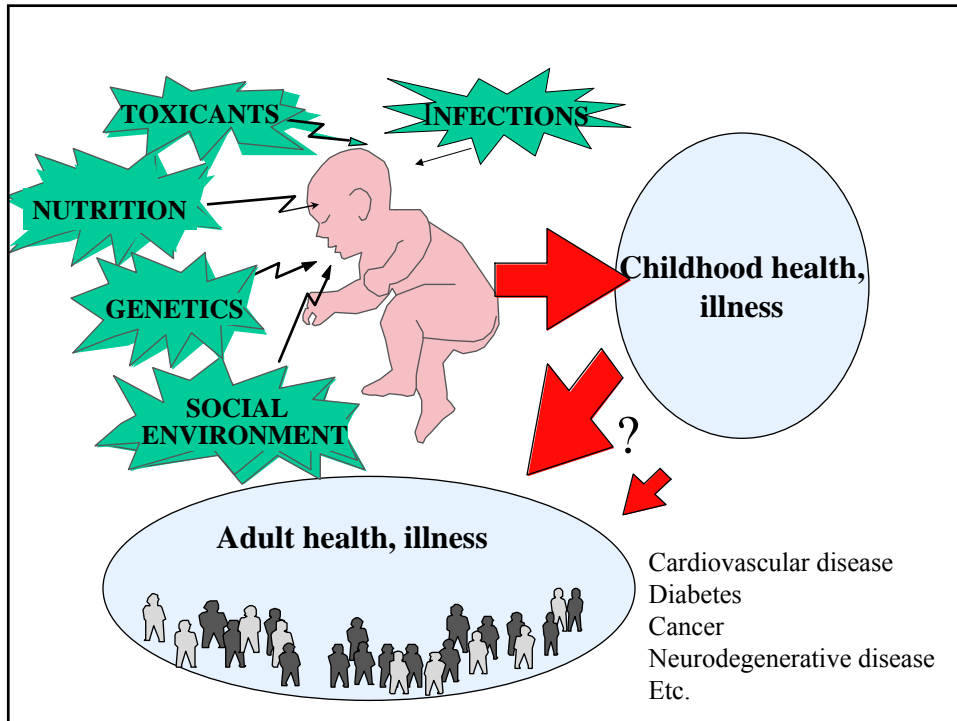
## National poll: top children's health concerns (2009)

1. Childhood obesity.
2. Drug abuse.
3. Smoking.
4. Bullying.
5. Internet safety.
6. Child abuse and neglect.
7. Alcohol abuse.
8. Stress.
9. Not enough opportunities for physical activity.
10. Teen pregnancy.

C.S. Mott Children's Hospital, U MI

An ecological health framework: the individual in the context of family, community, society and ecosystem.





## The vulnerability of developing children

- Increased exposure to many environmental contaminants
- Increased susceptibility to environmental factors

## Early life susceptibility

- Environmental exposures are handled differently by developing children
  - Differences in absorption, distribution, metabolism, and elimination
- Tissues of developing children are different
  - Often more vulnerable to disruption because of rapid cell division, less time for cellular repair
  - Developmental trajectories can be permanently altered by a variety of environmental factors
  - Set points of feedback loops changed

## Examples of multiple stressors

- Air pollution, socioeconomic status (SES), stress
- Nutrition, social circumstances, environmental chemicals

## Asthma

- Many indoor and outdoor air pollutants trigger asthma attacks and increase their severity
- Ambient ozone exposures in exercising children increases the incidence of asthma (McConnell, Lancet, 2002)
- Lower SES consistently associated with greater asthma morbidity

In people with asthma, high traffic density increases the risk of frequent asthma symptoms in all people, but more in people who are poor (adjusted for age, sex, race/ethnicity)

Traffic density (VMT per square mile)	Relative risk (95% CI)*			Population attributable risk percentage (95% CI)		
	Below FPL	Above FPL	Total population	Below FPL	Above FPL	Total population
0–20,000	1.00	1.00	1.00			
20,001–200,000	1.28 (0.40–3.12)	1.30 (0.94–1.76)	1.40 (1.04–1.86)	6.3 (–16.7–33.6)	4.7 (–1.0–11.2)	5.2 (–1.6–13.1)
>200,000	2.80 (1.04–4.91)	1.38 (0.93–1.96)	1.72 (1.23–2.32)	37.4 (1.3–56.5)	6.2 (–1.2–14.2)	16.5 (6.5–26.5)

Meng, et al, Ann Epid, 2008

## Why should people who are poor have more problems with asthma?

- Greater exposure to asthma triggers—single and cumulative
- Reduced access to health care
- Reduced compliance with medical interventions
- Psychosocial factors

## SES, psychological stress, asthma

- N = 76; half with asthma
- Age 13 yrs +/- 2.8
- Associations of SES with stress
- Associations of SES with immune process
- Associations of stress with immune process
- Pathway of SES > stress > immune response indicators (cytokines)

Chen et al. J Allergy Clin Immunol 2006

## Results

- Asthma vs. healthy:
  - Both groups: Higher SES > lower stress
  - Statistical analysis concluded that psychological stress is one pathway that links SES to increased levels of chemicals that are markers of inflammation.
  - (Inflammation plays a key role in asthma)

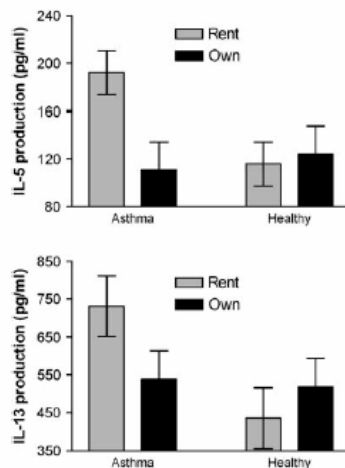


FIG 1. Differences in production of IL-5 and IL-13 for families who rent their homes versus families who own their own home by medical group status.

Chen, et al

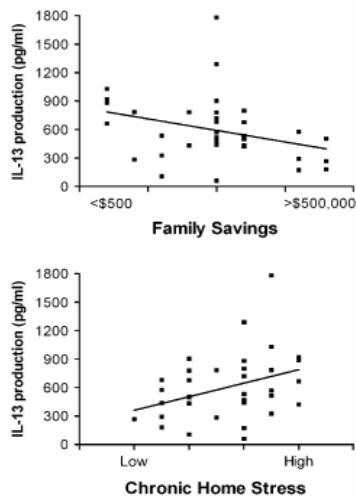


FIG 2. *Top panel*, Association of family savings with production of IL-13 among children with asthma. *Bottom panel*, Association of chronic home stress with production of IL-13 among children with asthma.

Chen, et al

## Traffic-related pollution, parental stress, incident asthma

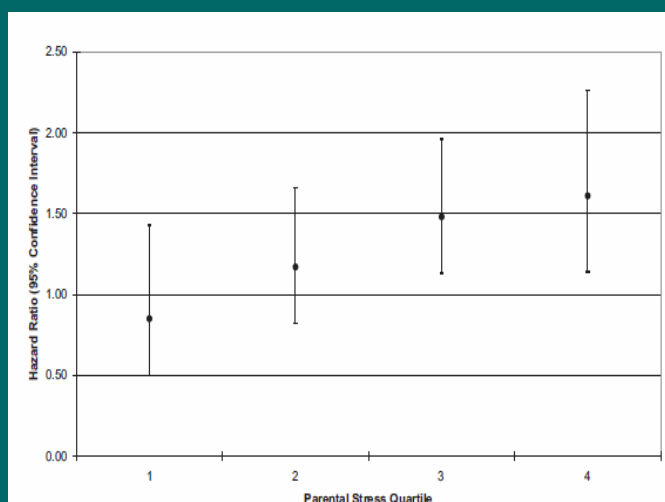
- Prospective, cohort study; n = 2497
- 5-9 yr old; followed for 3 yrs
- TRP estimates based on geocoding address, distance from road, dispersion modeling
- Perceived Stress Scale: a measure of the degree to which respondents believed their lives were unpredictable, uncontrollable, or overwhelming

Shankardass, PNAS; 2009

## Traffic-related pollution, parental stress, incident asthma

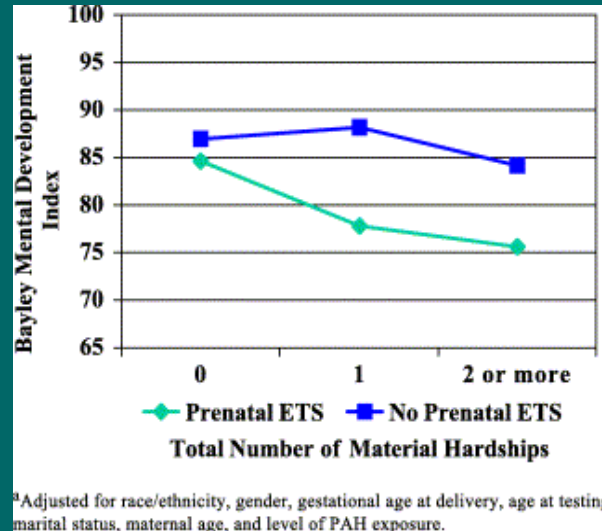
- Results:
  - No association of asthma onset with parental stress
  - No association of asthma and parental SES
  - Asthma risk increased with traffic pollution
  - The increase was greater with higher parental stress or lower SES (independently)
  - Same relationship seen with exposure to tobacco smoke

Effect of traffic-related pollution on incident asthma across quartiles of parental stress; 5-9 yr old children



Shankardass, PNAS; 2009

## 2 yr old Bayley MDI; prenatal ETS, material hardships



Rauh et al, Neurotox Teratol, 2004

## Risk factors for childhood obesity (moderately consistent)

- High birth weight
- High rate of weight gain in the first 4 months of life
- Formula feeding
- Low socioeconomic status
- Maternal obesity
- Excessive maternal weight gain during pregnancy
- Maternal stress
- Overeating
- Reduced activity levels

# Obesogens

- Environmental chemicals
  - Tributyltin
  - Phthalates
  - Bisphenol A
  - Perfluorinated cmpds
- Nutritional components
  - phytoestrogens
- Pharmaceuticals
  - DES
  - SSRIs
  - Tricyclic antidepressants
  - Antipsychotics

Multiple proposed mechanisms

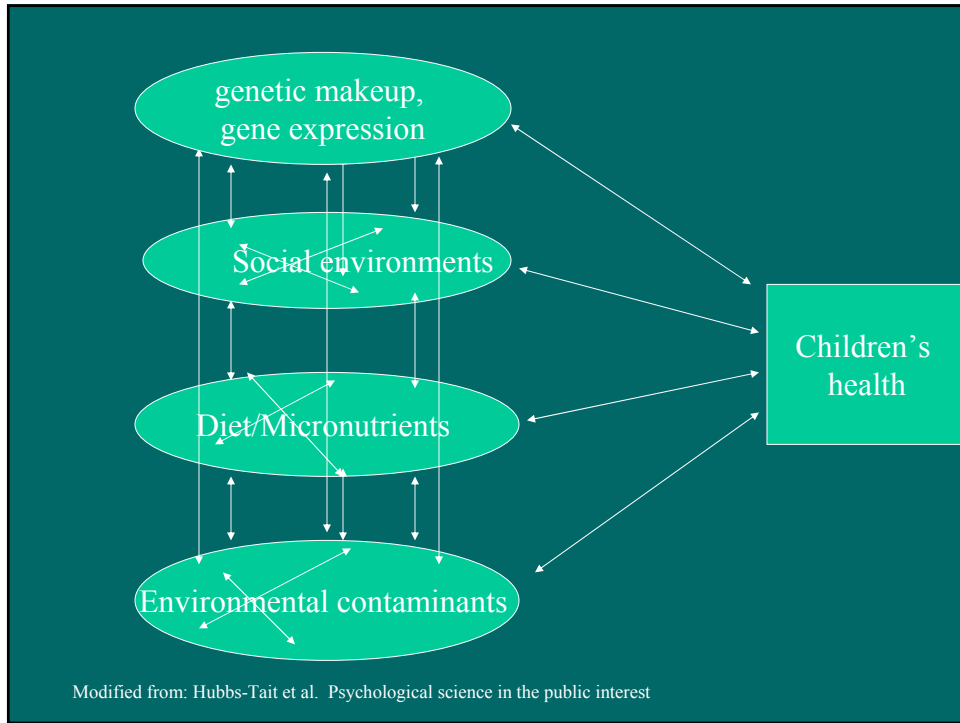
Grun, Blumberg. Mol. Endocrin., 2009

Prenatally exposed to 1 microgm/kg DES; days 9-16 gestation



Fig. 1. Representative photograph of control and des-treated mice. Photograph of 4-month-old mice showing the difference in body weight of a control mouse (lower panel) and a neonatally DES-treated mouse (upper panel).

Newbold, Repro Toxicol, 2007



## Ecological health framework

