Reducing Environmental Chemical Exposures: Why and How

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The Problem

early menopause and erythema nodosum

Early menopause may be common!

NHANEs trial of 31,575 women analyzed 111 endocrine disrupting chemicals

Women with high levels of phthalates, PCBs, and DDE had a 2-4 year earlier average age of menopause

Grindler NM et al. Persistent Organic Pollutants and Early Menopause in U.S. Women *PLOS one* Jan 2015

high blood pressure

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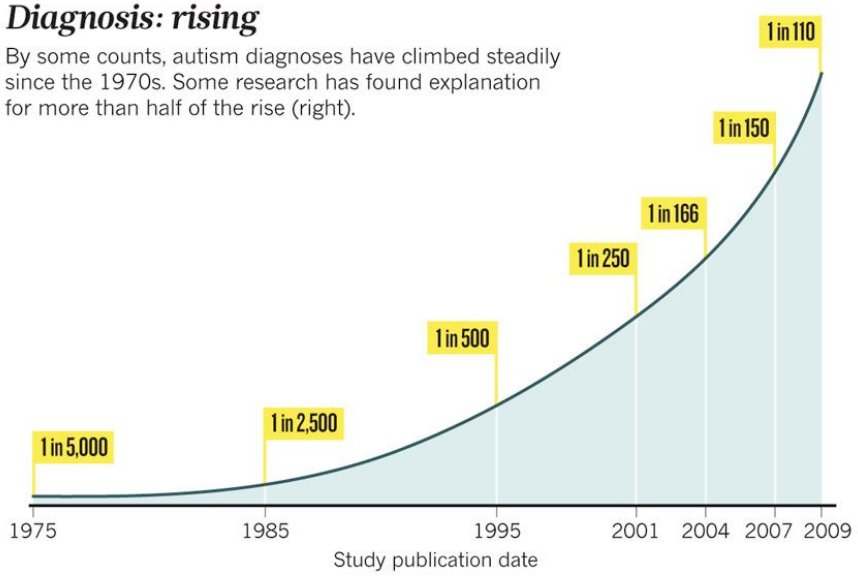

Weintraub K., "The prevalence puzzle: Autism counts", *Nature*; 2011,479,22-24.

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Obesity – Triggers in the Environment

Shankar A et al. Urinary bisphenol a levels and measures of obesity: results from the national health and nutrition examination survey 2003-2008. *Endocrinol.* 2012;2012:965243.

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Our Risk of Exposure

- >87,000 industrial chemicals in use in the US
  - 1976 Toxic Chemicals Substance Act has reviewed 200 and found 5 unsafe
- We are exposed to pesticides, heavy metals, and other chemicals in food, water, and packaging as well as in air pollution, flame retardants, solvents, and personal care products
- Exposure is widespread and increases over our lifetime

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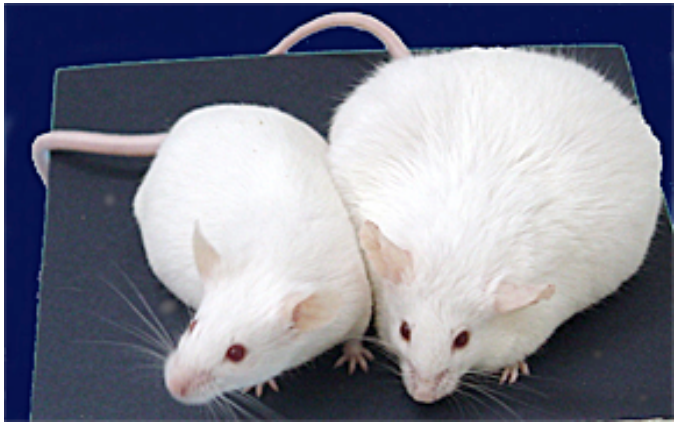
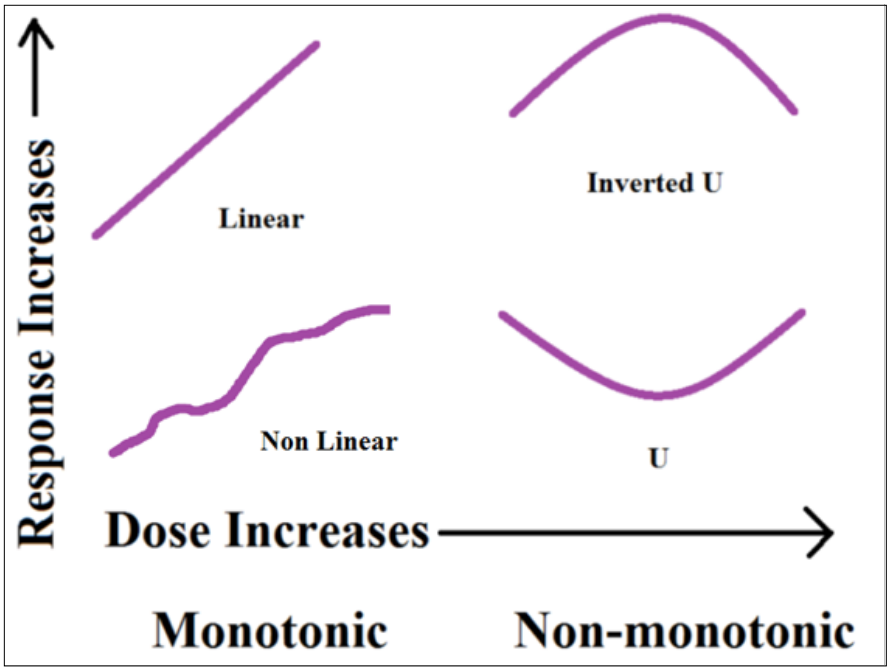
Endocrine Disruptors

- Interfere with the production, release, transport, metabolism, binding, action, or elimination of hormones in the body
- Alter estrogen, androgen, thyroid, and insulin signaling
- Examples: bisphenol A (BPA), phthalates, fragrances, and certain pesticides

"The dose make the poison"
Paracelsus

Does 'the dose make the poison'?





Does the timing makes the poison?

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Susceptibility of fetus/infant

- Neurological system is still developing
- Immune system is not fully developed
- Detoxification systems are not fully mature, so less able to metabolize and excrete harmful chemicals
- Pound for pound, children eat more than adults, and may be more heavily exposed

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Individual Differences

- Each person has unique exposure
- Differences in metabolism and body composition create variability in the degradation of environmental chemicals
- Susceptibility may vary according to genetic polymorphisms (SNPs)

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Evidence of Harm

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Organophosphate pesticides:

- Potent neurotoxins that can affect children's IQ and brain development
- Over the past decade OPs withdrawn from many agricultural uses and banned in home pesticides
- Still applied to certain crops

  2008: kale and collard greens contaminated with two OPs: chlorpyrifos and oxydemeton-methyl
- Decreased birth weight and shorter pregnancy in 300 Ohio mothers exposed to OPs during pregnancy

Rauch S, et al. Associations of Prenatal Exposure to Organophosphate Pesticide Metabolites with Gestational Age and Birth Weight. *Environmental Health Perspectives*. 2012; 120(7):1055-1060

Bisphenol A

- 8 billion pounds produced each year
- A plasticizer also in receipts and can liners
- 90% of us have in our urine (NHANES data)
- BPA exposure linked to breast and prostate cancer, metabolic changes, decreased fertility, early puberty, neurological problems, and immunological changes
- Negative health effects are shown from low-dose BPA exposure (much lower than EPA's "safe" dose)

http://www.breastcancerfund.org/assets/pdfs/publications/disrupted-development-the-dangers-of-prenatal-bpa-exposure.pdf

Phthalates

- Make plastics flexible act as lubricants in cosmetics
- Associated with obesity, reduced female fertility, preterm birth and low birth weight, worsening of allergy and asthma, and behavior changes
- Lower testosterone levels, decrease sperm counts and sperm quality
- Exposure during development linked to malformations of the male reproductive tract and testicular cancer

Ferguson, KK et al. Environmental Phthalate Exposure and Preterm Birth. *JAMA Pediatrics*. 2014; 168(1): 61-67.

Heavy Metals

- Lead (drinking water, wine, chocolate, Mexican candy)
- Mercury (fish, HFCS)
- Manganese (well water, herbal teas, infant formulas)
- Cadmium (oysters, fertilizers)
- Arsenic (rice, chicken, grape and apple juice)

Glyphosate

- The key chemical in Roundup Ready an herbicide used in GMO crops
- Monsanto claims it is safe
  - Humans don't metabolize as we lack the shikimate pathway
  - Our gut microbes DO use this pathway
- March 2015: IARC labels glyphosate a probable carcinogen (2A)
- April 2015 Danish govt outlaws Roundup

IARC Monographs Volume 112: evaluation of five organophosphate insecticides and herbicides

Precautionary Principle

"When an activity raises threats of harm to the environment or human health, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically."

1996 Food Quality Protection Act

- Requires EPA to set health standards for pesticides
  - Considers exposure from water, indoor air, and food
  - Considers cumulative pesticide risks
  - Stresses protection of vulnerable populations
- Agribusiness and pesticide companies have fought to weaken key protections
  - The American Crop Protection Association, successfully lobbied to overturn EPA decision to incorporate a tenfold margin of safety into every risk determination

What can we do?

Recognize environmental chemicals as a trigger for disease

Ask questions: What environmental chemicals might you be exposed to?

Reducing exposure to pesticides

- Eat a plant based diet
- Eat low on the food chain
- For animal products prioritize organic
- Wash produce thoroughly or peel

Organic

- Crops must be grown in safe soil, have no modifications (GMOs) and remain separate from conventional products. Farmers can not use synthetic pesticides, petroleum-based or sewage sludge-based fertilizers
- Livestock must have access to the outdoors and be given organic feed. They may not be given antibiotics, growth hormones, or animal-by-products
- Personal care products must be made with 95% organic ingredients

Food Decisions
when cost is an issue

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Table of Dirty Dozen

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Table of Clean Fifteen

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Less expensive foods:

- Bagged, dried beans
- Frozen vegetables and fruits
- Farmer's markets
- Coupons
- Cooking at home

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Does changing your diet make a difference?

Phthalates, oxidants and antibiotics

- 25 people, 5 days, vegetarian diet, at a Buddhist temple
- Found reduced levels of urinary excretion of antibiotic residues, phthalate metabolites and oxidative stress biomarkers

Ji, K. Influence of a five-day vegetarian diet on urinary levels of antibiotics and phthalate metabolites. *Environmental Research*. 2010; 110(4):375-82.

BPA and phthalates

- Pilot study of 5 SF families
  - Freshly prepared, catered meals, with minimal use of canned foods or plastic
  - Urinary levels of BPA and phthalate metabolites measured
    - BPA levels dropped by 66% in 3 days
    - DEHP levels dropped by 53-56%

Rudel, R et al. Food Packaging and Bisphenol A and Bis(2-Ethyhexyl) Phthalate Exposure: Findings from a Dietary Intervention. *Environmental Health Perspectives*. 2011: 119(7): 914-920.

Soda study

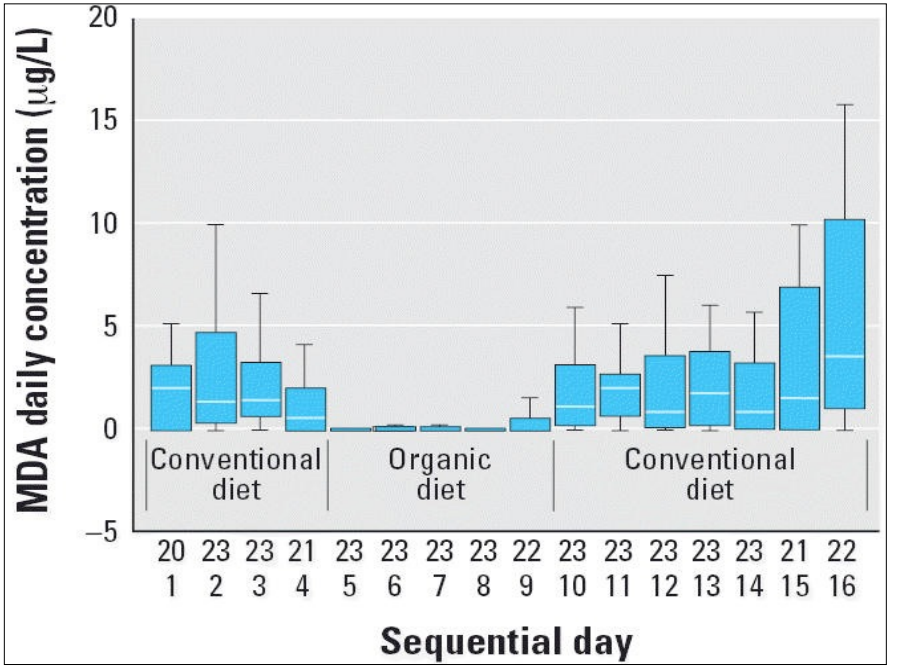
- 77 Harvard college students
- Urinary BPA concentrations rose 69% when drinking cold beverages from polycarbonate bottles compared with washout phase when polycarbonate bottles were avoided

Carwile JL, et al. Polycarbonate bottle use and urinary bisphenol A concentrations. *Environ Health Perspect*. 2009; 117: 1368–1372.

Organic Food in Children

- 23 children aged 3-11
- 15-consecutive-day sampling period
  - Phase 1: conventional diets (days 1–3)
  - Phase 2: organic foods substituted for most of children's conventional diet including fresh and processed fruits and vegetables, juices, and wheat- or corn-based items (pasta, cereal, popcorn, or chips)
  - Phase 3: conventional diet (days 9–15)

Lu C, et al Organic diets significantly lower children's dietary exposure to organophosphorus pesticides. *Environ Health Perspect*. 2006;114:260–3.



Conclusions:

"Organic diets provide a protective mechanism against organophosphate pesticide exposure in young children whose diets regularly consist of fresh fruits and vegetables, fruit juices, and wheat-containing items. Such protection is dramatic and immediate."

Lu C, et al. Organic diets significantly lower children's dietary exposure to organophosphorus pesticides. *Environ Health Perspect*. 2006;114:260–3.

Other reasons to eat organic

- Good for the environment
- Organic milk has more omega 3
- Eating organic chicken and pork reduced exposure to antibiotic-resistant bacteria

Smith-Spangler C, et al. Are organic foods safer or healthier than conventional alternatives? *Ann Intern Med*; 2012;157:348–66.

Limits of Organic

- Does not address chemicals that are introduced in the production or packaging
  - 50 mcg of BPA/liter in canned tomatoes
  - 90% of us have BPA in urine

Food Storage and Containers

filtration options

Carbon Filtration
Reverse Osmosis
Steam Distillation

Increase Detoxification and Elimination

Antioxidants

- Vitamin E and dietary flavonoids, as well as a high ratio of omega-3 to omega-6 fatty acids can protect endothelial cell damage from persistent organic pollutants

Hennig B,et al. Modification of environmental toxicity by nutrients. *Cardiovasc Toxicol*. 2005; (2): 153–160.
Majkova Z, et al. Omega-3 fatty acid oxidation products prevent vascular endothelial cell activation by coplanar polychlorinated biphenyls. *Toxicol Appl Pharmacol*. 2011; 251(1):41–49.
Wang L, et al. Changing ratios of omega-6 to omega-3 fatty acids can differentially modulate polychlorinated biphenyl toxicity in endothelial cells. *Chem Biol Interact*. 2008; 172(1): 27–38.
Petriello MC et al. Influence of nutrition in PCB-induced vascular inflammation. *Environmental Science & Pollution Research*. 2014; 21(10):6410-8.

Can a supplement help with detoxification?

- 291 participants from the Yangtze River delta region of China
- 12-week randomized controlled trial: Broccoli sprout beverage containing glucoraphanin and sulforaphane
- Rapid, statistically significant increases in excretion of benzene (61%) and acrolein (23%)

Egner PA et al. Rapid and sustainable detoxication of airborne pollutants by broccoli sprout beverage: results of a randomized clinical trial in China. *Cancer Prev Res (Phila)*. 2014; 7(8): 813-23.

What's a concerned citizen to do?

- Advocate for change
- Influence policy with your buying dollars
- Take personal precautions

Make the Economic Case!

- BPA exposure estimated to be associated with 12,404 cases of childhood obesity and 33,863 new cases of heart disease in 2008
  - Estimated costs $2.98 billion
  - Removing BPA from food might prevent 6,236 cases of childhood obesity and 22,350 cases of heart disease with potential savings of $1.74 billion

Trasande L. Further Limiting Bisphenol A In Food Uses Could Provide Health And Economic Benefits. *Health Affairs*. Jan 2014: DOI:10.1377/hlthaff.2013.0686.

Recommendations:

- Food recommendations:
  - Organic poultry and meat
  - EWG dirty dozen and clean fifteen or organic produce
  - Choose low mercury fish
  - Avoid GMO foods
  - Avoid canned foods
  - Limit rice
- Store food in stainless steel glass or ceramic
- Filter your water and carry your own bottle
- Check out your personal care products
- Limit exposure to electromagnetic fields

Human organism is complex

We react in variable and unpredictable ways

Seemingly innocuous exposures may be impacting your health

Trust your intuition if something seems amiss

Resources:

- ewg.org
- treehugger.com
- cornucopia.org
- cosmeticsdatabase.com/
- healthystuff.org/
- facebook.com/NoMoreDirtyLooks
- victoriamaizesmd.com