

Reproductive Environmental Health

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What is reproductive environmental health?

A. Environmental exposures during *preconception or the prenatal period* that affect

- maternal health during pregnancy
- fetal health and development
- organ development and function in offspring
- male reproductive capacity

B. Environmental exposures during the *entire life cycle* that affect reproductive capacity

What is reproductive environmental health? Not this!

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HEALTH

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Medicine Bedevils Pregnant Women With Too Many Warnings About Risk

Oct 26, 2013 5:45 AM EDT

A well-meaning medical community is worrying pregnant women silly with indiscriminate warnings about environmental hazards, writes Lenore Skanazy.

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A recent study showing that breast milk procured online is often tainted has many moms experiencing a familiar emotion: fear. It's part and parcel of modern parenting, and starts the minute the pee stick changes color, basically announcing, "Congratulations! And start worrying!"



Nevertheless...

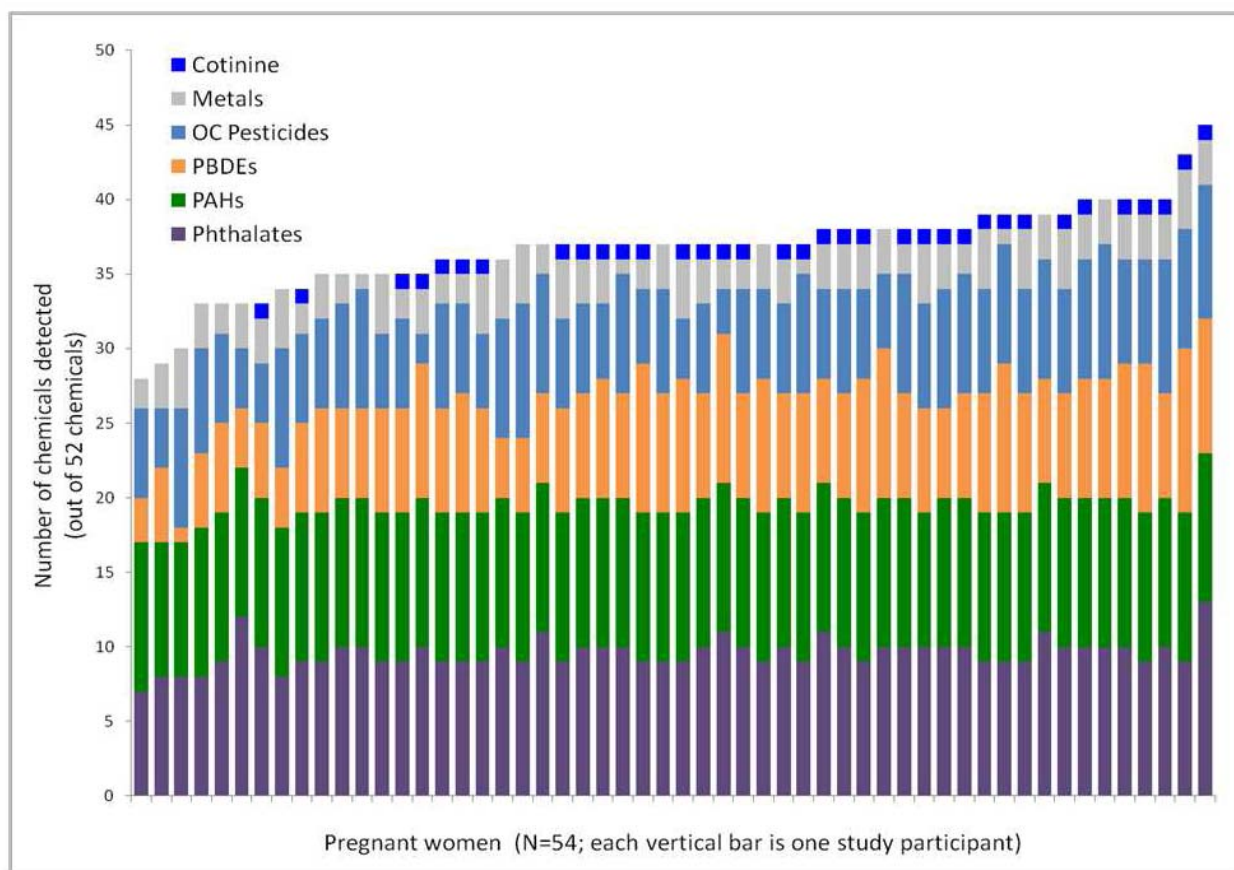
- 84,000 chemicals listed by the EPA
- 700 new chemicals released annually
- 3,000 chemicals are “high volume” or exceed 1million pounds of use a year

- *The vast majority have not been researched nor been subjected to standard studies*

U.S. Environmental Protection Agency. *TSCA Chemical Substance Inventory*. 2012.. Vogel, S.A. and J.A. Roberts, *Why The Toxic Substances Control Act Needs An Overhaul, And How To Strengthen Oversight Of Chemicals In The Interim*. *Health affairs*, 2011. **30**(5): p. 898-905.

Yes, we're all exposed

Figure 3.

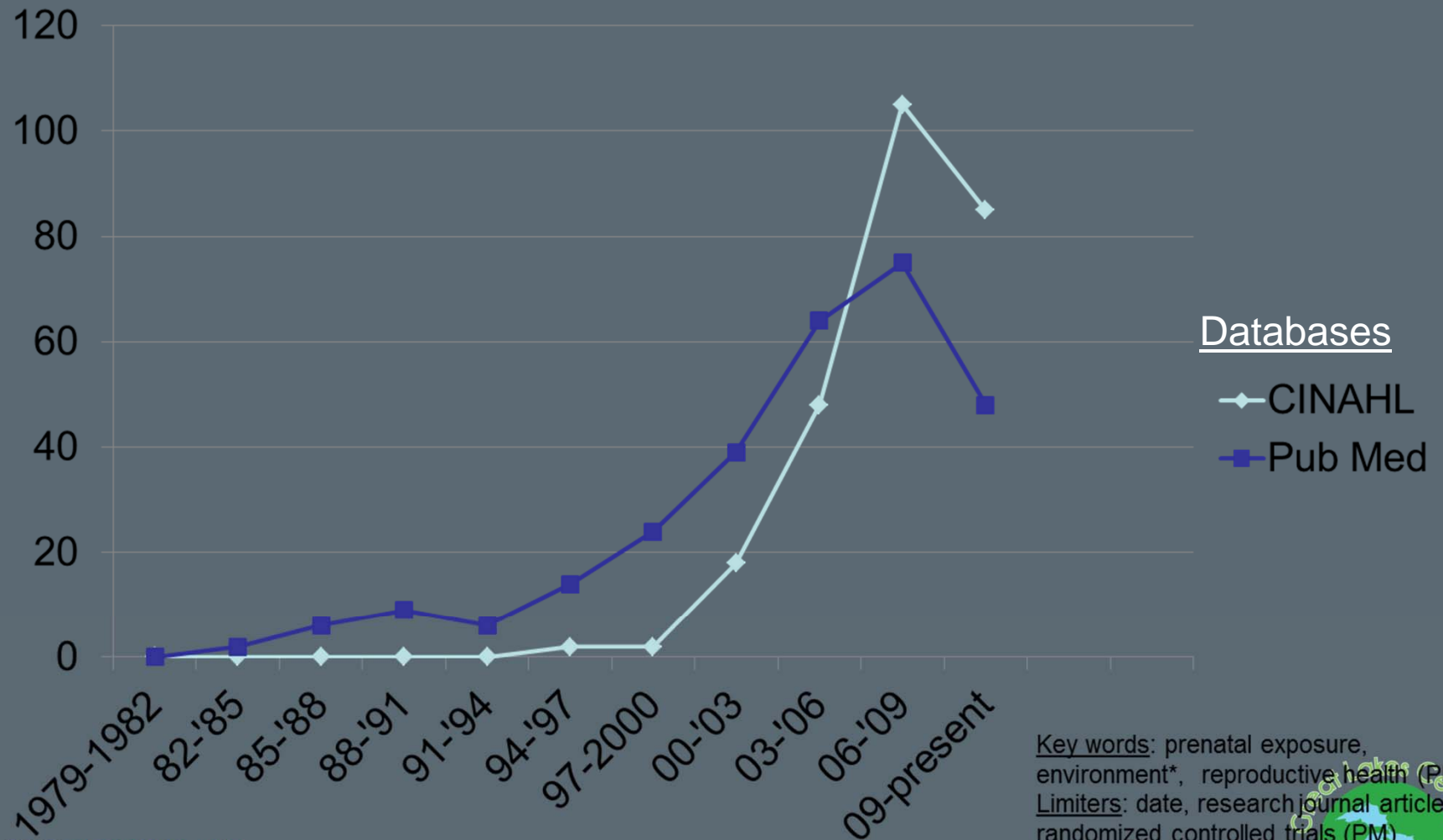


Environmental chemicals in pregnant women in the United States: NHANES 2003-2004 Woodruff TJ, Zota AR, Schwartz JM. *Environ Health Perspect.* 2011 Jun;119(6):878-85163

Reproductive Diseases/Disorders	Increase	Period	Location	Ref.
↑ Testicular cancer	1– 6%	1953 - 1999	Europe	[20]
	60%	1973 - 2003	USA	[21]
Certain childhood cancers	20 – 24%	1976 - 2005	USA	[22]
Autism	700–800%	1990 - 2006	California	[23]
Attention Deficit Hyperactivity Disorder	3% per year	1997 - 2006	USA	[24]
Birth defects:				
<i>Cryptorchidism</i>	200%	1970 - 1993	USA	[25]
<i>Gastroschisis</i>	300%	1978 - 2005	California	[26]
<i>Congenital hypothyroidism</i>	138%	1987 - 2003	New York	[27]
Reproductive Function		Time	Location	Ref.
↓ Reported difficulty conceiving and maintaining pregnancy				
<i>All ages</i>	60% more women	1982; 2002	USA	[28, 29]
<i><25 years old</i>	200% more women	1982; 2002	USA	[28, 29]
Prematurity	2.9% shorter gestation	1992 - 2002	USA	[30]
Pre-eclampsia	19-36%	1968-2002	Norway	[31]
Gestational Diabetes	122%	1989-2004	USA	[32]
Premature puberty:				
<i>Age at onset of breast development</i>	1 – 2 years younger	1940 - 1994	USA, Denmark	[6, 33]
<i>Age at onset of menstruation</i>	2.5 – 4 months younger	1940 - 1994	USA	[6]
Sperm count	~1% decline per year	1931 - 1994	Western countries	[34, 35]
Serum testosterone	1% decline per year	1987 - 2004	Boston, USA	[36, 37]

Woodruff, T.J., Schwartz J, and Giudice L.C., *Research agenda for environmental reproductive health in the 21st century. J Epidemiol Community Health*, 2010 . 64(4) : p. 307-10

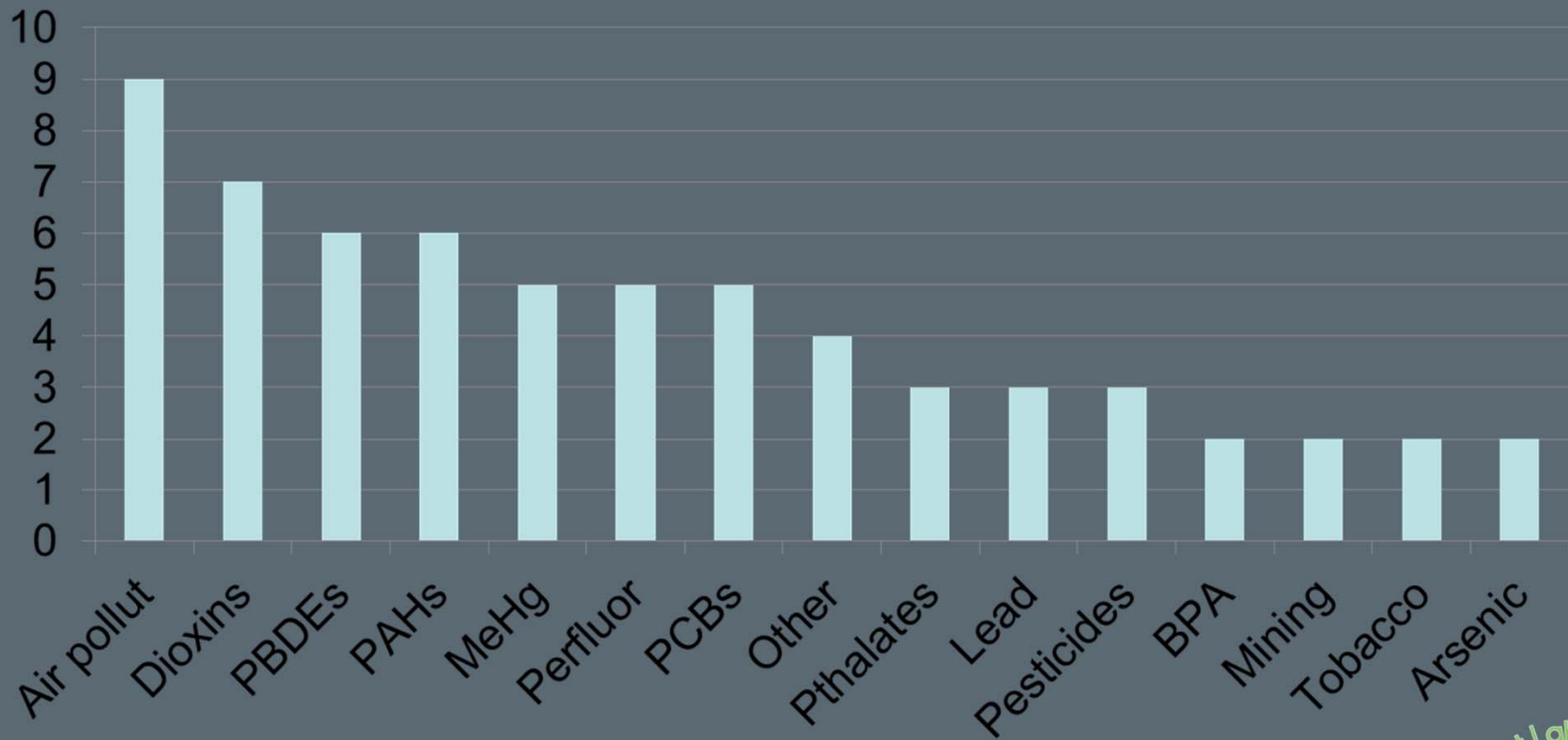
Number of research articles on reproductive environmental health 1979-present*



Key words: prenatal exposure, environment*, reproductive health (PM)
Limiters: date, research journal articles, randomized controlled trials (PM)

Exposures

Exposure



Health outcomes

- Reproductive capacity – age of menarche, menstrual irreg., onset of puberty, anovulation, semen quality
- Organ function of offspring – lung, thyroid, immune syst, cancer, vaccine response
- Maternal effects – thyroid, BP
- Birth defects
- Fetal health – preterm birth, LBW
- Growth of offspring - obesity
- Neurodevelopment – IQ
- Infant mortality

Current Obstetrical literature

Obstetrics and Gynecology (the “Green journal”)

1/2011 - 3/2012: **0 articles**

Contemporary Ob/Gyn

1/2011 - 3/2012: **0 articles**

American Journal of Obstetrics and Gynecology (the “Gray journal”)

1/2011 - 3/2012: **4 articles**

Toxicants Known to be Important in Fetal Origins of Disease in Humans

- **Air pollution**
 - PM
 - Diesel
 - PAHs
- **Heavy metals**
 - Methyl mercury
 - Lead
- **Chemicals**
 - Pesticides
 - Endocrine disruptors: BPA, phthalates, PBDEs

Polycyclic aromatic hydrocarbons--aromatic DNA adducts in cord blood and behavior scores in New York City children.

Perera FP, Wang S, Vishnevetsky J, Zhang B, Cole KJ, Tang D, et al. (2011). *Environ Health Perspect*, 119(8)

- 141 African American and Dominican mother/child pairs
- Cord blood for hydrophobic DNA adducts
- Child Behavior Checklist at 4.8 and 7 years

Table 3. Associations between DNA adducts in cord blood and CBCL syndrome and DSM-oriented outcomes.^a

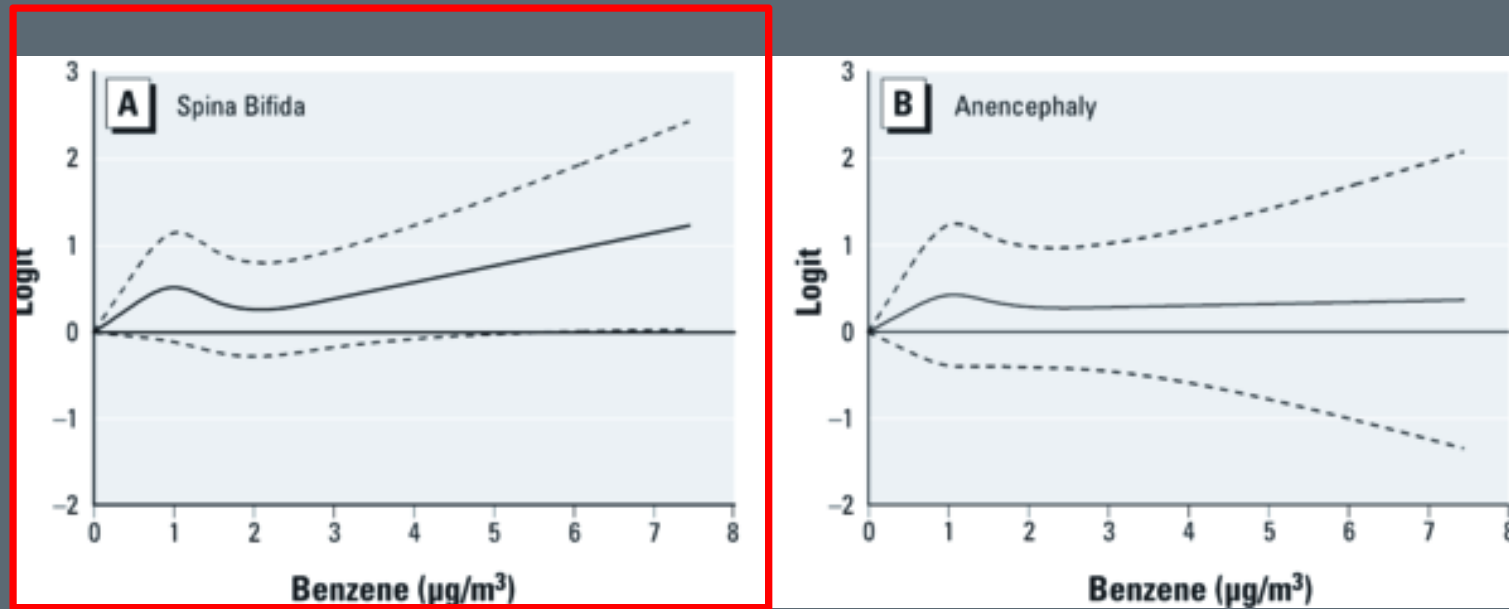
Exposure	CBCL: Anxious/depressed				CBCL: Attention problems				DSM: Anxiety problems	
	Poisson raw		Logistic dichotomized T		Poisson raw		Logistic dichotomized T		Logistic model	
	β (95% CI)	<i>p</i> -Value	OR (95% CI)	<i>p</i> -Value	β (95% CI)	<i>p</i> -Value	OR (95% CI)	<i>p</i> -Value	OR (95% CI)	<i>p</i> -Value
Cord ² P adducts, age 4.8 years ^{b,c}	0.34 (0.04–0.64)	0.026*	8.14 (1.21–54.94)	0.031*	0.38 (0.06–0.69)	0.018*	5.66 (0.64–50.05)	0.119	8.30 (1.13–60.71)	0.037*
Cord ² P adducts, age 7 years ^{b,d}	-0.03 (-0.22 to 0.16)	0.773	1.42 (0.45–4.46)	0.544	0.22 (0.06–0.38)	0.009*	3.30 (1.22–12.54)	0.022*	1.26 (0.42–3.82)	0.683

^aThe model includes prenatal ETS, sex of child, gestational age, maternal IQ, HOME inventory, maternal education, ethnicity, prenatal demoralization, age at assessment, and heating season as covariates. ^bAdducts were dichotomized at upper quartile. ^cRange: 3.75–5.91 years, *n* = 96, with 80 children classified as low exposure and 16 children classified as high exposure. ^dRange: 6–8 years, *n* = 205, with 149 children classified as low exposure and 56 children classified as high exposure. **p* < 0.05.

Maternal exposure to ambient levels of benzene and neural tube defects

among offspring: Texas, 1999-2004. Lupo PJ, Symanski E, Waller DK, Chan W, Langlois PH, Canfield MA, et al. 2011. Environ Health Perspect 119:397-402

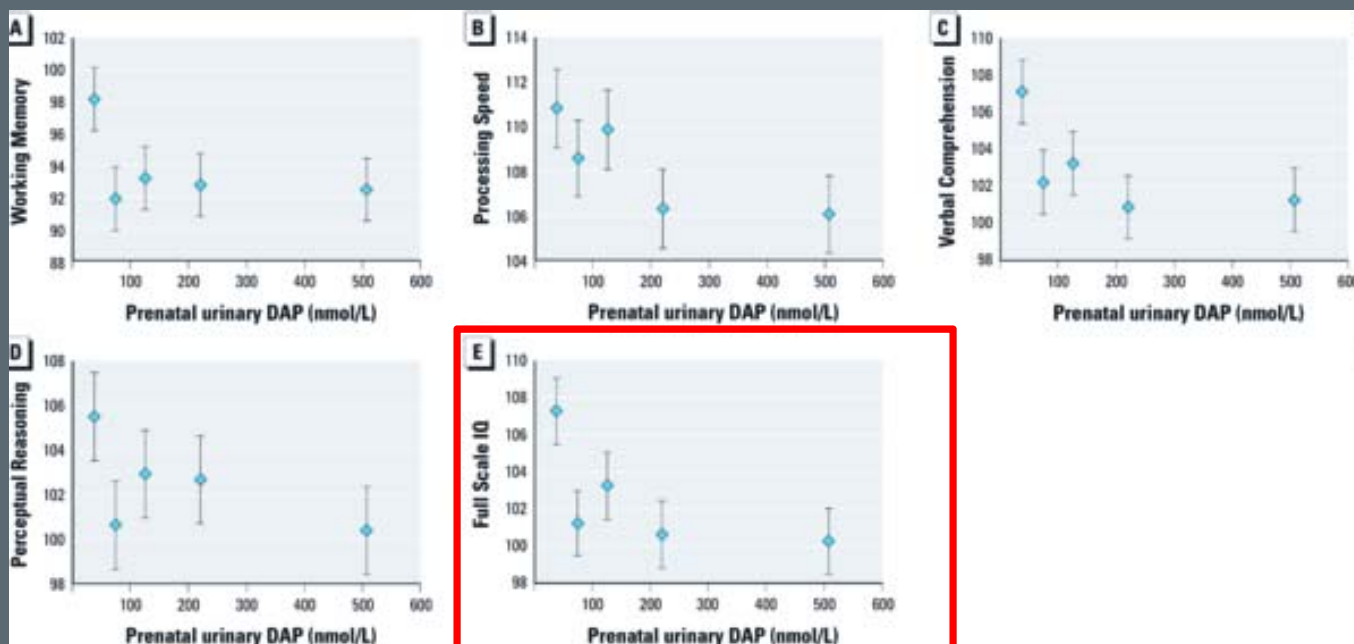
- The Texas Birth Defects Registry provided data on NTD cases (spina bifida and anencephaly)
- Census tract-level estimates of annual BTEX levels



Mothers living in census tracts with the highest benzene levels were more likely to have offspring with spina bifida than were women living in census tracts with the lowest levels. odds ratio = 2.30; CI (1.22 4.33)

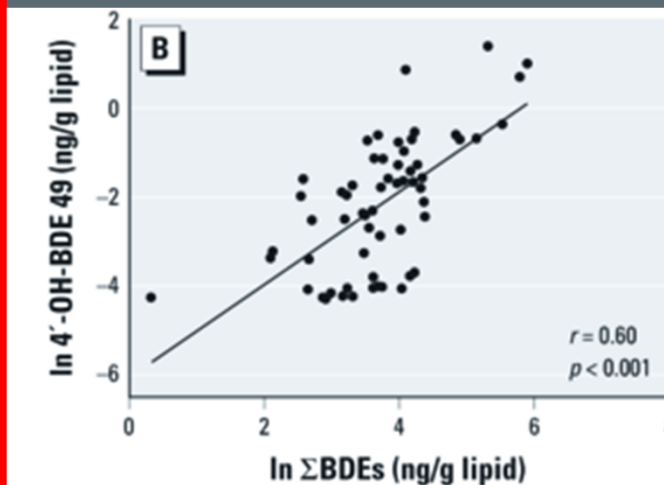
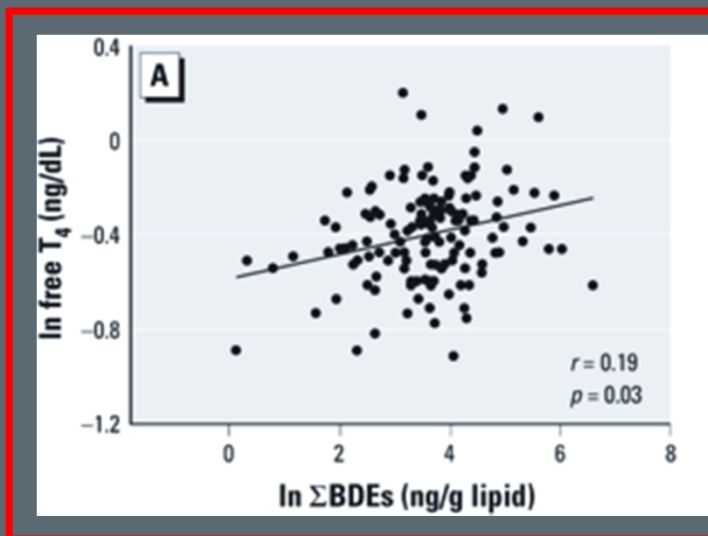
Prenatal Exposure to Organophosphate Pesticides and IQ in 7-Year-Old Children. Bouchard MF, Chevrier J, Harley KG, Kogut K, Vedar M, Calderon N, et al. (2011). *Environ Health Perspect*, 119(8), 1189-1195.

- Birth cohort study (Center for the Health Assessment of Mothers and Children of Salinas study): Latino farmworker families
- Dialkyl phosphate (DAP) metabolites in urine during pregnancy and from children at 6 months and 1, 2, 3.5, and 5 yo
- WISC-4 to 329 children at 7 yrs, adjusted for maternal education and intelligence, HOME score



“Children in the highest quintile of maternal DAP concentrations had an average deficit of 7.0 IQ points compared with those in the lowest quintile”

Associations Between Polybrominated Diphenyl Ether (PBDE) Flame Retardants, Phenolic Metabolites, and Thyroid Hormones During Pregnancy Stapleton H M, Eagle S, Anthopolos R, Wolkin A, & Miranda ML. (2011). Environ Health Perspect 119(10), 1454-1459

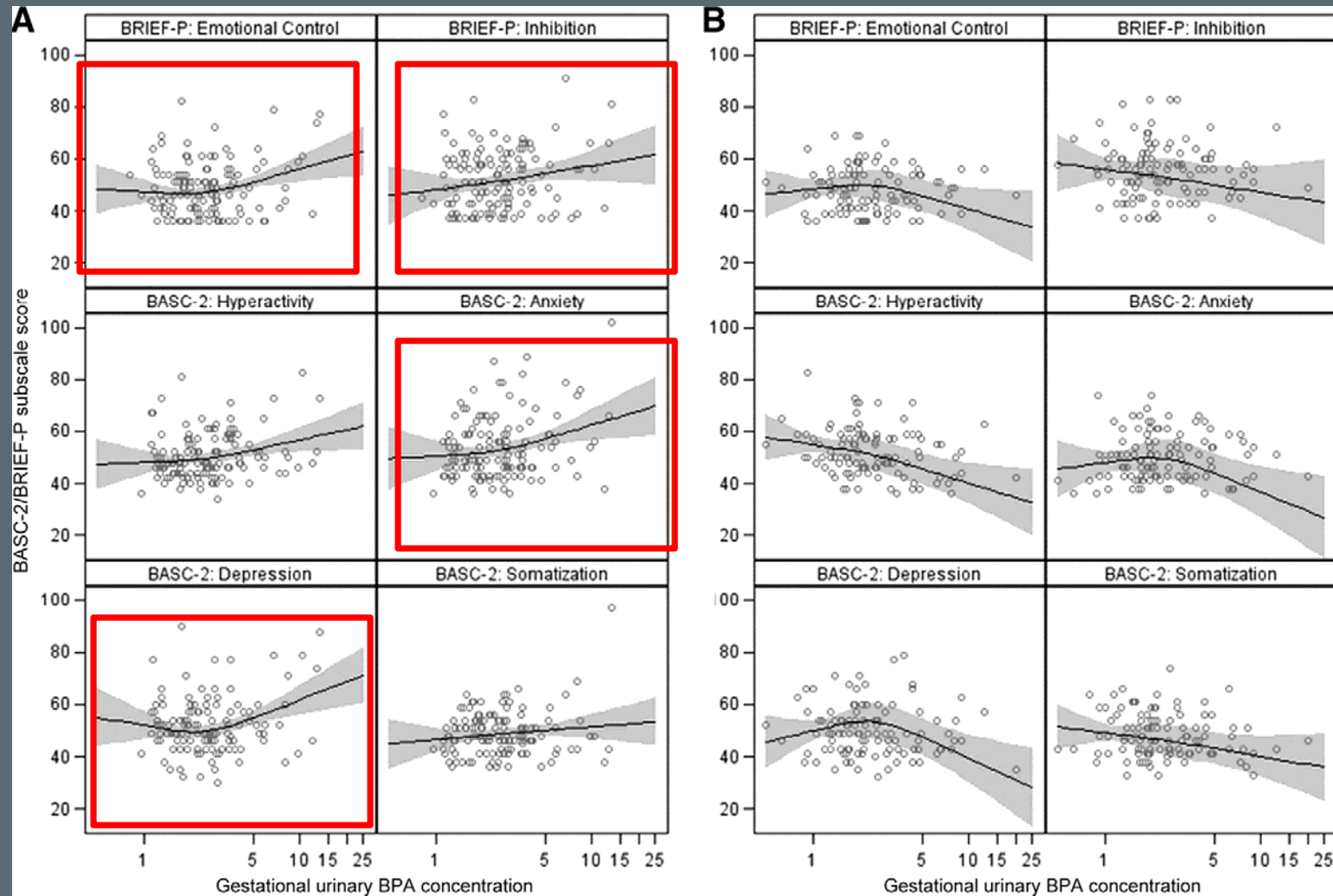


- African American patients from Duke OB clinics.
- TFTs in 3rd trimester

Impact of early-life bisphenol A exposure on behavior and executive function in children. Braun JM, Kalkbrenner AE, Calafat AM, Yolton K, Ye X, Dietrich K. N, et al.(2011). Pediatrics, 128(5), 873-882

- Health Outcomes and Measures of the Environment Study, birth cohort in Cincinnati
- Spot urines for BPA during preg and early childhood
- Behavior Assessment System for Children 2 (BASC-2) Parent Rating Scale for preschoolers and Behavior Rating Inventory of Executive Function-Preschool (BRIEF-P) at 3 yrs of age

Scatterplot and adjusted smoothed regression of gestational urinary BPA concentrations and BASC-2/BRIEF-P subscale scores at 3 years of age: A, girls; B, boys.



Braun J M et al. Pediatrics 2011;128:873-882

What's new?

- Lead Guidelines
- Outreach to prenatal healthcare providers
- Recommendations for clinical practice
- RCEH work group: focusing on education, clinical practice, policy

GUIDELINES FOR THE IDENTIFICATION AND MANAGEMENT OF LEAD EXPOSURE IN PREGNANT AND LACTATING WOMEN



National Center for Environmental Health
Division of Emergency and Environmental Health Services



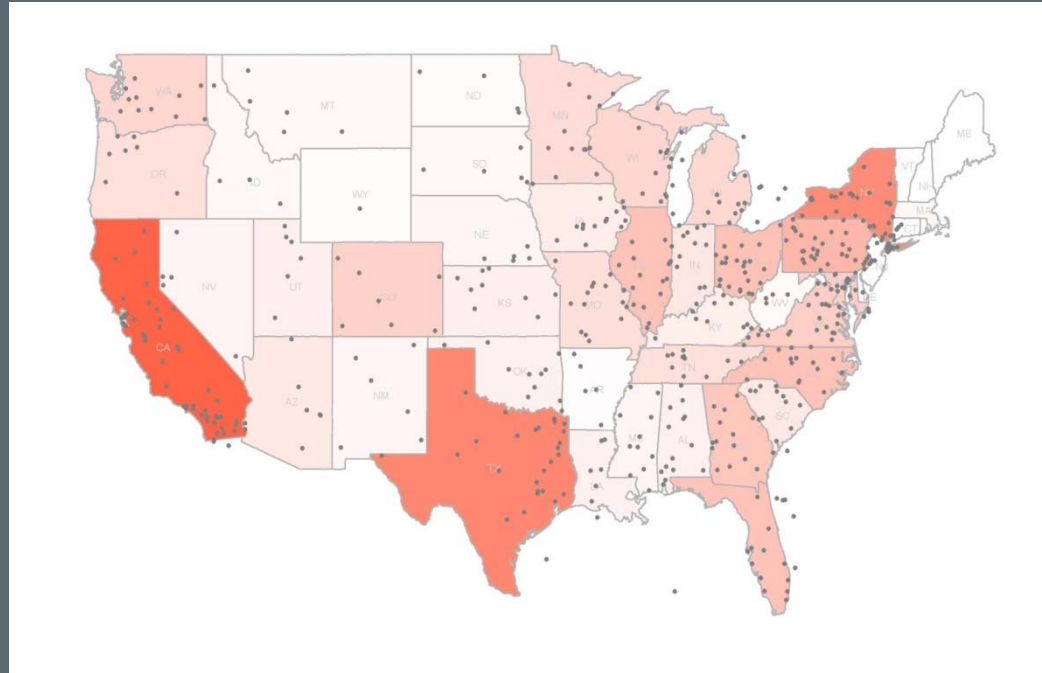
November 2010

Figure 5-1. New York City Department of Health and Mental Hygiene: Recommended Lead Risk Assessment Questions for Pregnant Women

Health-care providers should use a blood lead test to screen pregnant women if they answer “yes” to any of the following questions:

1. Were you born, or have you spent any time, outside of the United States?
In NYC, approximately 95% of identified lead-poisoned pregnant women are foreign born. Countries of birth in descending order of frequency include Mexico, India, Bangladesh, Russia, Pakistan, Ecuador, Haiti, Jamaica, Morocco, Dominican Republic, Guatemala, Guyana, El Salvador, Gambia, Ghana, Honduras, Israel, Ivory Coast, Korea, Nepal, Sierra Leone, and Trinidad.
2. During the past 12 months, did you use any imported health remedies, spices, foods, ceramics, or cosmetics?
3. At any time during your pregnancy, did you eat, chew on, or mouth nonfood items such as clay, crushed pottery, soil, or paint chips?
4. In the last 12 months, has there been any renovation or repair work in your home or apartment building?
5. Have you ever had a job or hobby that involved possible lead exposure, such as home renovation or working with glass, ceramics, or jewelry?

UCSF ACOG Survey 2011 (N=2,625)



Stotland NE, Sutton P, Trowbridge J, Atchley D, Charlesworth A, Conry J, Trasande L, Gerbert B, Woodruff TJ. Preventing Toxic Prenatal Environmental Exposures: Attitudes, Beliefs and Practices of U.S. Obstetricians (in review)



78%
of obstetricians
surveyed feel that
they can reduce
patient exposure

**Yet, less than 25% report they take
an environmental health history**

What Do Obstetricians Ask About?

100%



Less than 20%





The American College of
Obstetricians and Gynecologists
WOMEN'S HEALTH CARE PHYSICIANS



COMMITTEE OPINION

Number 575, October 2013

The American College of Obstetricians and Gynecologists Committee on Health Care for Underserved Women

American Society for Reproductive Medicine Practice Committee

The University of California, San Francisco Program on Reproductive Health and the Environment

This Committee Opinion was developed by the American College of Obstetricians and Gynecologists Committee on Health Care for Underserved Women and the American Society for Reproductive Medicine Practice Committee with the assistance of the University of California, San Francisco (UCSF) Program on Reproductive Health and the Environment. The Program on Reproductive Health and the Environment endorses this document. This document reflects emerging clinical and scientific advances as of the date issued and is subject to change. This information should not be construed as dictating an exclusive course of treatment or procedure to be followed.

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Exposure to Toxic Environmental Agents

ABSTRACT: Reducing exposure to toxic environmental agents is a critical area of intervention for obstetricians, gynecologists, and other reproductive health care professionals. Patient exposure to toxic environmental chemicals and other stressors is ubiquitous, and preconception and prenatal exposure to toxic environmental agents can have a profound and lasting effect on reproductive health across the life course. Prenatal exposure to certain chemicals has been documented to increase the risk of cancer in childhood; adult male exposure to pesticides is linked to altered semen quality, sterility, and prostate cancer; and postnatal exposure to some pesticides can interfere with all developmental stages of reproductive function in adult females, including puberty, menstruation and ovulation, fertility and fecundity, and menopause. Many environmental factors harmful to reproductive health disproportionately affect vulnerable and underserved populations, which leaves some populations, including underserved women, more vulnerable to adverse reproductive health effects than other populations. The evidence that links exposure to toxic environmental agents and adverse reproductive and developmental health outcomes is sufficiently robust, and the American College of Obstetricians and Gynecologists and the American Society for Reproductive Medicine join leading scientists and other clinical practitioners in calling for timely action to identify and reduce exposure to toxic environmental agents while addressing the consequences of such exposure.

ACOG/ASRM Committee Opinion

- *Reducing exposure to toxic environmental agents is a critical area of intervention for obstetricians, gynecologists, and other reproductive health care professionals.*
- *The evidence that links exposure to toxic environmental agents and adverse reproductive and developmental health outcomes is sufficiently robust*
- *[ACOG] and [ASRM] join leading scientists and other clinical practitioners in calling for timely action to identify and reduce exposure to toxic environmental agents while addressing the consequences of such exposure.*

Implications for Clinical Practice

- **Detect environmental threats** in the environments (home/work) of your patients.
- **Educate patients** regarding potential threats.
- **Mitigate impact of exposures** through recommendation of behavioral changes, patient level action.
- **Advocate – patient level** through screening practices in your institutions and clinics
- **Advocate - community level** through capacity building within interested groups of patients and community leaders
- **Advocate - policy level** through support of ACOG SMFM, etc. initiatives to respond to environmental threats
- **Participate** – through projects and collaborations, build new knowledge of level of effects and successes of interventions

- Insert environmental history questions into EHR
- Ask a single fish consumption question, a couple of lead exposure questions.
- Complete on-line CME – *HealthyFishChoices*, *FreshAirForMom*
- Utilize Pediatric Environmental Health Specialty Units (PEHSUs)
- Reproductive and Children’s Environmental Health

(RCEH) Work Group



PRENATAL ENVIRONMENTAL EXPOSURE HISTORY

Assessment	Yes	No	Steps to Reduce Risk
Have you or anyone living in your house ever been treated for lead poisoning?			<p>Have your home tested for lead if it was built before 1978</p> <p>Avoid remodeling or hire a certified contractor</p> <p>Call 1-800-424-LEAD for more information</p> <p>Do not use lead -containing home remedies</p> <p>Do not eat clay, soil, dirt, pottery, or paint chips because they may contain high levels of lead</p> <p>Eat foods enriched with iron (lean red meats, chicken), calcium (dairy products and green leafy vegetables), and vitamin C (oranges, grapefruits, tomatoes, and green peppers)</p>
Do you live in a house built before 1978?			
Are there any plans to remodel your home?			
Have you ever lived outside the United States?			
Does your family use imported pottery or ceramics for cooking, eating, or drinking?			
Have you used any home remedies such as azarcon, greta, pay-loo-ah?			
Have you ever eaten any of the following:			
Clay			
Soil or dirt			
Pottery			
Paint chips			
Is there a mercury thermometer in your home?			<p>Use a digital or mercury-free thermometer</p> <p>Dispose of mercury at hazardous waste sites</p> <p>Do not eat shark, swordfish, king mackerel or tilefish because they contain high levels of mercury</p> <p>Albacore tuna contains more mercury than canned light tuna; Do not eat more than one meal (6 oz) per week of albacore tuna.</p> <p>Contact local health dept. about local fish advisories</p>
Do you eat any of the following types of fish:			
Shark			
King Mackerel			
Swordfish			
Tilefish			
Albacore tuna ("white" tuna)			
If so, do you eat more than one meal per week of the selected fish?			



PRENATAL ENVIRONMENTAL EXPOSURE HISTORY

Assessment	Yes	No	Steps to Reduce Risk
Have you or anyone living in your house ever been treated for lead poisoning?			Have your home tested for lead if it was built before 1978
Do you live in a house built before 1978?			Avoid remodeling or hire a certified contractor
Are there any plans to remodel your home?			
Have you ever lived outside the United States?			Call 1-800-424-LEAD for more information
Does your family use imported pottery or ceramics for cooking, eating, or drinking?			Do not use lead-containing home remedies
Have you used any home remedies such as azarcon, greta, pay-loo-ah?			Do not eat clay, soil, dirt, pottery, or paint chips because they may contain high levels of lead
Have you ever eaten any of the following:			
Clay			Eat foods enriched with iron (lean red meats, chicken), calcium (dairy products and green leafy vegetables), and vitamin C (oranges, grapefruits, tomatoes, and green peppers)
Soil or dirt			
Pottery			
Paint chips			
Is there a mercury thermometer in your home?			Use a digital or mercury-free thermometer
Do you eat any of the following types of fish:			Dispose of mercury at hazardous waste sites
Shark			Do not eat shark, swordfish, king mackerel or tilefish because they contain high levels of mercury
King Mackerel			Albacore tuna contains more mercury than canned light tuna; Do not eat more than one meal (6 oz) per week of albacore tuna.
Swordfish			Contact local health dept. about local fish advisories
Tilefish			
Albacore tuna ("white" tuna)			
If so, do you eat more than one meal per week of the selected fish?			
Do you use a wood burning stove or fireplace?			Ensure adequate ventilation of wood burning stoves and fireplaces.
Do you plan on having rehab or painting done in your home during your pregnancy?			Avoid exposure to paint fumes, wood strippers, and other products containing solvents.
Do you use kerosene or gas space heaters?			Crack a window when using space heaters.
Do you live near an industrial site or busy roadway?			Avoid outdoor exercise on high air pollution days.
Does your home have a:			Smoke and carbon monoxide detectors should be installed on all floors and near bedrooms
Smoke detector?			
Carbon monoxide detector?			
Does anyone who lives in your home smoke?			Avoid public places where smoking is allowed
Do any people who will be taking care of the baby smoke?			Make your home smoke-free
Do you use pesticides (insecticides, herbicides, rodenticides) such as Raid, "Weed & Feed" or OFF:			Practice Integrated Pest Management
Inside your home?			Avoid sprays, foggers, and bug bombs.
Outside your home?			
On your pets?			For more information go to the National Pesticide Information website, http://npic.orst.edu/
What do you do for work?			
Are you exposed to any of the following at work:			Always wear proper personal protective equipment (PPE)
Metals			
Solvents			
Chemicals			
Radiation			
Fumes			

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