

Pregnancy and Vulnerability of Children

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Epidemiology

Director, Center for Children's Environmental Health Research

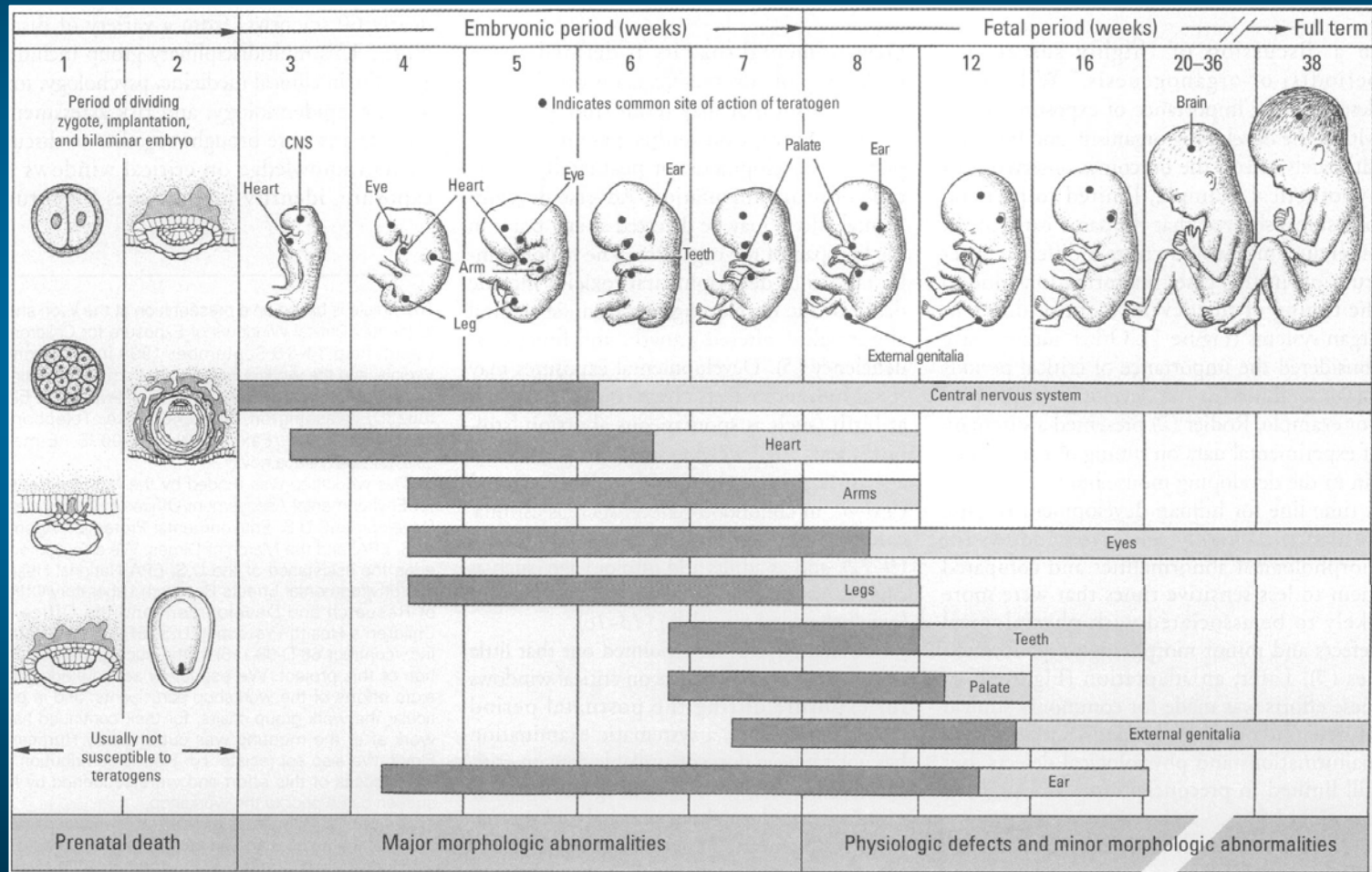
School of Public Health, UC Berkeley

Institute of Medicine
New Orleans
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Overview

- What should we consider in examining exposures to pregnant women and children?
- What do we know about oil spills?
What don't we know?
- What information can we get quickly and cheaply to understand risks?
- How do we prevent exposure in the face of uncertainty?
What do we tell pregnant women and concerned parents?

Fetuses are vulnerable: Critical Windows of Fetal Development



Developing organs are more sensitive.

Children are vulnerable

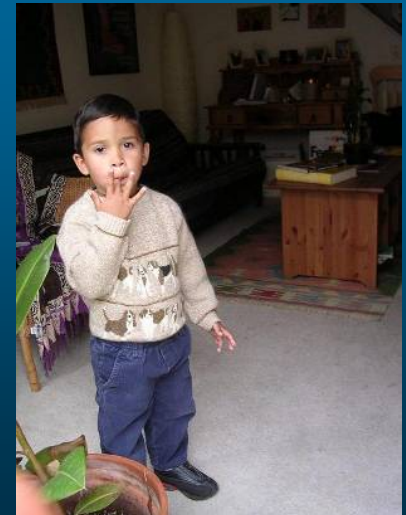
➤ Higher exposures:

- Eat, drink, and breathe more per kg
- Exploring their environment
- Frequent contact with ground or floor
- Hand-to-mouth activity

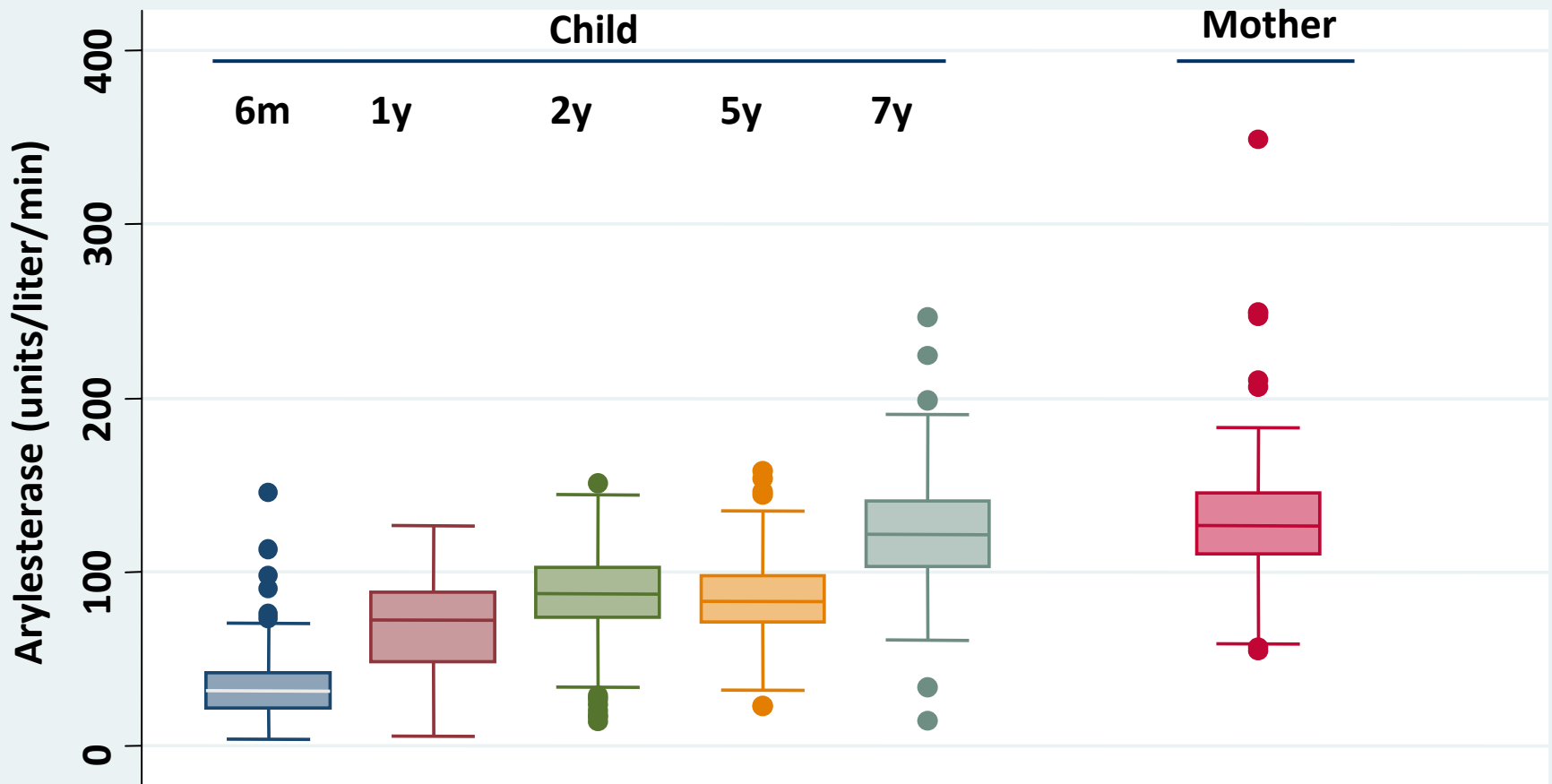


➤ Metabolism

- Less efficient at detoxifying/metabolizing chemicals



Enzymes needed for detoxification of OP pesticides do not reach adult levels until age 7 years



Ontogeny and genetics affect susceptibility

How do children get exposed?

1. Across the placenta



2. Ingestion



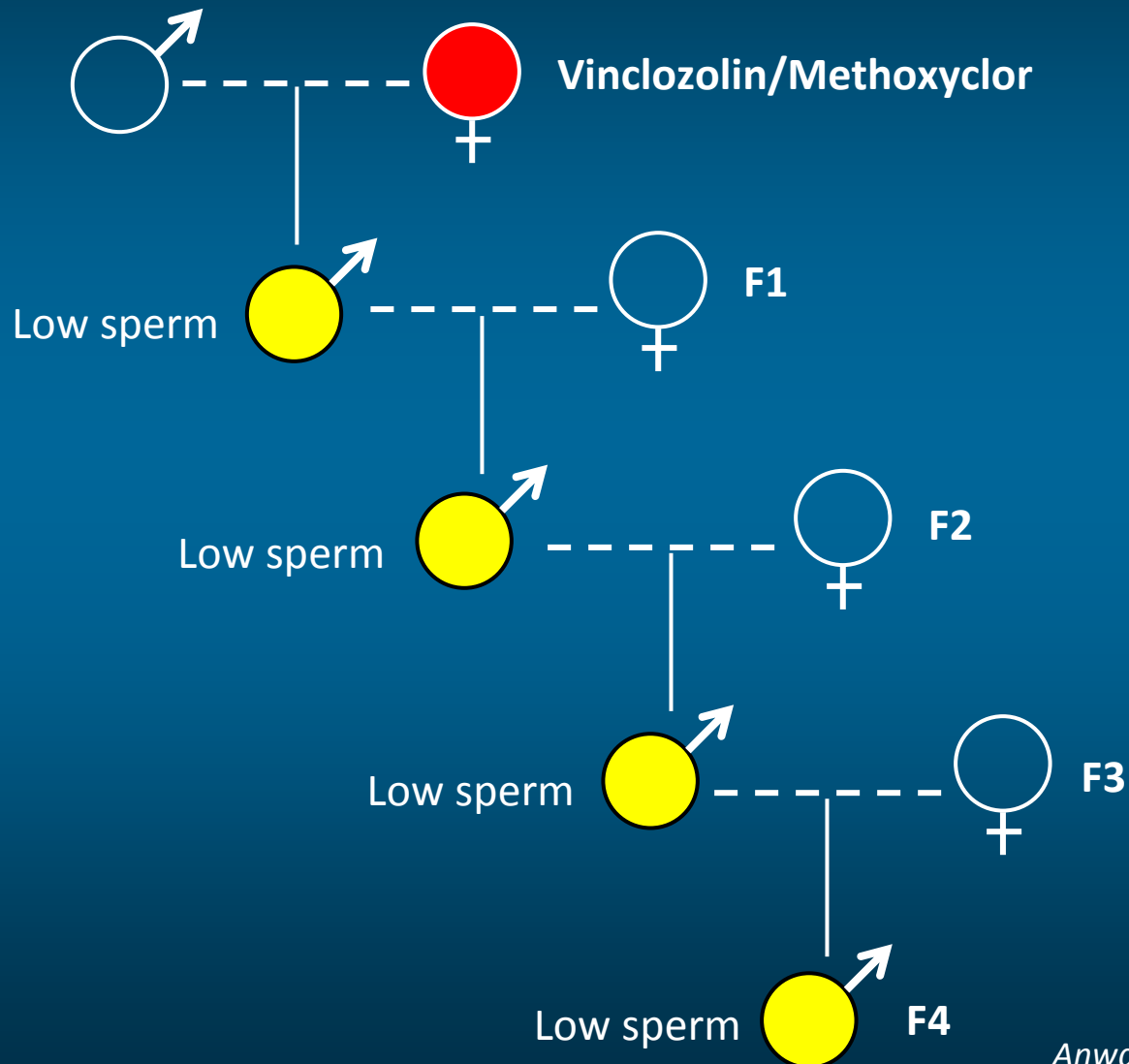
3. Inhalation of contaminated air



4. Dermal Absorption



Epigenetic Transgenerational Actions of Endocrine Disruptors and Male Fertility



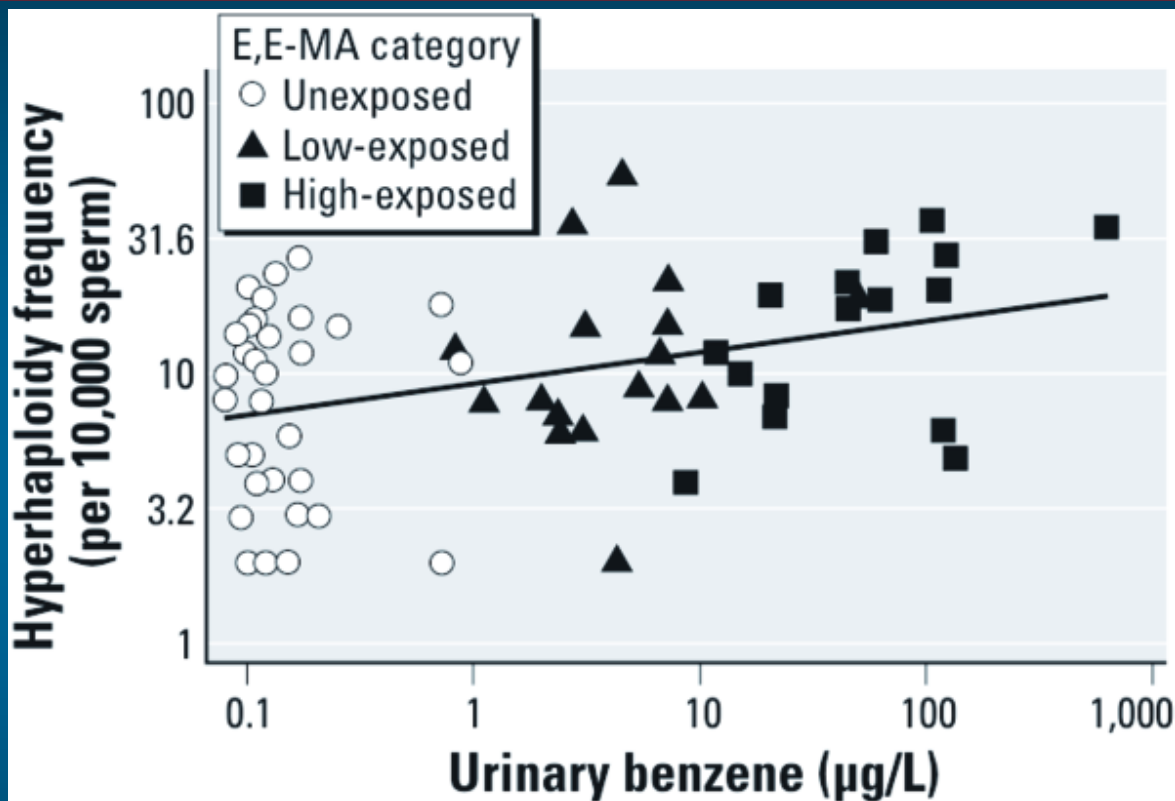
Paternal Exposures May Affect Offspring

Paternal exposure could increase risks of:

- spontaneous abortions
- birth defects
- children with aneuploidy syndromes (e.g., Down syndrome)
- *etc.*



Benzene exposure to the fathers may affect health of offspring



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What chemicals are humans potentially exposed to from the Oil Spill?

Crude Oil contains hundreds of individual chemicals

- Benzene
- n-octane
- n-hexane
- n-heptane
- n-decane
- Toluene
- Ethyl benzene
- o-Xylene
- m-Xylene
- p-Xylene
- Naphthalene
- 2,2-Dimethylbutane
- 2,3-Dimethylbutane
- 2-Methylpentane
- 3-Methylpentane
- 3-Ethylpentane
- 2,3-Dimethylpentane
- 2,4-Dimethylpentane
- 2-Methylhexane
- 3-Methylhexane
- 2,2- Dimethylhexane
- 2,3- Dimethylhexane
- 2,4- Dimethylhexane
- 2,5- Dimethylhexane
- 2,3- Dimethylheptane
- 2,6-Dimethylheptane
- 2-Methyloctane
- 3-Methyloctane
- 4-Methyloctane
- Cyclopentane
- Methylcyclopentane
- 1,1-Dimethylcyclopentane
- Indan
- Tetrahydronaphthalene
- Fluorene
- Phenanthrene
- 1,2,3,4-Tetramethylbenzene
- 1,2,3-Trimethylbenzene
- 1,2,4-Trimethylbenzene
- 1,3,5-Trimethylbenzene
- Cyclohexane
- Ethylcyclohexane
- 1,1,2-Trimethylcyclopentane
- 1,1,3-Trimethylcyclopentane
- Biphenyl
- 1-Trans-3-dimethylcyclopentane
- 1-Trans-2-dimethylcyclopentane
- 1-Cis-3-dimethylcyclopentane

Dispersants used for BP Oil Spill

- Main ones used by BP: COREXIT 9527 and COREXIT 9500 (Nalco Co)
- Components of COREXIT 9527 and 9500
 - 1,2-Propanediol
 - 2-butoxyethanol (COREXIT 9527)
 - Butanedioic acid, 2-sulfo-, 1,4-bis(2-ethylhexyl) ester, sodium salt
 - Sorbitan, mono-(9Z)-9-octadecenoate
 - Sorbitan, mono-(9Z)-9-octadecenoate, poly(oxy-1,2-ethanediyl)
 - Sorbitan, tri-(9Z)-9-octadecenoate, poly(oxy-1,2-ethanediyl)
 - 2-Propanol, 1-(2-butoxy-1-methylethoxy)
 - Distillates (petroleum), hydrotreated light

Examples of Studies:

Health Effects of PAHs on Pregnancy and Childhood

Population	N	Exposure	Outcome	Author, YR
Newborns in Poland (industrialized coal burning)	N=160	Airborne PAHs (adducts)	↓ birth length ↓ birth weight ↓ head circumference (HC)	Perera 1998
Pregnant women Krakow & NYC	N=340 (Krakow) N=380 (NYC)	Airborne PAHs (Air samples)	↓ birth weight	Choi 2006
Chinese children of mothers close to coal-fired power plant	N=150	maternal blood PAH	↓ birth head circumference ↓ body weight toddlers	Tang 2006
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Children w/brain tumors vs. children w/o cancer (7 countries)	1218 cases 2223 controls	Parental work exposure to PAHs 5 yrs before birth (job-exposure matrix)	Maternal exposure rare Paternal exposure: OR=1.3 brain tumors	Cordier 2004

Childhood Leukemia and Petrol

Population	N	Exposure	Result	Author/Yr
China (Shanghai)	309 cases 618 controls registry	Interview: Maternal exposure to gasoline, benzene	OR=2-4 for ANLL	Shu, 1988
France	280 incident cases 285 controls hospital	interview Petrol station repair garage	Dose related Both in utero and childhood	Steffen 2004
France	765 cases 1681 controls registry	Interview Next to petrol station	OR=2.1 ever from conception	Brosselin 2009
SE Texas	977 cases 1995-2004 registry	EPA benzene, butadiene GIS	OR=1.4 hi benzene OR=1.4 hi butadiene	Whitworth 2008
Taiwan	729 cases deaths 729 controls	Petrol station density, GIS	Dose-related	Weng 2010

Examples of Studies on

Health Effects of Benzene on Pregnancy and Childhood

Population	N	Exposure	Outcome	Author, Year
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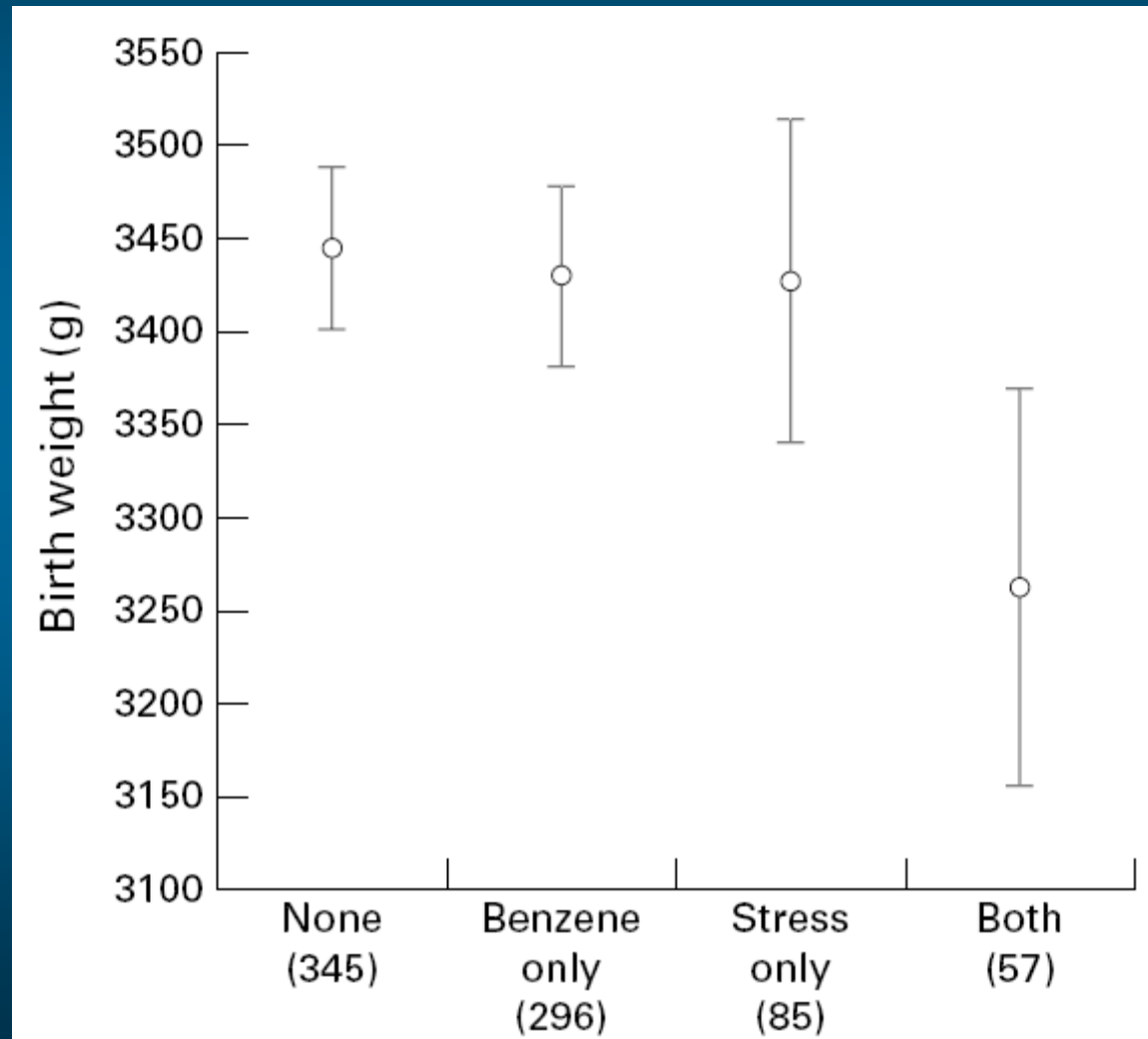
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Spain newborns	570 newborns	BTEX GIS traffic & samplers	-138 g 2 nd tri	Aguilera 2009
France	271 non smokers	Personal samplers benzene	-68 g 2 nd tri ↓ Head circumference	Slama 2009

Stress and Benzene Exposure Interact on Birth Weight



OIL SPILLS

UK: Braer Children 5-12y
spirometry normal
within 12 days of spill

Korea: Hebel pregnant women
Eye irritation
Headache
Abdominal pain
related to distance

What we know.

Biomarkers

Mental health

Endocrine
disruption

Mixtures

Long-term sequelae

Multiple traumas

What we don't know.

Exposed workers
as future fathers

Exposure to
metals

Cytotoxicity

Transgenerational
effects

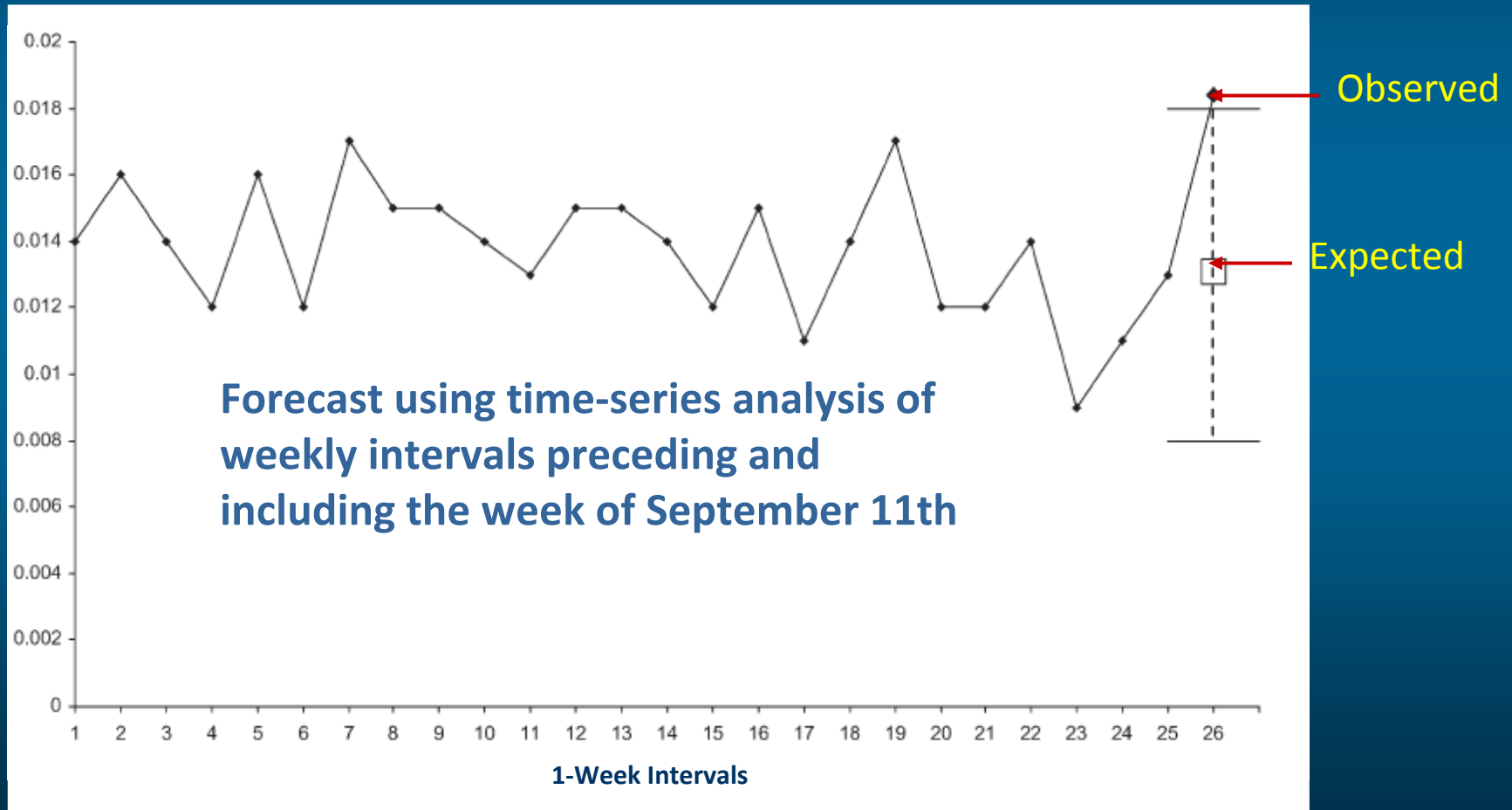
**Neurobehavioral
development**

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Birth Certificate can be used:

Events of September 11th related to more babies born of 1500–2000 g



Questions can be added to Birth Certificate

3. During your last menstrual cycle, were you or your partner using any of the following to prevent pregnancy? (Answer YES or NO below)

- YES: THE BIRTH CONTROL PILL CONDOM - MALE FEMALE CONDOM CERVICAL CAP THE SPONGE IMPLANT
(If YES, fill in all that apply) INJECTION DIAPHRAGM SPERMICIDE STERILIZATION - MALE STERILIZATION - FEMALE BREAST FEEDING
 NATURAL FAMILY PLANNING / RHYTHM METHOD (To avoid pregnancy) OTHER BIRTH CONTROL METHOD: _____

- NO: How many menstrual cycles or months of unprotected intercourse did it take to get pregnant, assuming that you are pregnant?
(If NO, answer question) 1 2 3 4 5 6 7 8 9 10 11 12 MORE THAN 12

We have also added questions on caffeine and on cigarette smoke exposure to the birth certificate.

Critical to collect biomonitoring data now



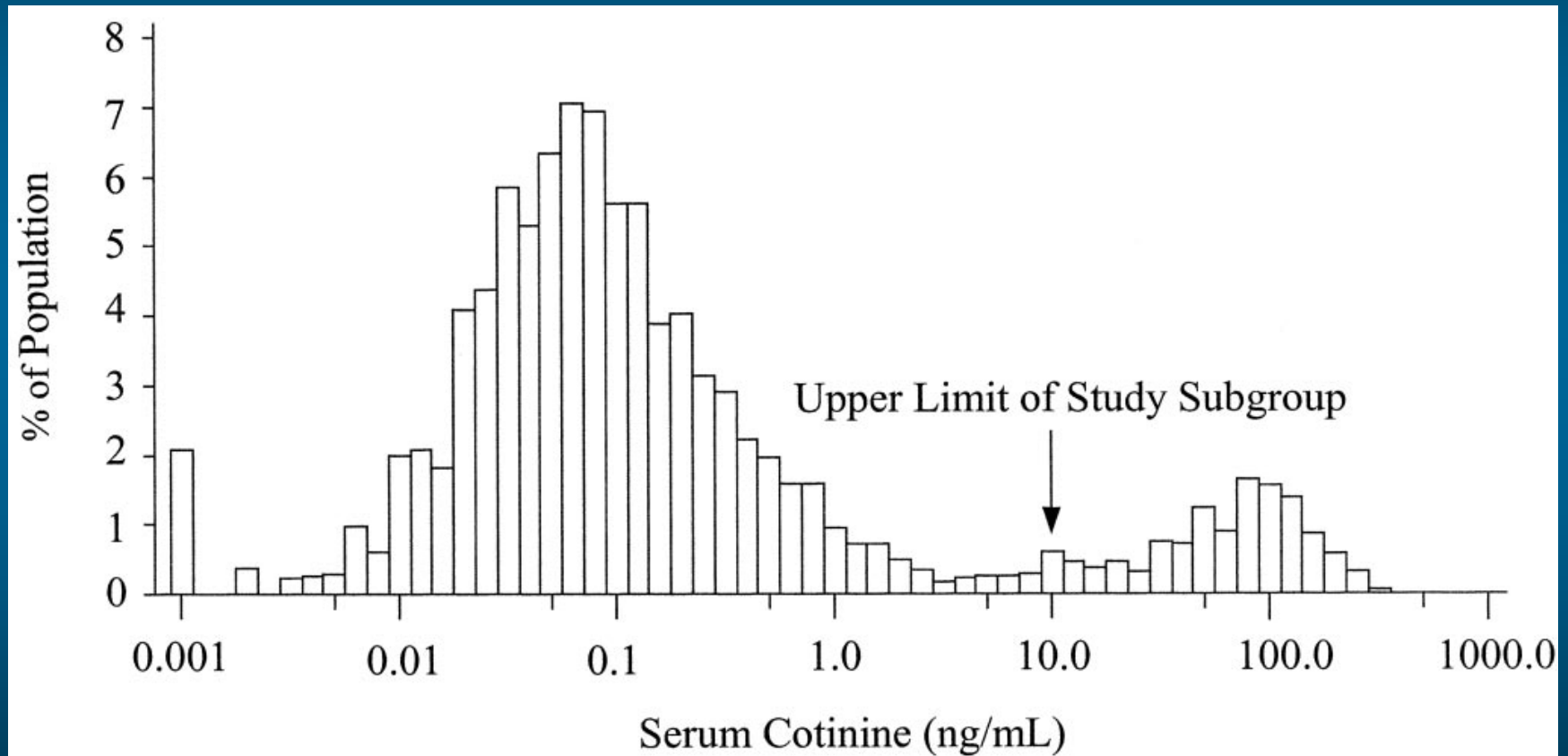
Seveso Women's Health Study

Easy to get biomonitoring data

- **Blood specimens:**
 - Neonatal Screening:
 - Prenatal AFP Screening
 - Guthrie Test (phenylketonuria)
 - Thyroid hormone



Cotinine measured in 3000 AFP sera collected in 11 California counties in 1 month



Easy to get biomonitoring data

- Urine
- Breast milk
- Amniotic Fluid
- Meconium



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What can I do to protect myself and my unborn baby?

- ✓ Avoid areas near where oil reaches the shore
- ✓ Limit your time outdoors
- ✓ If the smell bothers you or you see smoke
 - ✓ stay indoors
 - ✓ set your air conditioner to reuse indoor air
 - ✓ avoid physical activities that stress your lungs & heart
 - ✓ If you are pregnant or have respiratory problems, move inward if possible
- ✓ Avoid touching objects contaminated with oil
- ✓ If there is skin contact with oil, wash it off with soap and water
- ✓ Avoid swimming in coastal beaches
- ✓ Seafood that is unsafe will not be allowed in stores,
but do we recommend limit local intake?
- ✓ Follow EPA air monitoring



Take-home message

- We know fetuses and children are vulnerable; some more than others
- Future fathers count
- What we don't know >> What we know
- We know little
 - Mixtures
 - Interaction with stress
- Cheap and easy ways to begin surveillance
- Precautionary principle
- Community participation (CBPR framework)

*Special thanks to
Lesliam Quiros, Ph.D.*

- Hometown New Orleans
- Former oil rig worker
and
- 7 months pregnant





Thank you!

