Environmental Threats to Reproductive Health and Human Fertility

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The International Federation of Gynecology and Obstetrics
February 23, 2021
Maternal Mortality
Well-Woman Health
The Environment

Well-Woman Health Care
Environment
Maternal Morbidity and Mortality
HOW DID OBGYNS BECOME INVOLVED?
What is “The Environment”?
“ENVIRONMENT” Includes:

- Personal and industrial chemicals
  - BPA
  - Phthalates
  - PFOA
  - PBDE
- Agricultural chemicals
  - glyphosate
  - chlorpyrifos
- Physical agents
  - heat
  - radiation
- By-products of combustion and industrial processes
  - dioxin
  - P2.5
- Foods and nutrients
  - Blood glucose
- Prescription drugs
  - teratogens
- Lifestyle choices and substance abuse
  - tobacco
  - alcohol
  - drugs
- Social and economic factors
  - social determinants of health
GLOBAL HEALTH EXPOSURES

- AIR POLLUTION
- WATER POLLUTION
- PESTICIDES
- ENVIRONMENTAL TOXICS FROM PERSONAL PRODUCTS
- MINING POLLUTION
- DEFORESTATION
- CLIMATE CHANGE
Endocrine disruptors are chemicals that interfere in some way with hormone action and in so doing can alter endocrine function such that it leads to adverse effects on human and wildlife health.

OUR HISTORY

ENDOCRINE DISRUPTORS

- Lead
- Diethyl Stilbestrol (DES)
- Methylmercury
- Thalidomide
High Lead Levels In Michigan Kids After City Switched Water Source

Michigan AG: Flint water not even safe to 'bathe a newborn'
The water crisis in Flint, Michigan has had terrible consequences for residents’ health

Fertility rates fell by 12%, while fetal deaths increased
IMPACT OF LEAD on health

• FERTILITY FELL BY 12% IN JUST A FEW YEARS
• FETAL DEATHS INCREASED by 58%
Chemicals in the International Environment

- There are **70-100,000** chemicals in global commerce
- Production is **increasing** about 3.4% annually
- **4800 chemicals** are “**high volume**” or exceed 1 million pounds of use a year
- In 2020, **LOW RESOURCE countries** took the lead in high volume chemical production

THE ENVIRONMENT
GLOBAL LEADERSHIP
COMMITTEE OPINION

Number 375, 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

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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
International Federation of Gynecology and Obstetrics opinion on reproductive health impacts of exposure to toxic environmental chemicals

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ABSTRACT

Exposure to toxic environmental chemicals during pregnancy and breastfeeding is ubiquitous and affects the health of infants and children. There are too many toxic chemicals in our environment, and exposure to these chemicals during pregnancy can trigger adverse health consequences. Exposure to environmental chemicals and related health outcomes are inequitably distributed within and between communities; the consequences of exposure are disproportionately borne by people with low income, other social factors, economic factors, and occupation impact risk of exposure and harm. Disparities in exposure and health outcomes related to environmental chemicals are thus a social and environmental justice issue.

The International Federation of Gynecology and Obstetrics (FIGO) joins other reproductive health organizations in calling for timely action to prevent harm. FIGO recognizes the reproductive and other health professionals advocate for policies to prevent exposure to toxic chemicals, work to ensure a healthy food system for all, and make environmental health part of health care, and champion environmental justice.

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the Global Voice for Women’s Health
OUR CONCERNS

ENDOCRINE DISRUPTORS
• Pesticides
• Flame Retardants
• Climate Change
• Plastic Pollution
the Global Voice for Women’s Health
Endocrine Disruptors and Your Health

Endocrine disruptors are natural or human-made chemicals that may mimic or interfere with the body's hormones, known as the endocrine system.

Hormone-like chemicals had harmful effects on the organs and bodily functions of test animals, according to an independent panel of scientific experts organized by the National Toxicology Program (NTP), which is located at NIEHS. The Endocrine Society stated in 2015 that endocrine-disrupting chemicals may affect health and disease in people.

How do we encounter these chemicals?
Endocrine disruptors are found in everyday products, including some food and beverage packaging, cosmetics, toys, flame retardants, and pesticides. Your contact with these chemicals may occur through diet, air, skin, and water.

Chemicals that may disrupt your endocrine system
- Bisphenol A (BPA) is used to make polycarbonate plastics and epoxy resins found in many plastic products, including food storage containers.
- Dioxins are a byproduct of some manufacturing processes, such as herbicide production and paper bleaching, and are released into the air from waste burning and wildfires.
- PFAS (per- and polyfluoroalkyl substances) are a large group of chemicals used widely in industrial applications, such as firefighting foam, nonstick pans, paper, and textile coatings.
- Phthalates are used to make plastics more flexible; they are found in some food packaging, cosmetics, fragrances, children's toys, and medical devices.
- Phytoestrogens are naturally occurring substances in plants that have hormone-like activity, such as genistein and daidzein in soy products like tofu and soy milk.
- Polybrominated diphenyl ethers (PBDE) are used to make flame retardants for products such as furniture foam and carpet.
- Polychlorinated biphenyls (PCBs) are used to make electrical equipment, such as transformers, and are in hydraulic fluids, heat transfer fluids, lubricants.
- Cancers
- Thyroid
- Obesity and metabolism
- Neurodevelopment

Related research includes:
- Developing new models and tools to better understand how endocrine disruptors work.
- Improving ways to identify endocrine-disrupting substances.
- Understanding linkages between exposure to endocrine disruptors and health effects.
- Identifying and formulating strategies to reduce or prevent
What have NIEHS and NTP discovered?
Recent NIEHS-supported research shows links between endocrine-disrupting chemicals and the ways in which well-being may be harmed, for example:

- **Attention.** The drug diethylstilbestrol (DES) may be linked to an increased chance of attention deficit hyperactivity disorder (ADHD) in grandchildren of women who used it during pregnancy.⁴

- **Immunity.** Children exposed to high levels of PFAS had a diminished immune response to vaccines.⁵

- **Metabolism.** Long-term exposure to arsenic can disrupt metabolism, increasing the risk of diabetes and other metabolic disorders.⁶

- **Puberty.** Chemicals in lavender oil and tea tree oil were associated with premature breast development in girls,⁷ and abnormal breast development in boys.⁸

- **Reproduction.** DES can alter the way genes are turned on and off in reproductive organs of mice, potentially affecting fertility and reproduction.⁹
Pesticides as EDC

Proximity to agricultural activity:

• epidemiological studies of low birth weight
• fetal death
• childhood cancers
• higher prevalence of cryptorchidism and hypospadias found in areas with extensive farming and pesticide use and in sons of women working as gardeners
• Relation has been reported between cryptorchidism and persistent pesticide concentration in maternal breast milk
• The impact of endocrine disruptor pesticides on fertility with ovulatory dysfunction and sperm function

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3138025/
IT’S COMPLICATED!

ZIKA
Zika outbreak: What you need to know

31 August 2016

Zika Virus a 'Serious Threat' to Pregnancy
ZIKA virus effects on neuroprogenitors are exacerbated by the main pyriproxyfen metabolite via thyroid hormone signaling disruption

Petra Spirhonzlova, Anthony Sébillot, Pieter Vancamp, Jean-David Gothié, Sébastien Le Mével, Michelle Leemans, Karn Wejaphikul, Marcel Meima, Bilal B. Mughal, Lucile Butruille, Pierre Roques, Sylvie Remaud, Jean-Baptiste Fini, Barbara A. Demeneix

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This article is a preprint and has not been certified by peer review [what does this mean?].
ZIKA and Insecticide Pyrifproxifen

North-Eastern Brazil saw intensive application of the insecticide pyriproxyfen (PPF) during the microcephaly outbreak caused by the Zika virus. Initially the pesticide itself was implicated in the microcephaly seen, but research quickly led to the identification of the Zika Virus. Dr Barbara Demeniex lab in France has led research to determine whether in fact the pesticide affects the ZIKA induction of microcephaly. What have they found:

1. ZIKV requires the protein Musashi-1 to replicate.
2. Thyroid hormone represses Musashi1.
3. The insecticide Pyriproxyfen is a Thyroid hormone disruptor, in other words, it is an endocrine disruptor
4. Pyriproxyfen significantly induces Musashi-1
5. Pyriproxyfen dysregulates thyroid signals that are crucial for brain development-the actual neural cells proliferate LESS and have MORE Musashi-1, which ZIKA needs to replicate
6. Infecting stem cells pre-exposed to the endocrine disruptor did not amplify viral replication, but aggravated expression of genes implicated in brain development.
7. Our results suggest the insecticide is particularly deleterious to brain development in areas with ZIKA virus prevalence.
WHAT CAN HEALTH CARE PROVIDERS DO?

EDUCATE. ADVOCATE. RESEARCH
Ob-gyns don’t need to be experts in environmental health to provide useful information to patients. However, they should:

1. Be familiar with their geographic area
2. Take an exposure history early
3. Provide information about how the food system affects health
4. Communicate the science and areas of uncertainties about environmental exposures
How can we help clinicians?
<table>
<thead>
<tr>
<th>PROVIDE GUIDANCE</th>
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<tbody>
<tr>
<td><strong>DON’T HEAT IN</strong></td>
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<tr>
<td>DON’T HEAT IN PLASTIC!</td>
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<tr>
<td><strong>USE</strong></td>
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<tr>
<td>USE CERAMIC and IRON COOKWARE, NOT TEFLON OR NON-STICK</td>
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<tr>
<td><strong>CONSIDER</strong></td>
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<td>CONSIDER WATER PURIFIER FOR HOME</td>
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<tr>
<td><strong>EVEN</strong></td>
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<tr>
<td>ORGANIC FOOD: EVEN SELECTIVE, AND KNOW YOUR PRODUCE SOURCE, BUT KNOW LABELING!</td>
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<tr>
<td><strong>KNOW</strong></td>
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<tr>
<td>KNOW PERSONAL CARE PRODUCTS: AVOID PHTHALATES, PARABENS, OXYBENZONE, TRICLOSAN AND LOOK FOR A LINE OF PRODUCTS THAT AVOIDS TOXICS (JUICE BEAUTY)</td>
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<tr>
<td><strong>USE</strong></td>
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<td>USE EWG AS A REFERENCE SITE! <a href="https://www.ewg.org/skindeep/">https://www.ewg.org/skindeep/</a></td>
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WHAT CAN CLINICIANS DO?

• Educate yourself and your patients
• Learn about your particular environment and risks
• Get the online links: UCSF PRE, eBook
• Advocate for improved environmental conditions
• Volunteer to give Grand Rounds to the hospital and community
INTERNATIONAL FEDERATION OF GYNECOLOGY AND OBSTETRICS
SUBCOMMITTEES

RESEARCH: IDENTIFY RESEARCH CENTERS BUT MORE IMPORTANTLY TRANSLATE THE SCIENCE FOR FIGO

ADVOCACY: TO ESTABLISH CLOSE TIES TO OTHER ADVOCACY GROUPS AND TO ASSIST MEMBER SOCIETIES

EDUCATION: DEVELOP EDUCATION PROGRAMS AND TRAINING OPPORTUNITIES
THE INTERNATIONAL FEDERATION OF GYNECOLOGY AND OBSTetrics

PREPARED TO **CREATE** GLOBAL TRAIN-THE-TRAINER PROGRAMS TO INCREASE AWARENESS OF ENVIRONMENTAL EFFECTS

ALREADY **AMPLIFYING** THE MESSAGES ABOUT MATERNAL MORTALITY AND WELL WOMAN HEALTH CARE

WHAT DOES RESEARCH TELL US?: BIOBANKS, ELECTRONIC RECORDS, MEASURE OF TOXIC LEVELS?

YOU ARE DOING THE RESEARCH... **WHAT WOULD YOU TELL A PATIENT SEEKING ADVICE TO IMPROVE HER HEALTH AND THAT OF HER CHILDREN?**
PREGNANCY and CLIMATE CHANGE

The PROBLEM
Climate change worsens air pollution and extreme weather which can have severe impacts on health during and after pregnancy including:

- PRETERM BIRTH
- LOW BIRTHWEIGHT
- STILL BIRTH
- EFFECTS ON BRAIN DEVELOPMENT
The PROBLEMS with PFAS

**HOW DOES IT GET INTO OUR BODIES?**

- Cooking with nonstick pans
- Products containing PFAS
- PFAS-contaminated water
- PFAS in air or dust

**HEALTH PROBLEMS LINKED TO PFAS**

- Kidney and testicular cancer
- High blood pressure and pre-eclampsia
- Higher cholesterol
- Lower infant birth weights
- Decreased vaccine response in children

**PFAS** is short for **per- and poly-fluoroalkyl substances** used in non-stick cookware, water
THE EXPOSOME AND WOMEN’S HEALTH

Paradigm to encompass the totality of human environmental exposures from conception onwards, complementing the genome.
Where does the Exposome fit in and where do measurements of toxic substances fit in?

First: What database should be used to determine which toxics to measure?

Will behavioral changes decrease toxics...and will such testing drive a market to fewer exposures to toxic substances?

Second: IF a patient has measurements of toxics where does she go to interpret results and what do the results mean?

Will patients electively test and retest to determine their “Toxics Level”?

AND: Are we looking at the “Toxics-equivalent” of 23 and Me?
ENVIRONMENT

Well-Woman Health Care

Maternal Morbidity And Mortality
EVERY WOMAN…
EVERY TIME…
EVERY WHERE
THANK YOU