International Federation of Gynecology and Obstetrics
WORKING GROUP ON REPRODUCTIVE AND ENVIRONMENTAL DEVELOPMENTAL HEALTH

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ENVIRONMENTAL TOXICANTS AND REPRODUCTIVE HEALTH
GOALS

• Briefly review the link between human health and reproductive health and non-communicable disease trends affecting reproductive health

• Discuss some evidence of endocrine disrupting chemical (EDC) effects on reproductive health

• Review some efforts aimed at moving the needle on reproductive and developmental health globally
Multiple Factors and Policies Affect Health and Reproduction
How is the Global Health Report Card?

- Marked increase in non-communicable diseases (NCDs)
  - obesity and diabetes
  - neurodevelopmental disorders
  - reproductive compromise
  - respiratory and thyroid dysfunction
  - cancers

- Marked increase in unregulated global chemical production, use, disposal

- Increasing evidence that environmental chemicals (e.g., endocrine disrupting chemicals) and air pollution contribute to NCDs and developmental origins of health and disease (DOHaD)
U.S. and Global Chemical Production

Chemical production has increased 23.5-fold between 1947 and 2007

- In 2012: In U.S. 9.5 trillion pounds of industrial chemicals domestically manufactured/imported (30,000 lbs for each person)
- Limited safety testing
- Pesticides
  - ~ 900 active ingredients
- Chemicals in food ~ 3,000
- Chemicals in drugs and cosmetics ~ 5,000

No RCTs. Environmental chemicals act like uncontrolled medicines....

Birnbaum LS. When environmental chemicals act like uncontrolled medicine. Trends Endocrinol Metab. 2013 Jul;24(7):321
Environmental chemicals cross borders through trade, food, wind, and water.

Inequities and injustices prevail on toxic chemicals moving about the world.
Chemicals are Ubiquitous Contaminants in Women and Men

- Every person in the U.S. has measurable contaminants in their body

- Mixtures of chemicals are the rule

- Contaminants found also in pregnant women:
  - environmental tobacco smoke, lead, perfluorinated compounds, perchlorate, mercury, phthalates, bisphenol A

- “To a disturbing extent, babies are born pre-polluted….”
Periods of Vulnerability to Disruption by Environmental Factors

Pre/periconception

Blastocyst

Embryo

Fetus

Infant

Child

Adolescent

Prenatal

Postnatal

Childhood

Adulthood

Paternal & Maternal Exposures

Woodruff 2010
Endocrine Disrupting Chemicals (EDCs)

EDCs = chemicals or mixtures of chemicals that interfere with any aspect of hormone action at any time of development and/or during the life course.

Sensitive Developmental Periods When EDC Exposures Greatly Increase Risk of Female Reproductive Disorders

*mice, rats, lamb, sheep, humans*

- PCOS
- Meiotic disruption during oogenesis
- Endometriosis
- Uterine fibroids
- Lactation duration
- Early thelarche
- Premature menarche

Organo-genesis, Neonatal, Pre-pubertal, Pubertal, Reproductive Menopause

Crain Fertil Steril 2008
EDCs Affect the Male Reproductive System

- INSL3, androgens, AMH, E\textsubscript{2} drive testicular descent
- ANDROGENS drive external genitalia masculinization

- ANTI-ANDROGENs, ESTROGENs and DIOXINS are main players in male reproductive disruption.
EDCs Are Believed to Contribute to Testicular Dysgenesis Syndrome (TDS)

- Impaired Spermatogenesis
- Undescended testis
- Impaired Spermatogenesis
- Undescended Testis
- Hypospadias

Mild TDS

Medium TDS

Severe TDS

Testis Cancer

Damgaard 2006 Skinner 2011 germ cells transgenerational
# Biomass Fuels (Wood Fuel) Are Associated with Preterm Birth in Central East India

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**Table 3 Pregnancy outcomes comparing women cooking with wood versus gas, unadjusted and adjusted analyses**

<table>
<thead>
<tr>
<th></th>
<th>Birth Weight</th>
<th></th>
<th></th>
<th>Stillbirth&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Preterm delivery (&lt;37 weeks)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean birth weight (grams)</td>
<td>Low birth weight (&lt;2500 grams)</td>
<td>Small for gestational age (birth weight &lt;10%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gas</td>
<td>2736 ± 409</td>
<td>48/253 (19.0%)</td>
<td>20/244 (8.2%)</td>
<td>0/253 (0%)</td>
<td>33/245 (13.5%)</td>
</tr>
<tr>
<td>Wood</td>
<td>2623 ± 429</td>
<td>286/1199 (23.9%)</td>
<td>71/1190 (6.0%)</td>
<td>50/1255 (40%)</td>
<td>390/1194 (32.7%)</td>
</tr>
<tr>
<td>Effect size (wood vs gas), unadjusted (95% CL)</td>
<td>-112 (-170, -55)</td>
<td>1.33 (0.95, 1.88)</td>
<td>0.71 (0.42, 1019)</td>
<td>2.71 (0.99, ∞)</td>
<td>3.11 (2.12, 4.59)</td>
</tr>
<tr>
<td>Adjusted effect size (95% CI)</td>
<td>-14 (-93, 66)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.95 (0.58, 1.57)&lt;sup&gt;d&lt;/sup&gt;</td>
<td>0.53 (0.23, 1.19)&lt;sup&gt;e&lt;/sup&gt;</td>
<td>2.06 (0.08, ∞)&lt;sup&gt;f&lt;/sup&gt;</td>
<td>2.29 (1.24, 4.21)&lt;sup&gt;g&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

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For birth weight outcomes, analyses limited to singleton live births with recorded birth weights. For stillbirths, all singleton births included. For preterm delivery, analyses limited to singleton live births with recorded Ballard examinations. Values represent n(%) or mean ± STD.

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*Wylie et al. Environmental Health 2014, 13:1  [http://www.ehjournal.net/content/13/1/1](http://www.ehjournal.net/content/13/1/1)*
Mounting Evidence That This Matters

Woodruff T, Jansen S, Guillette, L, Giudice LC 2008

Diamanti-Kandarakis E et al. 2009
Endo Rev 30:293-342

UCSF Program on Reproductive Health and the Environment

Endocrine-disrupters and child health
Possible developmental early effects of endocrine disruptors on child health

2012

INTRODUCTION TO ENDOCRINE DISRUPTING CHEMICALS (EDCs)
A GUIDE FOR PUBLIC INTEREST ORGANIZATIONS AND POLICY-MAKERS

December 2014

EDC-2, 2016 Gore et al.

State of the Science of Endocrine Disrupting Chemicals 2012
Summary for Decision-Makers
Edited by Åke Bergman
Jarrod J. Hindel
Susan Johbing
Karen A. Kidd
R. Thomas Zeiger
Might Green Chemistry Help?

Green chemistry replaces hazardous chemicals, processes, and products with safer alternatives

DES $\rightarrow$ BPA $\rightarrow$ BPS and BPF

No, there is more hormone disruption!
Actions Can Reduce Exposures But They Need Policy Changes

Blood Lead Levels

Year

Lead Gasoline Phase-out (1973)

Blood Lead Levels

Lead in Gasoline

Year


Blood Lead Levels (µg/dL)

0 2 4 6 8 10 12 14 16 18 20

0 50 100 150 200 250

Lead in Gasoline (KTons)
Professional Organizations at Work Globally

Scientific Impact Paper No. 37
May 2013

Chemical Exposures During Pregnancy: Dealing with Potential, but Unproven, Risks to Child Health

Committee Opinion
Number 533, August 2012
Committee on Obstetric Practice
This document reflects emerging clinical and scientific advances as of the date issued and is subject to change. The information should not be considered as dictating an exclusive course of treatment or procedure to be followed.

Lead Screening During Pregnancy and Lactation

International Conference on Children’s Health and Environment, Jerusalem
November 2013
Commitment to Protect Children's Health from Environmental Hazards

October 2015 FIGO
- Opinion on environmental exposures and reproductive health
- 2015 FIGO Vancouver Summit
- RDEH WG launch 2016
Recommendation 1: Advocate for policies to prevent exposure to toxic environmental chemicals

Recommendation 2: Work to ensure a healthy food system for all

Recommendation 3: Make environmental health part of health care

Recommendation 4: Champion environmental justice
So Much More to Do!

- Strengthen professional education in reproductive environmental health
- Share what we know with our patients and their families
  - disparities in exposures
  - protecting our communities
- Advocate for chemical policy reform
- Advocate for scientific research to reverse population risk
It is time to take action!

Thank You