Webinars
Series of scientific webinars that provide a forum for discourse on scientific issues.
Live and On-Demand
Case Conferences
Journal Clubs
Grand Rounds
CE Available

Online Courses
Evidence-based online courses on a variety of children's environmental health topics.
Interactive and Self-Paced
CE Available

Resource Catalog
Fact sheets, journal publications, reports, and other resources for parents, community members, patients and healthcare professionals
Topics included:
Air Quality, Pesticides, Natural Disasters, BPA, Mold, Lead, Mercury
It’s a dirty planet!
How to reduce your exposure to toxins.

Kurt Martinuzzi, MD
Assistant Professor
Emory University
Acknowledgements

Marya Zlatnik, MD
Maternal-Fetal Medicine
University of California, San Francisco

This material was supported by the American Academy of Pediatrics (AAP) and funded (in part) by the cooperative agreement FAIN: 1U61TS000237-02 from the Agency for Toxic Substances and Disease Registry (ATSDR).

Acknowledgement: The U.S. Environmental Protection Agency (EPA) supports the PEHSU by providing partial funding to ATSDR under Inter-Agency Agreement number DW-75-95877701. Neither EPA nor ATSDR endorse the purchase of any commercial products or services mentioned in PEHSU publications.
After participating in this webinar participants will be able to:

1. Explain how a chemical can act like a hormone
2. Recount 3 chemicals with strong evidence for human harm
3. Recommend 5 ways to personally decrease exposure to environmental toxins
Pre-webinar quiz

1. How many potentially harmful chemicals are detectable in all pregnant woman?
   a) 0       b) 2       c) 6       d) 12       e) 43

2. Fish that are low in mercury include:
   a) shark and swordfish   b) salmon   c) king mackerel   d) tile fish   e) all of the above

3. Bisphenol A (an endocrine disruptor) has been:
   a) banned in the United States
   b) banned for use in food products
   c) present in the majority of canned foods

4. Toxicology research often:
   a) studies a single agent   b) is short-term   c) is single generation
   d) is influenced by private corporations   e) all of the above

5. The greatest hope to decrease chemical exposure to pregnant women is:
   a) encouraging private companies to better police themselves
   b) providing women with tips and tricks to decrease their personal risk
   c) through legislation, place the responsibility on industry to determine that a chemical is safe prior to introducing into the marketplace
Workers reported having difficulty conceiving
Tony Mazzocchi - union leader - set up testing for 5 of the men
All 5 had low sperm counts or counts of zero!
142 of the men at the plant were studied

<table>
<thead>
<tr>
<th>Sperm count</th>
<th>Exposed to DBCP</th>
<th>Not exposed to DBCP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N- 107</td>
<td>N- 35</td>
</tr>
<tr>
<td>severely oligozoospermic &lt; 20 million/ml</td>
<td>17%</td>
<td>0</td>
</tr>
<tr>
<td>azoospermic</td>
<td>13%</td>
<td>2.9%</td>
</tr>
</tbody>
</table>

Dibromochloropropane — known gonadotoxin

- DBCP – introduced in US in 1955
- Lab experiments in 1961 showed effects on male rats

<table>
<thead>
<tr>
<th>Concentration (PPM)</th>
<th>Effect on Rat</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 PPM</td>
<td>Decrease in size of testicles</td>
</tr>
<tr>
<td>10 PPM</td>
<td>Down by 50%</td>
</tr>
<tr>
<td>20 PPM</td>
<td>Azoospermia!</td>
</tr>
</tbody>
</table>

“If anyone wants to use a male birth control drug. I think we have identified one, but it is not very pleasant to use.”
DBCP - no longer used in USA but very long half-life

- 1977 - Banned (except for pineapple crops)
- 1985 - Total ban
- 1992
  - 20,000 groundwater samples checked
  - 10% with detectable DBCP
Healthy sperm donors from 1973-1992
2% decrease per year

Declining age of menarche in women

Two to three months per decade

What is leading to earlier menarche?

• Better health
• Increase in body fat
• Unfortunately, endocrine disruptors are likely also playing a role
Of course pesticides are likely bad for us

- Are we being exposed to harmful chemicals/endocrine disruptors through our daily activities?
- The food we eat?
- The make-up we wear?

Yes, yes, yes!
• Conducting a study to see if yeast has estrogen steroid receptors.
• Yeast was put in medium, and surprisingly an estrogen-like molecule was found. Not produced by yeast, so where was it from?
  • Was it in the media? No.
  • Was it in the pure water? No.
They put pure water in the flask and then autoclaved the flask.

- Surprise!
- The estrogen-like compound was leaching from the flask.
Unfortunately polycarbonate is very useful plastic used to make many products
Bisphenol A (BPA) was the estrogen-like substance.
When a chemical has a similar shape to a hormone it can act as a disruptor

- Estrogen
- Thyroid
Comparison of estradiol, diethylestibesterol and bisphenol A
• “The reported levels of BPA in human fluids are higher than the BPA concentrations reported to stimulate molecular endpoints invitro and appear to be within a magnitude of the levels needed to induce effects in animal models.”

• Present in blood, serum, plasma, breast milk, amniotic fluid, semen, follicular fluid

Vandenberg LN, Hauser R, Marcus M et al. Human exposure to bisphenol A (BPA). Reproductive Toxicology 2007;(24):139-177
Action of BPA

- Binds to nuclear estrogen receptors that regulate transcription
- Binds to estrogen receptors on the cell membrane to promote calcium mobilization and intracellular signaling
- Membrane receptors are more sensitive than nuclear
- Effects present at 1 part/million

Vandenberg LN, Hauser R, Marcus M et al. Human exposure to bisphenol A (BPA). Reproductive Toxicology 2007;(24):139-177
Epoxy linings in most canned foods
“… all metal cans are lined with a coating that uses BPA as a starting material.”
Carbonless receipts
You don’t need to work in a pesticide factory to have unhealthy chemicals in your body

- Chemicals are ubiquitous
- A growing business in the United States
- Make possible many of the conveniences of modern day life
- One simple way to determine the extent to which we all carry chemicals in our bodies is through testing of urine samples
Nationally representative survey and physical examination

To assess the health and nutritional status of the civilian non-institutional US population

268 pregnant women

Urine samples screened for 163 chemicals

Some of chemicals/categories (NHANES) 2003-2004

- Tobacco exposure – Cotinine
- Metals
- Pesticides
- Flame retardants (polybrominated diphenyl ethers - PBDE)
- Waste from burning fossils fuels
  (polycyclic aromatic hydrocarbons - PAH)
- Chemicals to soften plastics, dissolving agents - Phthalates
All sorts of chemicals that don’t belong in us!
The sad conclusion of this study


Chemicals Detected in Every Pregnant Woman in the US
Susceptible stages in our lives
**Strength of the Evidence**

Strong evidence: infertility, malformations, cancers

Mounting evidence: thyroid, neuroendocrine, obesity and metabolism, insulin and glucose homeostasis.

Endocrine disrupters/toxins can affect more than one generation

Mothers took DES

Daughters and sons affected

Mother took to decrease miscarriage rate

Daughter with increased risk of vaginal cancer

Sons with reproductive tract abnormalities

Uterine and ovarian cancer

Prostate, seminal vesicle cancers

Ovarian and uterine cancers

Animal studies show affected grandchildren

Human data not yet convincing
Phthalate – another group of endocrine disruptors that we’re exposed to on a daily basis

- Nail polish, hair spray, after shave
- Soft plastic toys
- Vinyl flooring
- Shower curtains
- The “new car smell”
Phthalates – anti-androgenic

BBP

DBP

DEHP

DIDP

DINP

DNOP
Endocrine disruptors affect genital development

How to measure anogenital distance
Phthalates

- Prenatally exposed rats – decreased anogenital distance, hypospadius, cryptorchidism, testicular tumors

- Humans – decreased anogenital distance.
  - 3 month old breastfed males – increased LH, decreased free testosterone

Increased maternal urine phthalates correlate with shorter anogenital distance

134 boys
2 mo - 3 yrs

Cosmetic products and ingredients are not subject to FDA approval (color additives are)

<table>
<thead>
<tr>
<th>product</th>
<th>phthalate</th>
</tr>
</thead>
<tbody>
<tr>
<td>nail polish</td>
<td>Dibutyl phthalate (DBP)</td>
</tr>
<tr>
<td>hair spray</td>
<td>Dimethyl Phthalate (DMP)</td>
</tr>
<tr>
<td>perfumes</td>
<td>Diethyl Phthalate (DEP)</td>
</tr>
<tr>
<td>&quot;fragrance&quot;</td>
<td>presume phthalates</td>
</tr>
<tr>
<td>&quot;parfum&quot;</td>
<td>&quot;parfum&quot;</td>
</tr>
</tbody>
</table>

Barrett JR. Chemical Exposures: The ugly side of beauty products. Environ Health Perspect 2005;113(1):A24
Companies are reformulating
No legal standards for personal care products labeled as “pure”, “natural”, or “organic”
Choose products with simpler ingredient lists and fewer synthetic chemicals

FDA does not have evidence that phthalates as used in cosmetics pose a safety risk
Toxicology Studies

- High dose, limited length of exposure
- Single agent study
- Single generation

Reality

- Life-long exposure, multiple agents, effect possibly over several generations
Can changes in our behavior lower the chemical levels in our bodies?

- What we eat?
- What we drink?
- How we take care of our home?
• Low mercury seafood is beneficial in pregnancy.
• Pregnant women, women who might become pregnant and breastfeeding women should eat . . . up to 12 ounces per week of a variety of fish lower in mercury.
Good news!

Advising women on diet can decrease serum mercury levels

- Study from South Korea - 2006
- Organic mercury – half life 70 days
- Questionnaire, baseline lead level
- Controls (N - 12) – no change in diet
- Study group (N - 19) – received prenatal education on fish consumption
Control group – no change in fish intake

Women instructed on fish intake – mercury levels decreased

Does eating “organic” make a difference?
Organic diet decreases urinary (OP) pesticide levels

- 23 children ages 3-11
- Regular diet days 1-3 and 9-15
- Organic diet 4-8 (phase 2)
- Phase 2 – organic fresh fruits, vegetables, juices, processed fruit and vegetables and wheat or corn-based items. All purchased from one store.
- A USDA lab tested the organic foods and confirmed absence of OP pesticides
- Organophosphorus pesticides are not regularly detected in meat and dairy so these food items weren’t substituted.

3,5,6-tricholor-2-pyridinol (TCPY)

Organic diet
Malathion dicarboxylic acid (MDA) levels – in urine

Organic diet
7 day washout phase
Participants only drank cold beverages from stainless steel bottles, 
Avoided polycarbonate plastic cold water dispensers in the dining hall

7 day - intervention week
Participants drank all cold beverage from polycarbonate bottles

69% increase in urinary BPA

Mercury – a neurotoxin

- Effects on children if exposed in utero
  - attention, memory
  - language
  - fine motor skills
  - visual spatial skills

- Inhaled due to mercury spill
  - weakness, muscle atrophy, twitching
  - mood swings, irritability
  - headaches, insomnia

http://www.epa.gov/mercury/health-effects-exposures-mercury
DARN... I DON'T LIKE THE GREEN ONES...
A single serving of good fish
6 ounces of salmon
Bad fish

Shark

Tile fish

Swordfish

King Mackerel
Better fish

- Salmon
- Tilapia
- Tuna (canned light)
- Cod
- Catfish
- Shrimp
- Some sushi – if you love it, look up the guide and pick the low mercury choices

http://www.nrdc.org/health/effects/mercury/sushi.asp
Should you take your shoes off at the door?

- Professional applicators – yes
  - Clothes and shoes carry the pesticides
  - Doormats don’t trap enough

- If you apply pesticides to your own lawn or garden – yes

- Active children and indoor/outdoor pets increase transfer from lawn to indoors

FIGURE 1. Schematic representation of one cycle of walking performed by one participant for track-in simulation. Five participants each completed 20 cycles of walking in a single experiment.
Lead – it doesn’t belong in our bodies

- Pregnancy
  - Infertility
  - Poor fetal growth, miscarriage, stillbirth
  - Preterm birth
- Childhood
  - lower IQ, hyperactivity
- Adults
  - Hypertension
  - Decreased kidney function
Occupations with exposure risk for lead
Who is at risk for high lead levels?

- Occupational risk
- Home renovations – pre-1978 – hire a pro
- “Bad” hobbies – artistic painting, car repair, electronics, metal soldering, glazed pottery making, molding of bullets, slugs, or fishing sinkers, stained-glass
- Target shooting
- Facial makeup, hair coloring with lead
- Cosmetics with lead – surma sinhooor, kohl, popular in certain Asian countries
Current approaches

- Trust companies to do the right thing
- Decrease risk through legislation after the fact
- Personal change in behavior
Legislation matters

1975 new cars require unleaded gas

Adapted from US EPA data 1999. 1974 - 1992
US FDA acts – July 2012
Ban on BPA in baby bottles and cups

- U.S. Food and Drug Administration—expressed "some concern about the potential effects of BPA on the brain, behavior and prostate gland of fetuses, infants and children."

No longer allows BPA in baby bottles and children’s drinking cups.

The agency has not restricted its use in other consumer products.
Perhaps the introduction of new chemicals should proceed as drugs do?

- In vitro and in vivo toxicity testing
- Human experiments
- Then chemical can enter the marketplace

- 62,000 chemical introduced prior to 1976
- Bad outcomes occur and the courts are the avenue to try to effect change
Hexavalent chromium used by Pacific Gas and Electric

- Lung cancer
- Irritation of nose throat eyes
- Nose bleeds/perforation of the nasal septum
“No data, no market”

Responsibility is on industry to manage the risks from chemicals.

Manufacturers and importers are required to gather information on chemicals and to register the information in a central database.

Goal to substitute dangerous chemical as soon as suitable alternatives have been identified.

http://ec.europa.eu/environment/chemicals/reach/reach_en.htm
Where should we go from here?

- Are we exposed?
- Are we at risk?
- Is there anything that we can do?
Bubble Boy
Move far away?
10 practical steps that we can all take!
10. Eat low mercury fish twice a week

- Salmon
- Tilapia
- Tuna (canned light)
- Cod
- Catfish
- Shrimp
9. Eat organic fruits and vegetables

- Less pesticide residue
- Wash produce
8. Avoid foods with substantial plastic contact

- Canned foods and soda – lined with plastic
- Bulk foods are safer
- Coca-cola bottles do not release BPA
7. Avoid lead

- Home older than 1978 hire a professional for renovations
- Avoid hobbies that are associated with lead exposure
  - Artistic painting, car repair, electronics, metal soldering, glazed pottery making, molding of bullets, slugs, or fishing sinkers, stained-glass
6. Avoid carbonless receipts

- Many contain BPA
- Don’t take if you don’t need it
- If your patient works as a cashier
  - Wear gloves if possible
  - Thoroughly wash hands before eating
5. Don’t microwave plastic

- Heating increases leaching of chemicals
- Glass lid or paper to cover food
- Use glass, porcelain stainless steel especially for hot foods and drinks

4. Take your shoes off at the door

- Professional applicators – yes
  - Clothes and shoes carry the pesticides
  - Doormats don’t trap enough

- If you have children crawling on the floor

- Active children and indoor/outdoor pets increase transfer from lawn to indoors

3. Make up and sushi

- Investigate what you like and pick the safest choices
- Environmental Working Group
  www.ewg.org
2. Avoid tobacco smoke

- First and second hand
1. Support politicians who will act to decrease our ever growing exposure to toxins

- We need to switch to the European model where the onus is on industry
- The City of San Francisco
- The Erin Brockovich approach to changing company behavior is impractical
Questions/Discussion
Post-webinar quiz

1. How many potentially harmful chemicals are detectable in all pregnant woman?
   a) 0        b) 2        c) 6        d) 12        e) 43

2. Fish that are low in mercury include:
   a) shark and swordfish  b) salmon  c) king mackerel  d) tile fish  e) all of the above

3. Bisphenol A (an endocrine disruptor) has been:
   a) banned in the United States  
   b) banned for use in food products  
   c) present in the majority of canned foods

4. Toxicology research often:
   a) studies a single agent  b) is short-term  c) is single generation  
   d) is influenced by private corporations  e) all of the above

5. The greatest hope to decrease chemical exposure to pregnant women is:
   a) encouraging private companies to better police themselves  
   b) providing women with tips and tricks to decrease their personal risk  
   c) through legislation, place the responsibility on industry to determine that a chemical is safe prior to introducing into the marketplace
Webinars
Series of scientific webinars that provide a forum for discourse on scientific issues.
Live and On-Demand
Case Conferences
Journal Clubs
Grand Rounds
CE Available

Online Courses
Evidence-based online courses on a variety of children's environmental health topics.
Interactive and Self-Paced
CE Available

Resource Catalog
Fact sheets, journal publications, reports, and other resources for parents, community members, patients and healthcare professionals
Topics included: Air Quality, Pesticides, Natural Disasters, BPA, Mold, Lead, Mercury

www.pehsu.net/nationalclassroom.html