Forging New Intersections between Environmental and Reproductive Justice through Research and Advocacy

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Our invisible chemical environment

- Fragranced products
- Cleaning products
- Household furnishings
- Food packaging
- Personal care products
Examining Consumer Product Chemicals and Reproductive Health Disparities through an EJ/RJ Lens
Case Study #1

Environmental Injustice of Beauty
Black women have higher exposures to individual phthalates than other racial/ethnic groups

Reproductive-aged women (n=739), NHANES 2001-2004

Branch, Woodruff, Mitro, & Zota. Environ Health 2015
Environmental Injustice of Beauty

Highlighting the connections between environmental justice and beauty-product related chemical exposures

External Factors
- Colorism
- Racism
- Odor discrimination
- Rules/Dress codes

Internal Factors
- Community norms
- Coping strategies
- Peer pressure
- Internalized racism

Product Purchase

Product Use

Individual Exposure

Adverse Health outcome

Marketing & Advertising

Zota & Shamasunder, AJOG 2017
Environmental Injustice of Beauty

• Racial/ethnic differences in cosmetic use occur across multiple product categories

• Structural racism can influence beauty norms and product use

• Beauty product use can contribute to disparities in chemical exposures and health outcomes

• Potential for cumulative impacts
  • Women of color often face elevated environmental exposures in their neighborhoods and workplaces

Ad in *Jet*, 1982 cited by Ferranti, 2011

Zota & Shamasunder, AJOG 2017
## Environmental Injustice of Beauty Examples

<table>
<thead>
<tr>
<th>External factors</th>
<th>Vulnerable populations</th>
<th>Product use</th>
<th>Chemical exposures</th>
<th>Potential adverse outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colorism</td>
<td>Dark skinned women</td>
<td>[Image]</td>
<td>Mercury</td>
<td>Mercury poisoning, neurotoxicity, kidney damage</td>
</tr>
<tr>
<td>Hair texture preferences</td>
<td>African American women</td>
<td>[Image]</td>
<td>Parabens, placenta</td>
<td>Uterine fibroids, endocrine disruption</td>
</tr>
<tr>
<td>Odor discrimination</td>
<td>African American women</td>
<td>[Image]</td>
<td>Phthalates, talc powder</td>
<td>Gynecologic cancers, endocrine disruption</td>
</tr>
</tbody>
</table>

Zota & Shamasunder, AJOG 2017
Case Study #2

Cumulative Impacts of Chemical Exposures during Pregnancy
Cumulative impacts of consumer product chemicals during pregnancy

**Scientific Data Gaps**

- Inflammation may be important pathway linking chemicals to pregnancy complications, such as preterm birth among women of color
- Health impacts of chemical mixtures
- Common co-morbidities among communities of color, like obesity, have the potential to modify impacts of chemicals
Cumulative impacts of consumer product chemicals during pregnancy

Maternal Adiposity, Metabolism, and Stress Study (MAMAS)

- Mindful eating intervention for overweight and obese pregnant women (majority women of color, income <500% poverty level)
- Exposure: PBDEs, PCBs, PFASs, OH-PBDEs in serum during 2nd trimester
- Outcome: inflammation & cellular aging biomarkers at 3 time points: 2nd trimester and 3 and 9 mos. postpartum (N=103)

Zota et al., under revision
Consumer product chemicals and inflammation during pregnancy

- PBDEs & PFASs associated with IL-6
- PBDEs associated with TNF-alpha

- Chemical mixtures analysis: 2-fold increase in chemical index associated with 36.4% increase in IL-6 during pregnancy (p=0.03)

Zota et al., under revision
Consumer product chemicals and inflammation during pregnancy

Stronger associations between chemical exposures and biomarkers of inflammation and cellular aging among obese (compared to overweight) women

Zota et al., under revision
Socio-exposome model of uterine fibroids

Case Study #3
Uterine leiomyoma (fibroids): towards an ecosocial model of disease

- Non-cancerous, hormone-dependent tumor
- Affect 7 in 10 premenopausal women
- US Black women disproportionately impacted
- Reproductive complications
- Economic burden: more than breast or ovarian cancer
- Few permanent treatment options
  - Invasive surgery only permanent treatment option
- Etiology and root causes of racial disparities unknown
  - Consumer product chemicals may play a role
Fibroids: Observational Research on Genes & the Environment (FORGE)

To understand how socio-environmental factors may become biologically embedded and influence fibroid growth and severity

Study Design:

- 61 GW MFA patients undergoing surgery for uterine fibroids
- Phthalates and phenols (urine)
- Epigenetic modifications – miRNAs (blood and fibroid tissue)
- Demographic and medical information (survey, medical charts)
- Stress and stigma (qualitative interviews, perceived stress surveys)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Median (Range) or %</th>
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<th>Median (Range) or %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>39 (26, 55)</td>
<td>Fibroid size (cm)</td>
<td>7.2 (2, 28.5)</td>
</tr>
<tr>
<td>Black race</td>
<td>64%</td>
<td>Uterine vol. (cm(^3))</td>
<td>563 (54, 7229)</td>
</tr>
<tr>
<td>College/grad degree</td>
<td>67%</td>
<td>Myomectomy</td>
<td>58%</td>
</tr>
</tbody>
</table>

Zota et al., work in progress
Associations of phthalates with uterine fibroid burden

Uterine volume significantly associated with:

- **ΣDEHP** metabolites (OR 3.05, 95% CI 1.08, 8.63)
- **ΣDiNP** metabolites (OR 1.87, 95% CI 1.07, 3.29)
- **Cumulative phthalates** (p trend = 0.02)

Zota et al., work in progress
MiRNAs may mediate EDC toxicity on fibroids

- miRNAs: Small, noncoding RNA molecules that regulate post-transcriptional gene expression
- miRNA expression varies between fibroid tissue and healthy myometrium
- Of the miRNAs that were differentially expressed in fibroid and myometrium, 1 miRNA (miR-577) in fibroid tissue significantly differed between women with low and high DEHP exposure after multiple comparison adjustment
Concluding Remarks

• Zota Lab is forging new intersections between environmental and reproductive justice by developing novel conceptual frameworks and original empirical evidence.

• The long-term goals of this work are to secure environmental justice and improve equity in women’s health through advancements in science, policy, and clinical practice.
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