Race & phthalates: disparities in exposure & effect

Michael S. Bloom, PhD
Associate Professor
Global and Community Health
November 18th, 2020
Phthalate diesters are non-persistent chemicals used widely in plastics & personal care products.

~99% pregnant U.S. women had detectable urinary PHT (2003-2004)

Some phthalates are endocrine disrupting chemicals in experimental models

Dong et al., Int J Environ Res 2017;14:44; Sharpe, Best Pract Res Clin Endocrinol Metab 2006;20:91-110
Reproductive Development Study to extend links of endocrine disruptors & fetal development

• Associations between phthalates & birth outcomes
• Associations between phthalates & fetal genital development
• Impacts of race & sex as modifying factors
• Sources of exposure to endocrine disruptors

Thank you to colleagues!
Roger Newman, John Brock, John Kucklick, Abby Wenzel, Rebecca Wineland, Elizabeth Unal & Lori Cruz

Participants were enrolled in the Reproductive Development Study from 2011 to 2014.

- **T₁**: 18-22 weeks (n = 391)
  - Questionnaire
  - Urine
  - Blood

- **T₂**: 24-32 weeks
  - Median = 8.6 weeks (n = 219)
  - Urine

- **T₃**: 25-43 weeks (n = 319)
  - Urine
  - Blood
  - Cord blood

- Black or white (n = 310)
Black women had higher phthalate levels than white women

U.S. women, 18-44 yrs. (2011-2014)

Race: □ Black • White
Black women delivered earlier & with lower birth weight newborns than white women

<table>
<thead>
<tr>
<th>Outcome</th>
<th>n</th>
<th>%</th>
<th>Mean</th>
<th>Min</th>
<th>Median</th>
<th>Max</th>
<th>P-value (race)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gestational age (wks.)</td>
<td>310</td>
<td>-</td>
<td>38.8</td>
<td>25.1</td>
<td>39.1</td>
<td>43.0</td>
<td>0.01</td>
</tr>
<tr>
<td>Preterm birth</td>
<td>28</td>
<td>9.4</td>
<td>9.5%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.91</td>
</tr>
<tr>
<td>Birth size</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Birth weight (g)</td>
<td>308</td>
<td>-</td>
<td>3285.0</td>
<td>1125.0</td>
<td>3253.0</td>
<td>5020.0</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Low birth weight</td>
<td>19</td>
<td>6.2</td>
<td>8.0%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.08</td>
</tr>
<tr>
<td>Small for gestational age</td>
<td>33</td>
<td>10.7</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Bloom et al., Environ Int 2019;127:473-486
Greater 3rd trimester urinary MiBP & MMP were associated with lower birth weight

*Adjusted for maternal age, BMI, smoking, race & education
2\textsuperscript{nd} trimester urinary MEP was associated with lower birth weight among white women

\[
B: T_1 = 0.06; T_2 = 0.05 \\
W: T_1 = -0.11; T_2 = -0.14 \\
P=0.03
\]
2\textsuperscript{nd} trimester urinary MEHP was associated with higher risk for a preterm birth

*Adjusted for maternal age, BMI, smoking, race, education & sex
2nd trimester MBP & MEP was associated with higher preterm birth risk in black & MEHP in white.
A doubling in 3rd trimester urinary MEP associated with smaller head circumference

*Adjusted for maternal age, BMI, smoking, race, education & sex
Associations of head circumference with MBP, MBzP, MEHP, MMP & ΣDBP limited to white

- **B**: $T_1 = 0.28; T_2 = 0.66$
  
  W: $T_1 = -0.41; T_2 = -1.86$

- **T**: $T_1 = 0.28; T_2 = 0.66$

- **W**: $T_1 = -0.41; T_2 = -1.86$

- **P**: $P = 0.04$

- **T1**: $T_1 = 0.28; T_2 = 0.66$

- **T2**: $T_1 = 0.28; T_2 = 0.66$

- **W**: $T_1 = -0.41; T_2 = -1.86$

- **P**: $P = 0.04$

- **T1**: $T_1 = 0.28; T_2 = 0.66$

- **T2**: $T_1 = 0.28; T_2 = 0.66$

- **W**: $T_1 = -0.41; T_2 = -1.86$

- **P**: $P = 0.04$

- **T1**: $T_1 = 0.84; T_2 = 0.84$

- **T2**: $T_1 = 0.84; T_2 = 0.84$

- **B**: $T_1 = -0.02; T_2 = -0.02$

- **W**: $T_1 = -0.73; T_2 = -0.73$

- **P**: $P = 0.04$

- **T1**: $T_1 = 0.84; T_2 = 0.84$

- **T2**: $T_1 = 0.84; T_2 = 0.84$

- **W**: $T_1 = -0.73; T_2 = -0.73$

- **P**: $P = 0.04$

- **T1**: $T_1 = 0.76; T_2 = -1.11$

- **T2**: $T_1 = 0.76; T_2 = -1.11$

- **W**: $T_1 = -1.38; T_2 = 0.63$

- **P**: $P = 0.02$

- **T1**: $T_1 = -0.76; T_2 = -1.11$

- **T2**: $T_1 = -0.76; T_2 = -1.11$

- **W**: $T_1 = -1.38; T_2 = 0.63$

- **P**: $P = 0.02$

- **T1**: $T_1 = 0.02; T_2 = 0.04$

- **T2**: $T_1 = 0.02; T_2 = 0.04$

- **W**: $T_1 = -0.55; T_2 = -1.77$

- **P**: $P = 0.06$

- **T1**: $T_1 = 0.02; T_2 = 0.04$

- **T2**: $T_1 = 0.02; T_2 = 0.04$

- **W**: $T_1 = -0.55; T_2 = -1.77$

- **P**: $P = 0.06$

- **T1**: $T_1 = -0.12; T_2 = 0.46$

- **T2**: $T_1 = -0.12; T_2 = 0.46$

- **W**: $T_1 = -0.19; T_2 = -1.55$

- **P**: $P = 0.06$

- **T1**: $T_1 = -0.12; T_2 = 0.46$

- **T2**: $T_1 = -0.12; T_2 = 0.46$

- **W**: $T_1 = -0.19; T_2 = -1.55$

- **P**: $P = 0.06$

- **Race**: ■ Black ● White
Conclusions & next steps

• Impacts of gestational phthalates on fetal development vary by race & by timing:
  • Mode of action?
  • Targeted interventions?
• Recent funding to incorporate environmental phenols & explore the impact of the mixtures
• Integrate objective measures of non-chemical stressors in other populations

Thank you for your time!

The most exciting phrase in science, the one that heralds new discoveries, is not ‘eureka’ but ‘shucks, I’m silly’...

- Isaac Asimov, PhD 1920-1992