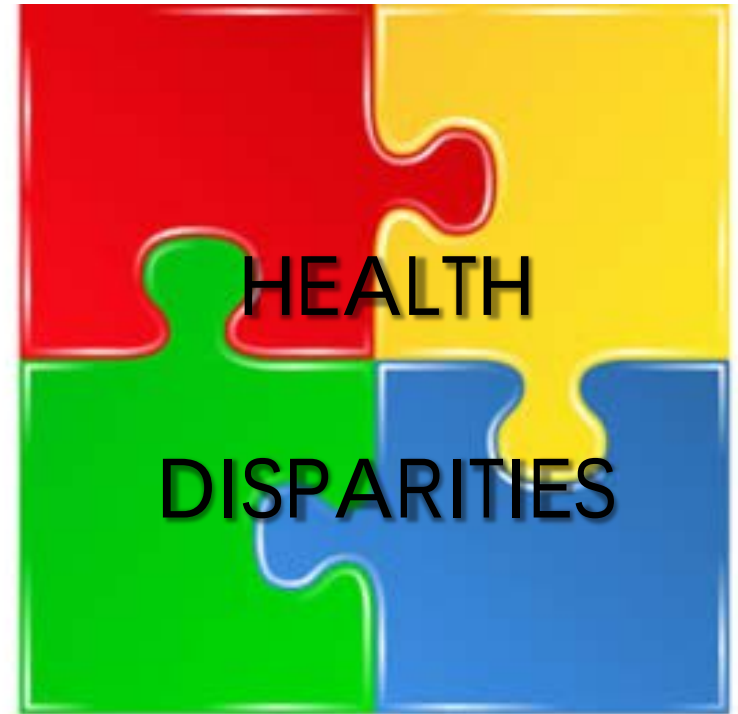


Examining the Interplay Between Consumer Product Chemicals and Social Inequality Through an Environmental Justice Lens

Ami R. Zota, ScD, MS
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Rutgers University April 28, 2017

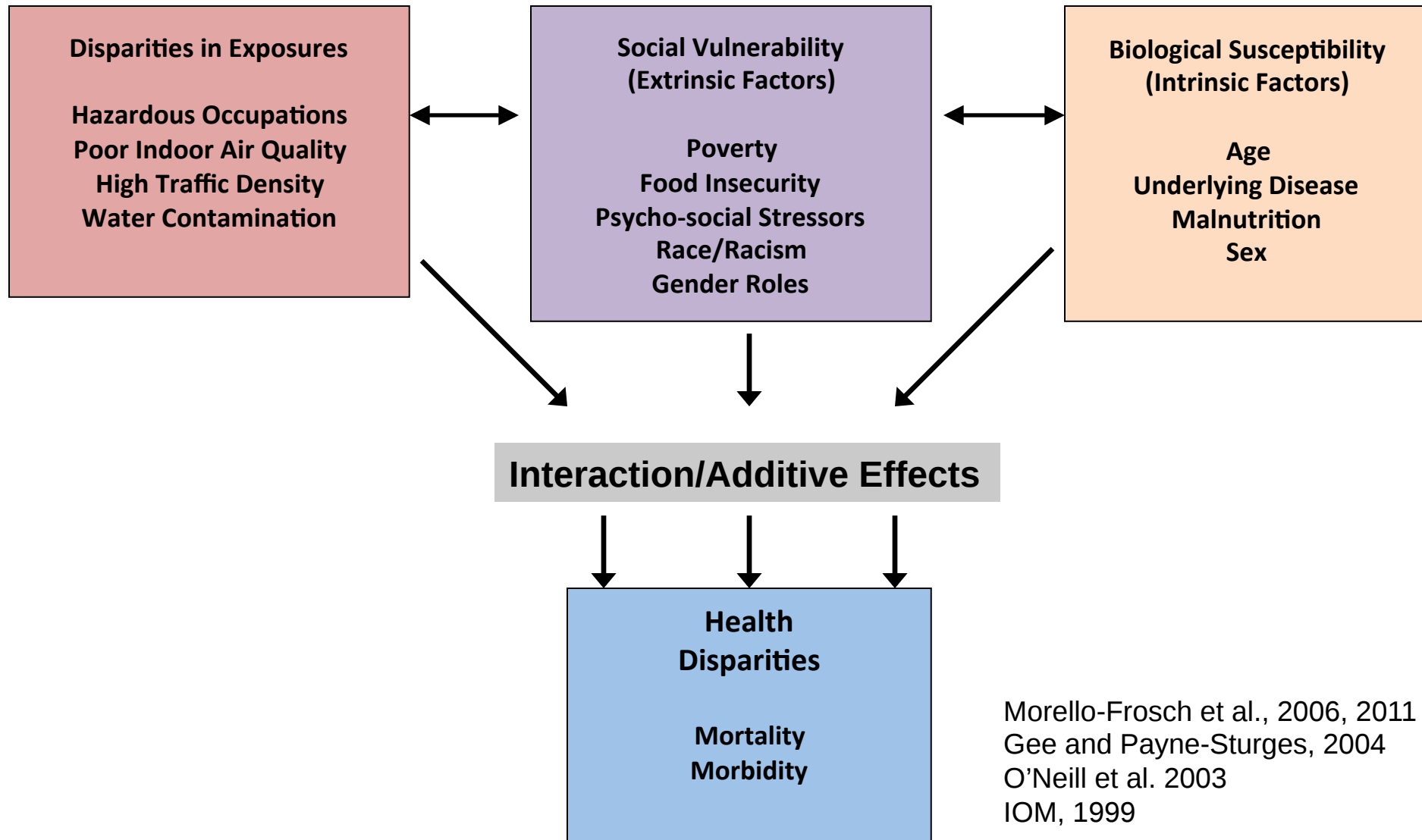
Vulnerable populations: Socially disadvantaged communities



How do social inequalities and environmental exposures interact to exacerbate health disparities?

What are the best strategies to achieve health equity?

Cumulative impacts framework

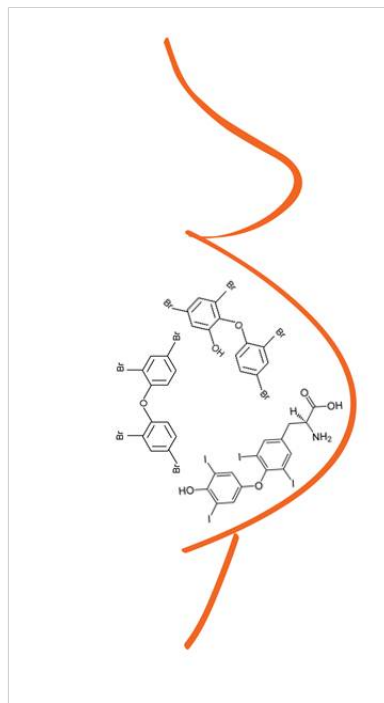


Morello-Frosch et al., 2006, 2011
Gee and Payne-Sturges, 2004
O'Neill et al. 2003
IOM, 1999

Our invisible chemical environment



Fragranced products



Cleaning products



Household furnishings



Food packaging



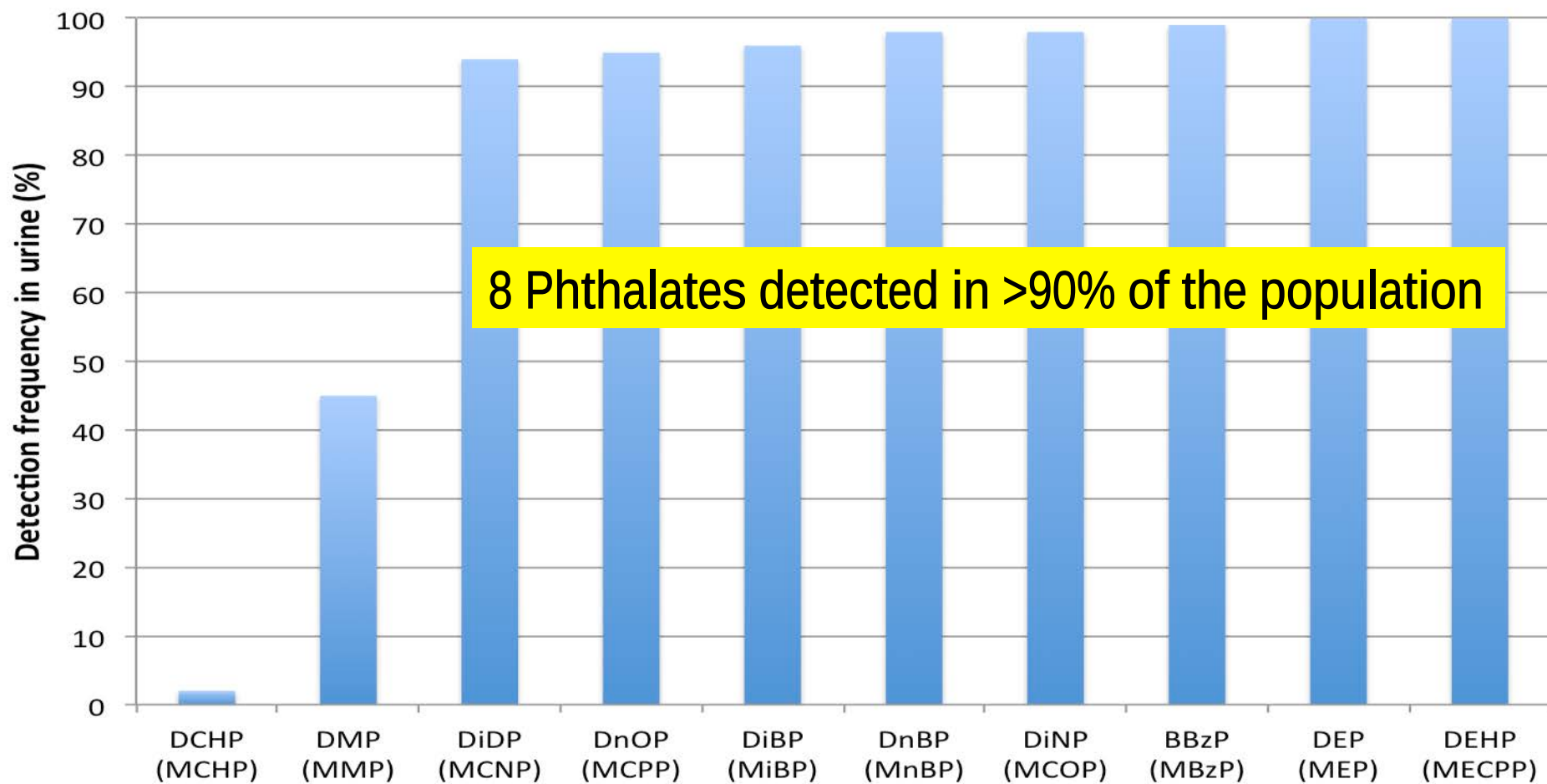
Personal care products

Roadmap for today's presentation

- Biomonitoring & racial disparities in chemical exposures
- Individual and contextual drivers of racial disparities in chemical exposures
- Novel epidemiologic models for consumer product chemicals and women's health outcomes
- Prevention and exposure reduction strategies

US population widely exposed to multiple phthalates

CDC NHANES 2009-2010 data



Phthalates are associated with adverse health effects at levels commonly found in the environment

Exposures during early life may contribute to:

- Endocrine dysfunction
- Problems in male reproductive tract development
- Neurodevelopmental disorders
- Respiratory problems

Exposures during adulthood may contribute to:

- Endocrine dysfunction
- Pregnancy complications
- Chronic disease: Type 2 diabetes and obesity

Attina et al. The Lancet Diabetes & Endocrinology 2016; Chronic Hazard Advisory Panel on Phthalates and Phthalate Alternatives 2014; Ferguson et al. JAMA Pediatrics 2014; Braun et al. Current Opinion in Pediatrics 2013.

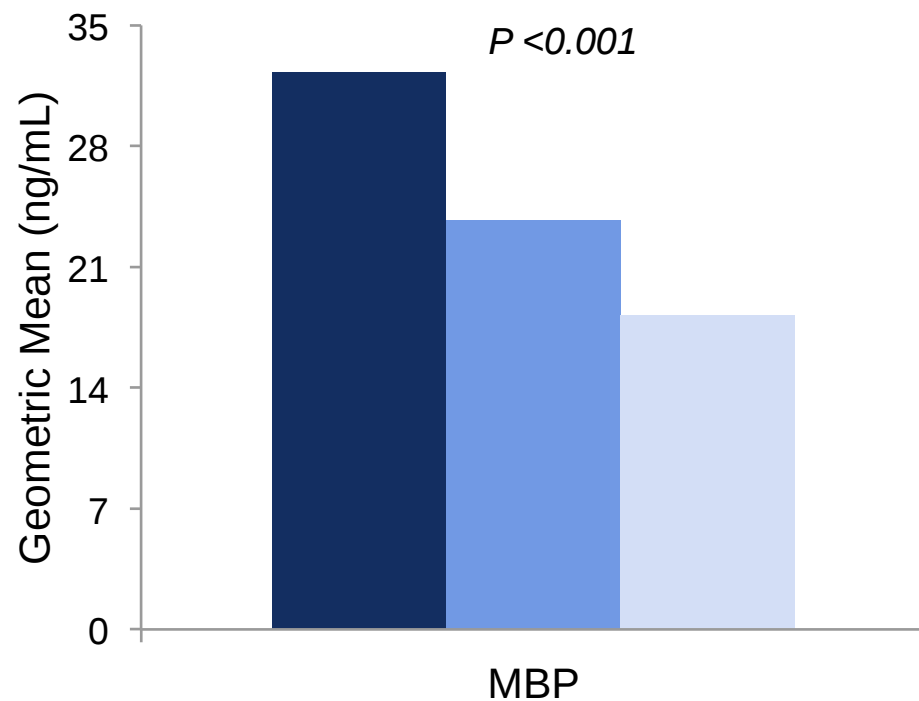
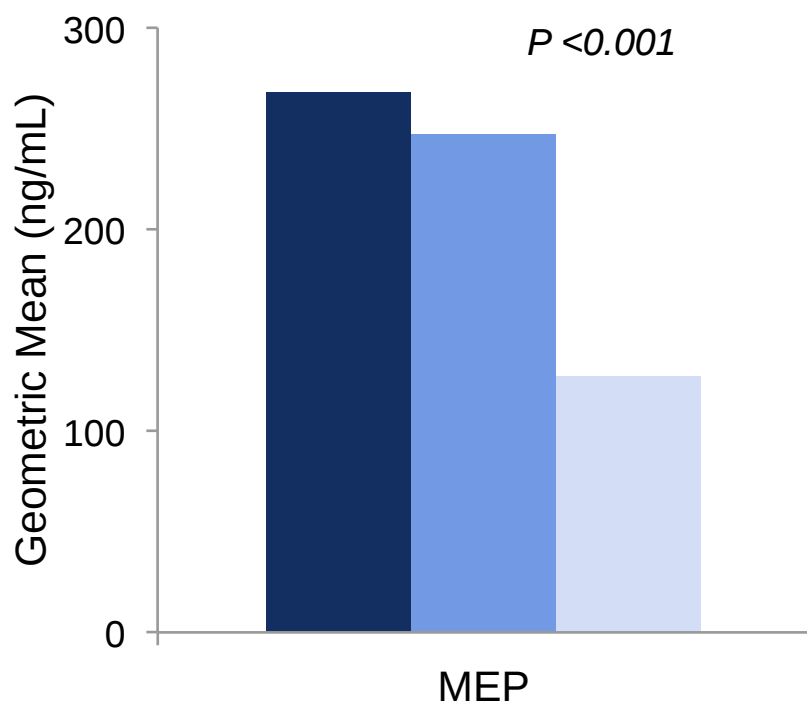
Economic burden of phthalates exposure in USA: ~60 billion dollars in 2010

Outcome	Burden of Disease	Economic Costs
Adult obesity	5900 cases	1.7 billion
Adult diabetes	1300 cases	91.4 million
Endometriosis	86,000 cases	47 billion
Male infertility	240,100 cases	2.5 billion
Low testosterone resulting in increased early mortality	10,700 attributable deaths	8.8 billion

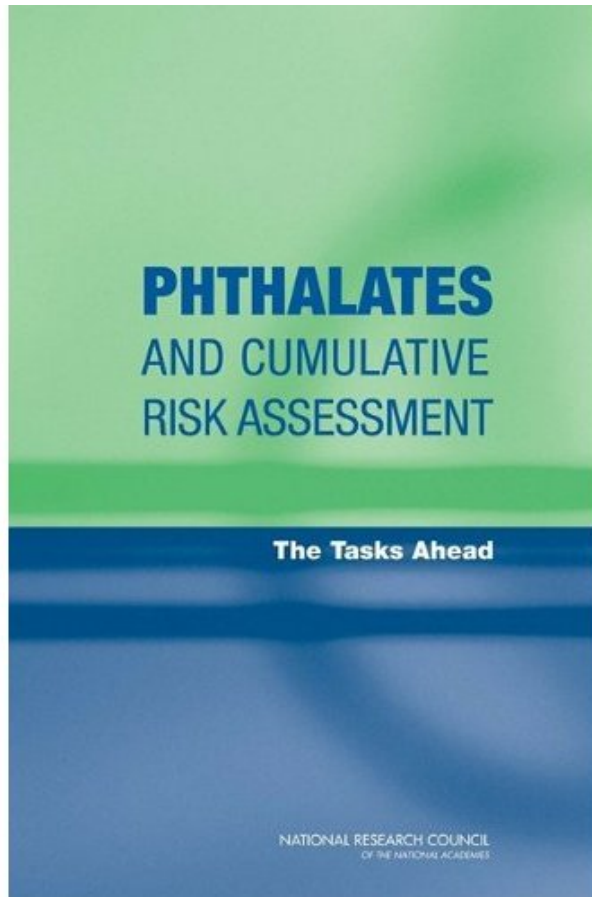
Black women have higher exposures to individual phthalates than other racial/ethnic groups

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

Black Mexican American White



Black women have higher cumulative phthalate exposures than white women



- Multiple phthalates can have greater impacts than individual exposure
- NAS recommends them for cumulative assessment
- We developed a anti-androgenic potency-weighted sum of cumulative phthalates based on NAS recommendations
- Racial/ethnic differences persisted after controlling for SES

DAINTINESS
yours...with "Lysol"!



Just as lotions and creams protect your beauty, "Lysol" protects your daintiness!

For douching with "Lysol" stops odor by killing odor-causing germs. You know you can't offend!

Yet new "Lysol" is mild. Can't harm you. Leaves you sweet and clean!

Discover new daintiness. Use "Lysol" brand disinfectant regularly—and be sure of your daintiness!

For free booklet on how to douche, write: "Lysol," Bloomfield, N. J., Dept. NN-58.



Lysol

BRAND DISINFECTANT

A LEHN & FINE PRODUCT

Synthetic chemicals and feminine care



Photo Credit: Women's Voices for the Earth

Vaginal douching use contributes to racial differences in phthalate exposure

- Vaginal Douches
- Feminine Spray
- Feminine Powder
- Wipes/Towelettes

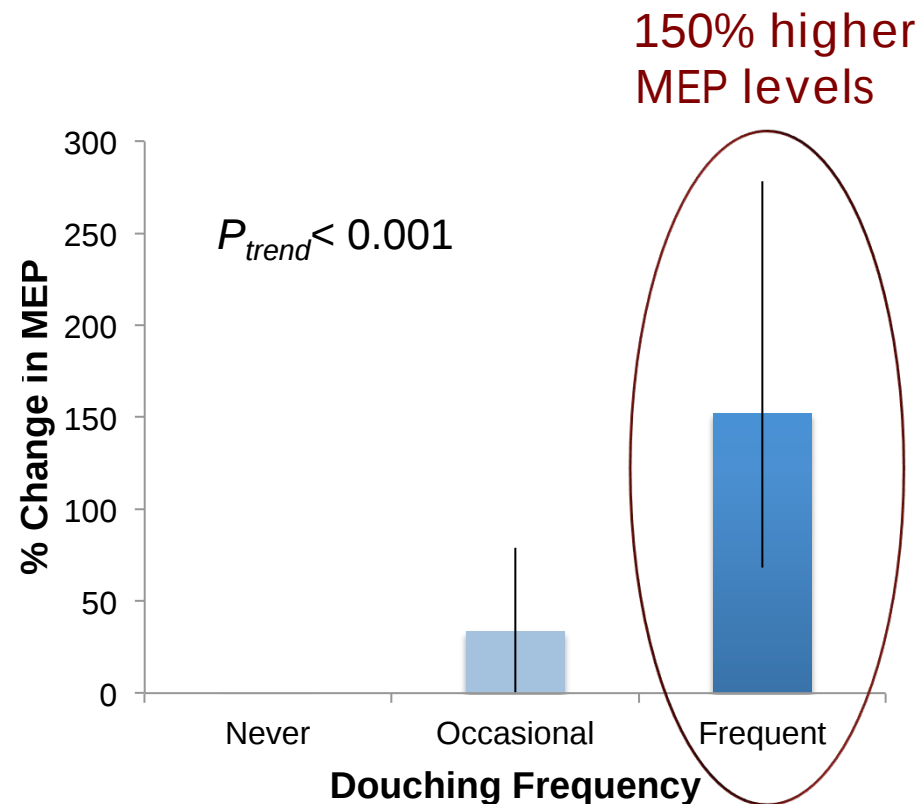
- Tampons



Black women



White women



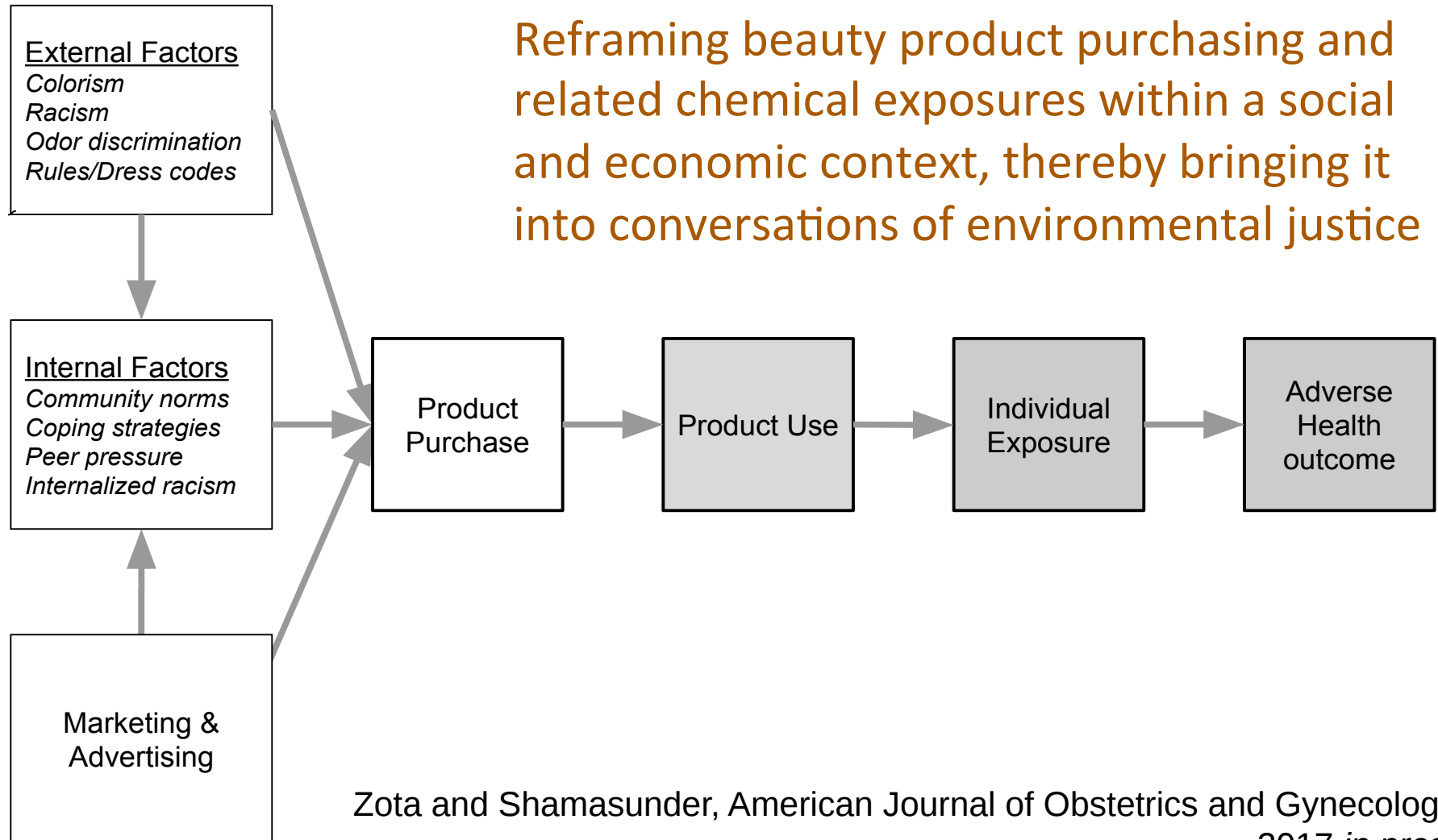
Adjusted for age, race, BMI, creatinine, and education

Douching mediates the race → phthalates association ($p < 0.001$)

Branch et al. 2015

Environmental Injustice of Beauty

Reframing beauty product purchasing and related chemical exposures within a social and economic context, thereby bringing it into conversations of environmental justice



Zota and Shamasunder, American Journal of Obstetrics and Gynecology, 2017 in press

Racism and Beauty Norms

Hair Texture



Hair Straightening



Parabens, placenta

Colorism



Skin Whitening



Mercury

Odor Discrimination



Vaginal Douching



Phthalates

Synthetic chemicals and fast food

Fast food is highly processed, packaged, & handled

Fatty foods and high cooking temperatures may accelerate contaminations



Study Design: 24 hour dietary recall data and urinary chemical biomarkers, NHANES 2001-2010 (n = 8,792)

Heavy fast food consumers have higher DEHP and DINP exposures, with evidence of dose-response

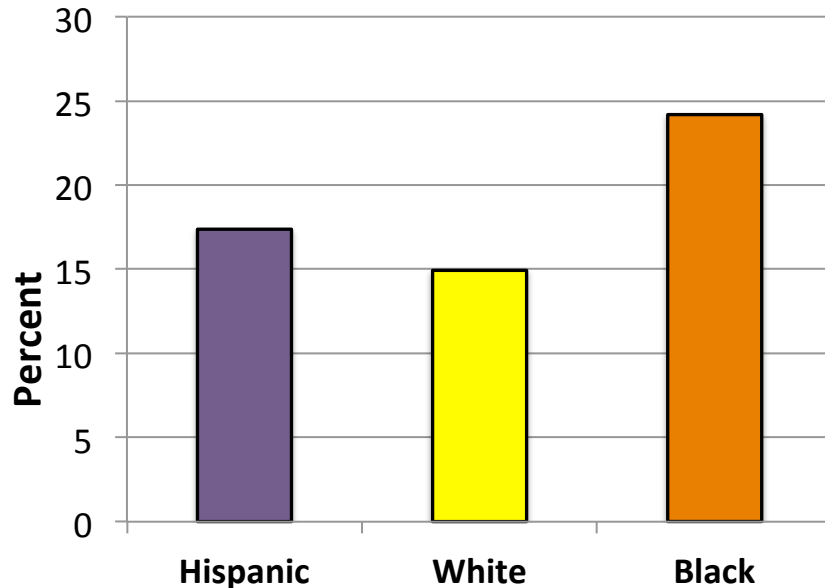
	Σ DEHPm	DINPm
	% Difference (95% CI)	% Difference (95% CI)
Total Energy Intake (TEI;kcal)		
Low	Ref	Ref
Moderate	4.3 (-3.7, 13.1)	6.2 (-2.5, 15.6)
High	3.6 (-4.5, 12.3)	6.5 (-2.0, 15.8)
P for trend	0.39	0.13
Fast food intake (% TEI from fast food)		
None	Ref	Ref
Low	15.5 (6.3, 25.6)**	24.8 (12.9, 37.9)**
High	23.8 (11.9, 36.9)**	39.0 (21.9, 58.5)**
P for trend	<0.0001	<0.0001

Adjusted for age, sex, race, household income, BMI, creatinine, NHANES cycle

* $p < 0.01$; ** $p < 0.0001$

Disproportionate impacts among U.S. blacks

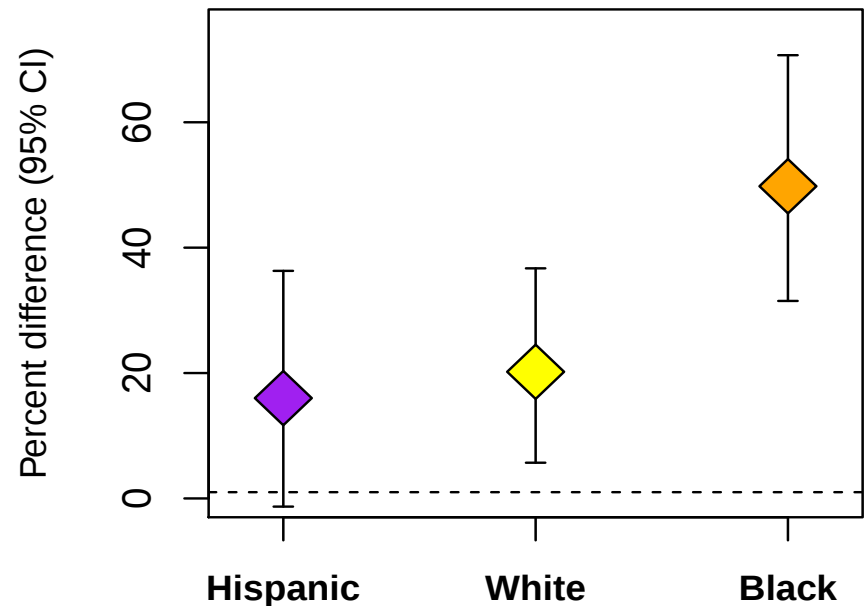
“High” Fast Food Consumption



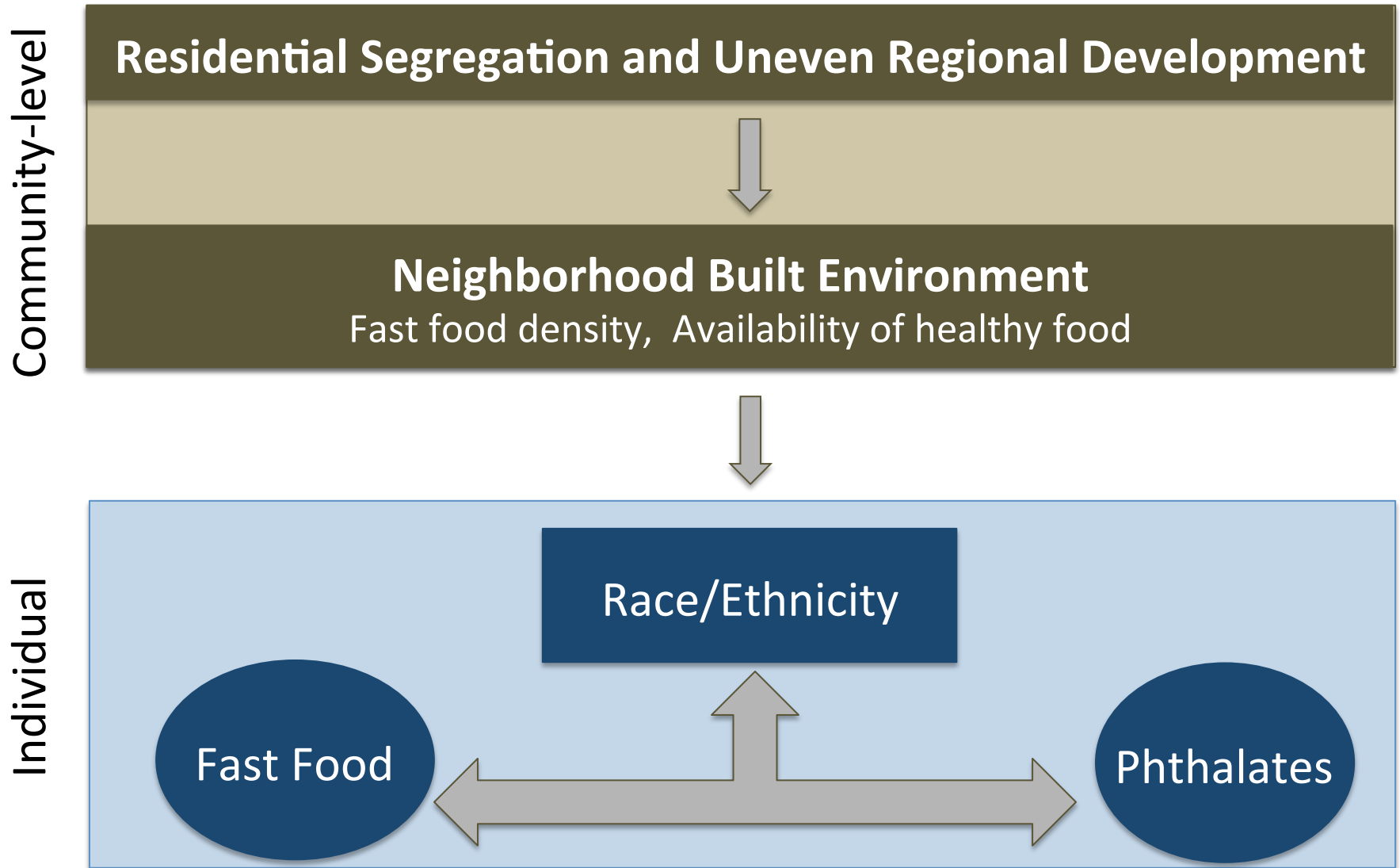
Steeper dose-response association between fast food and DEHP among U.S. blacks

Greater fast food consumption among U.S. blacks

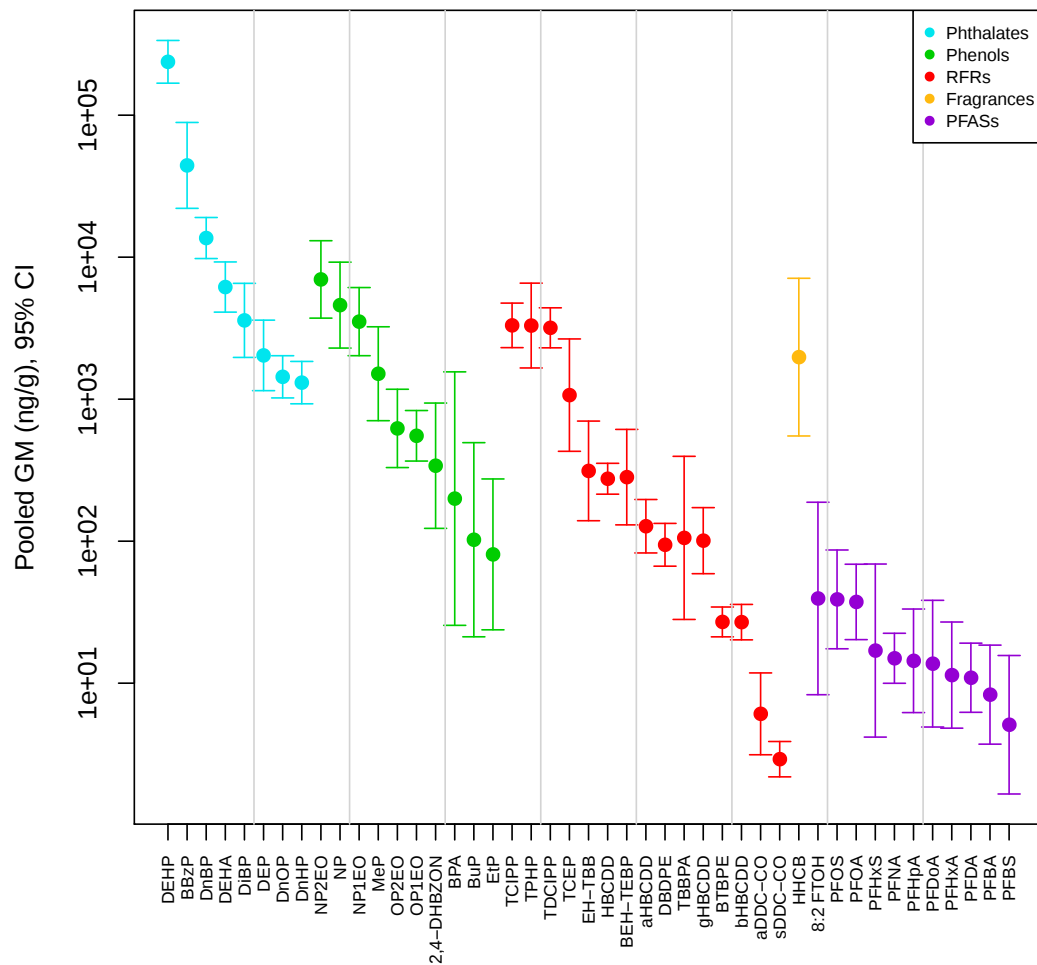
Association between high fast food consumption and DEHP



Phthalate exposures: a symptom of food injustice?

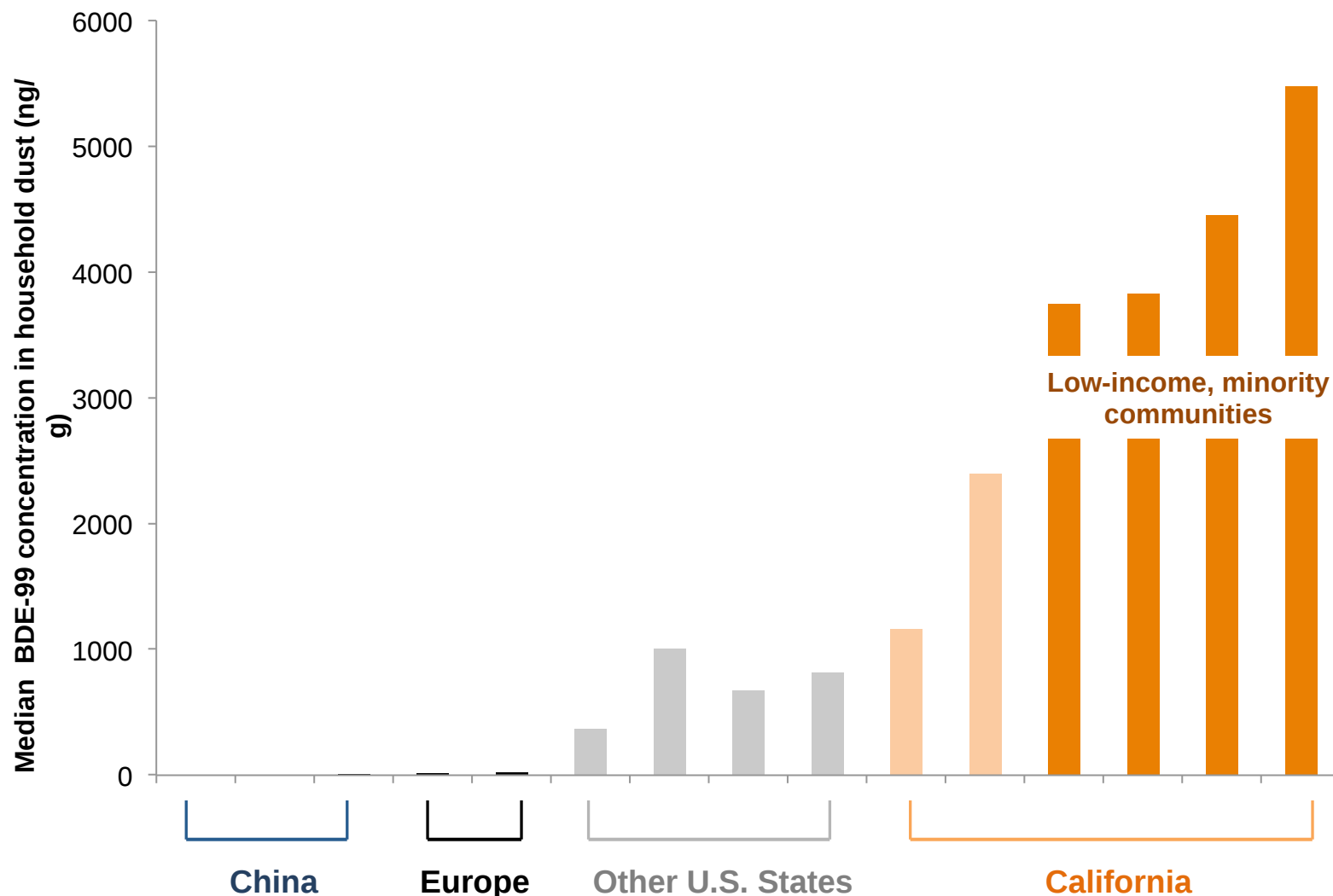


Systematic review: Consumer product chemicals in US indoor dust



- Many phthalates detected in 95-100% of homes
- Phthalates occurred in highest concentrations (among 5 chemical classes studied)

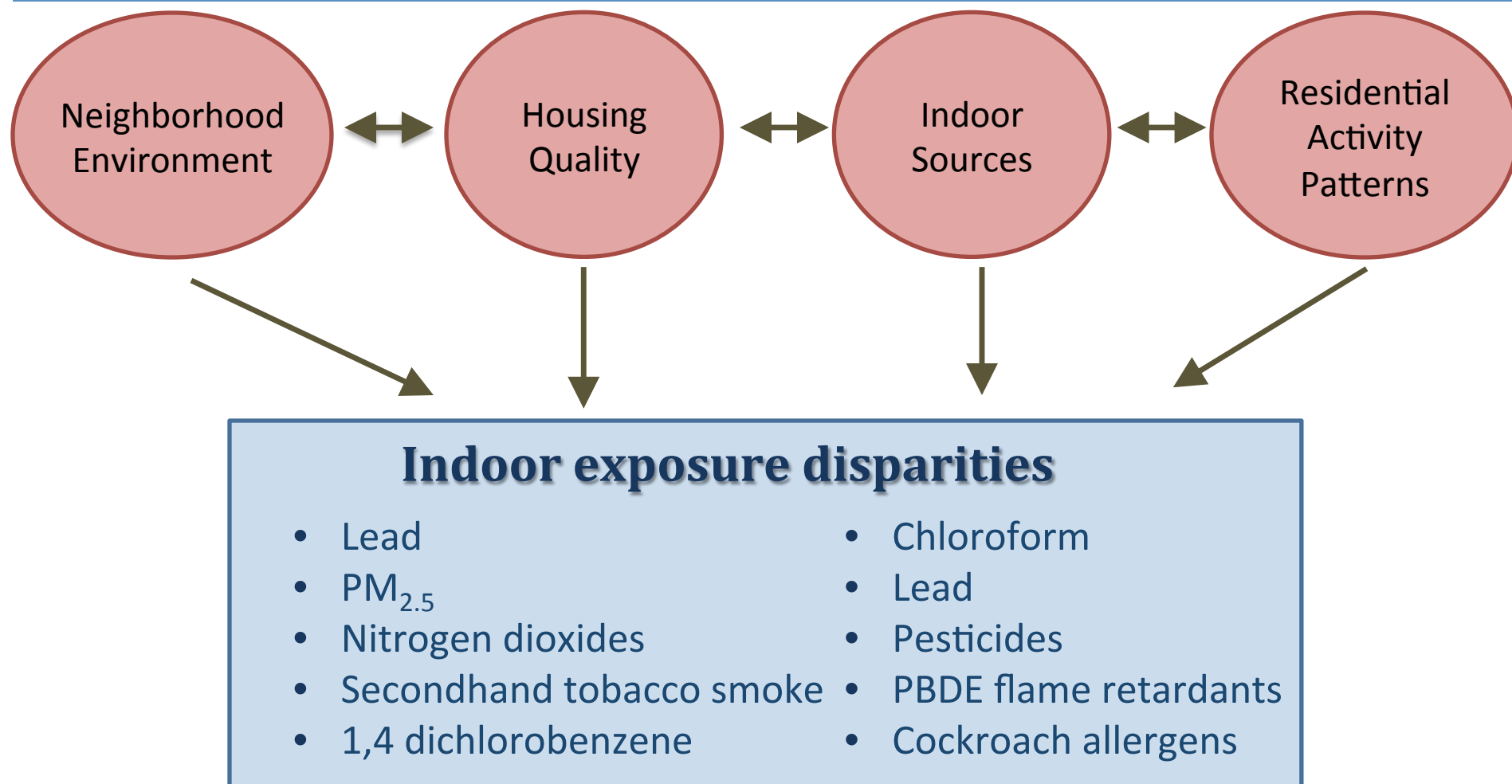
Low-income, communities of color in California have the highest penta-PBDE household dust levels in the world



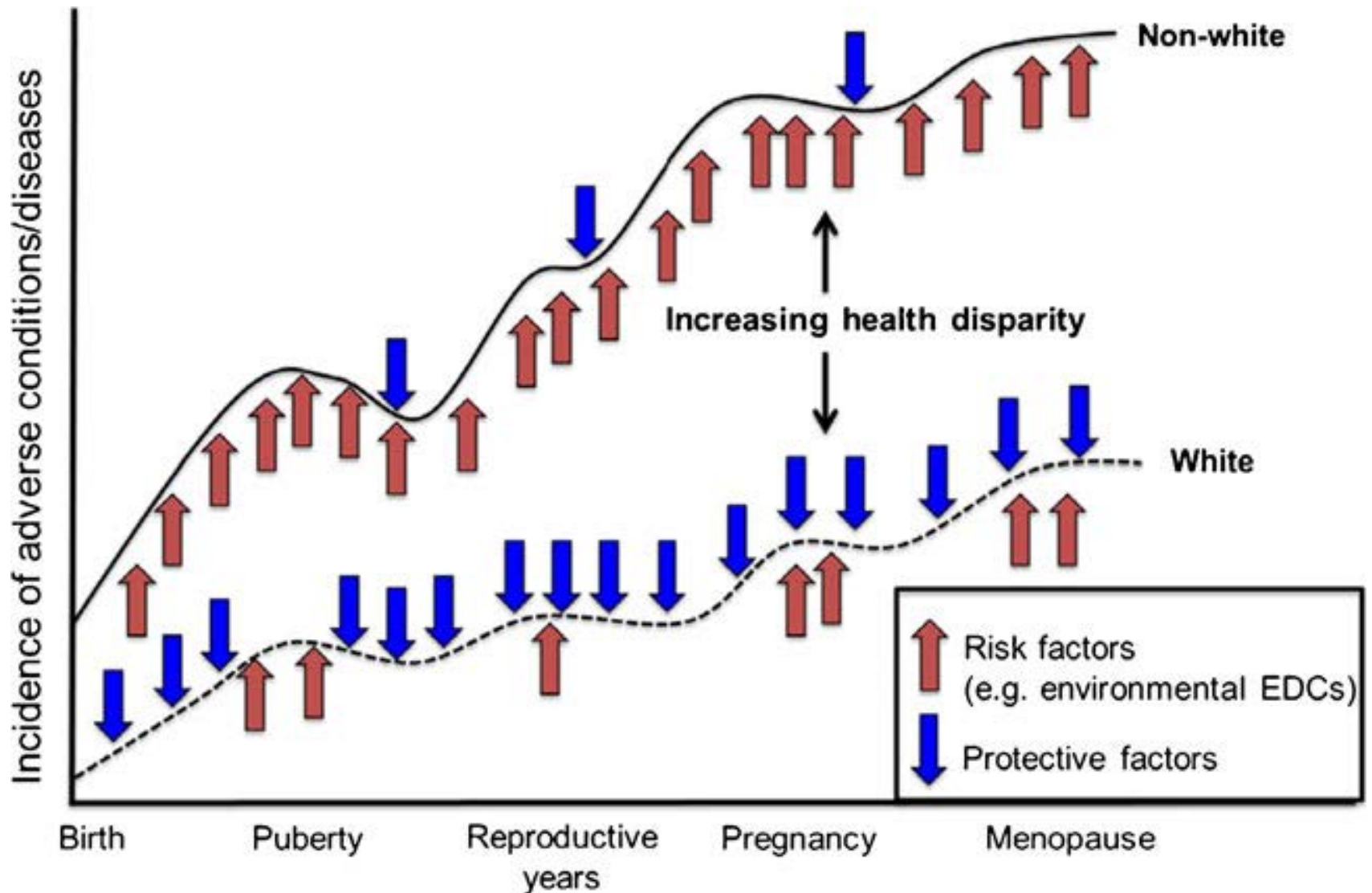
Zota A. et al. 2008 Environmental Science & Technology; Quirós-Alcalá L. et al. 2011 Environment International; Yang et al. 2010 Chemosphere; Whitehead T. et al. 2012 13th Workshop on Brominated Flame Retardants

Moving Environmental Justice Indoors: Understanding Structural Influences on Residential Exposure Patterns in Low-Income Communities

Gary Adamkiewicz, PhD, MPH, Ami R. Zota, ScD, MS, M. Patricia Fabian, ScD, Teresa Chahine, ScD, Rhona Julien, ScD, John D. Spengler, PhD, and Jonathan I. Levy, ScD



Contribution of unequal environmental exposures to increasing risk of adverse health disparities across the life course



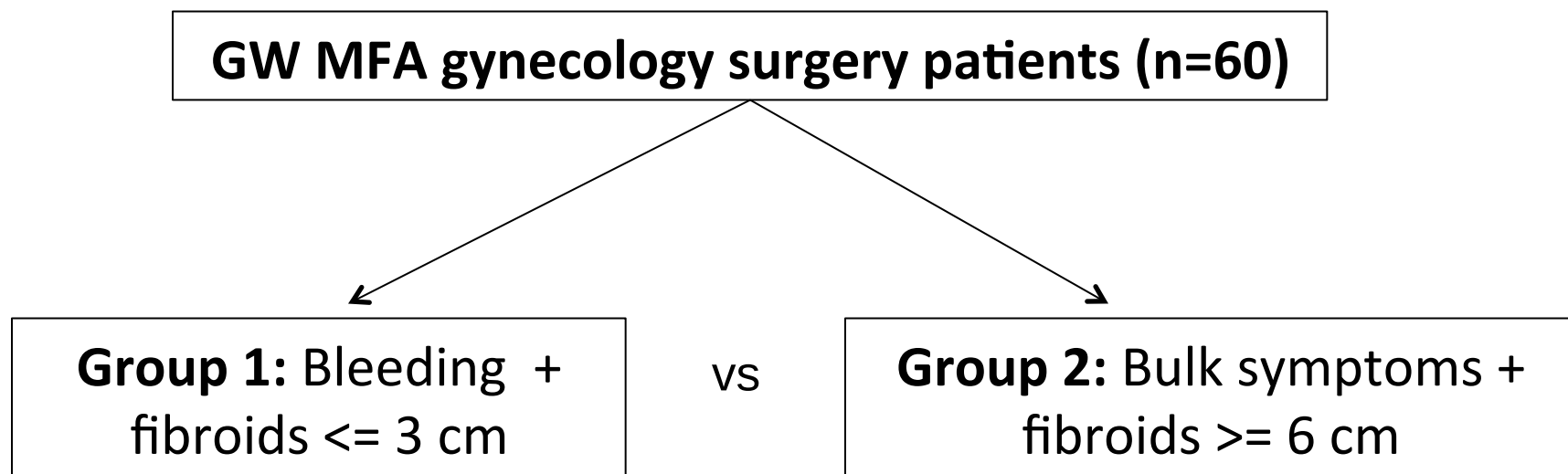
Adapted from Lu and Haflon in James-Todd, Chiu, and Zota 2016

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 treatment options
 - Hysterectomy most common treatment option; 200,000 hysterectomies and 30,000 myomectomies annually
- Etiology and root causes of racial disparities unknown
 - Consumer product chemicals may play a role

Fibroids: Observational Research on Genes & the Environment (FORGE)

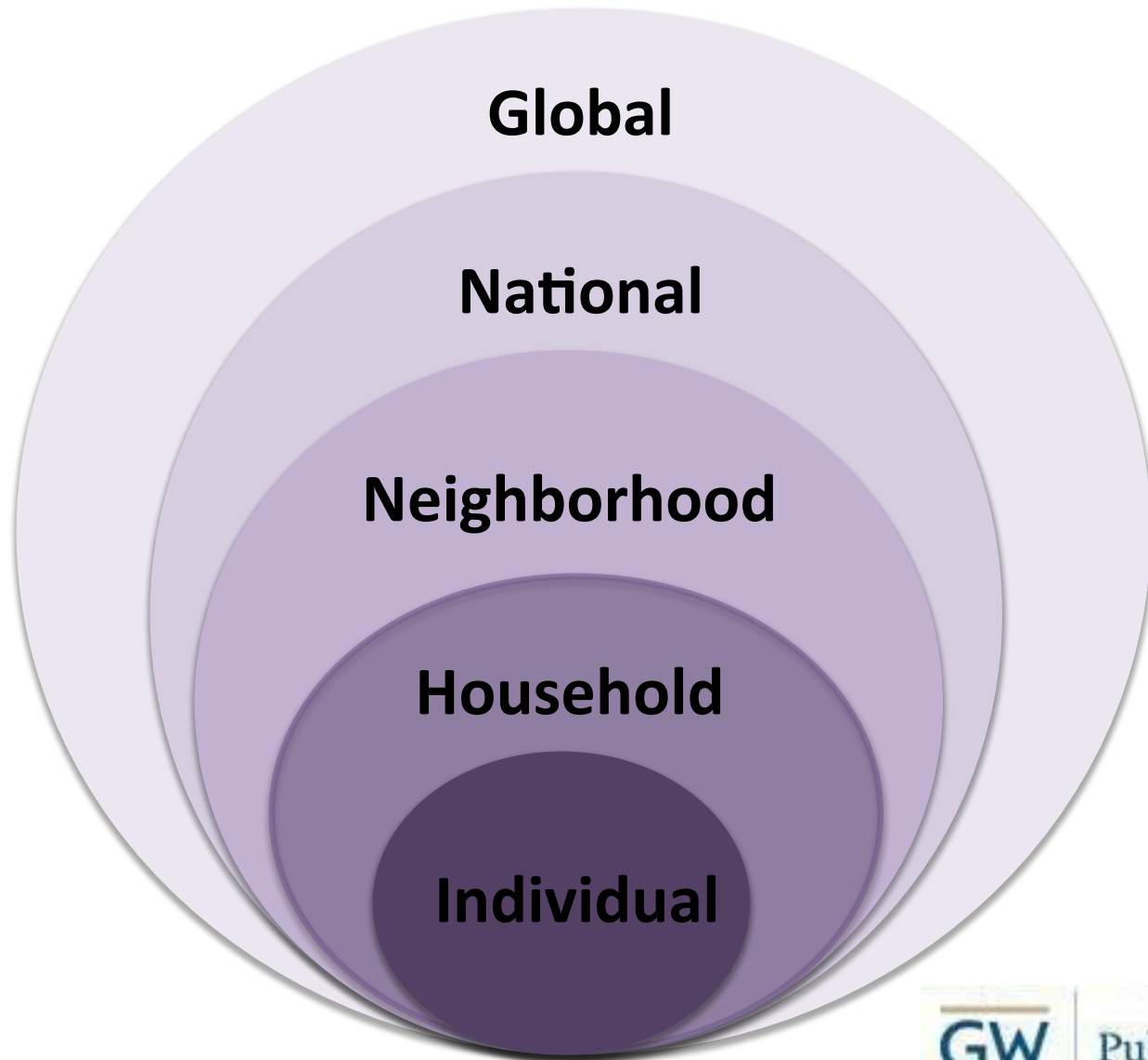
To understand how socio-environmental factors may become biologically embedded and influence fibroid growth and severity



Study Design:

- Urine sample (Phthalates and phenols)
- Blood and fibroid tissue (Epigenetic modifications - miRNAs)
- Demographic and medical information (survey, medical charts)
- Stress and stigma (qualitative interviews, perceived stress surveys)

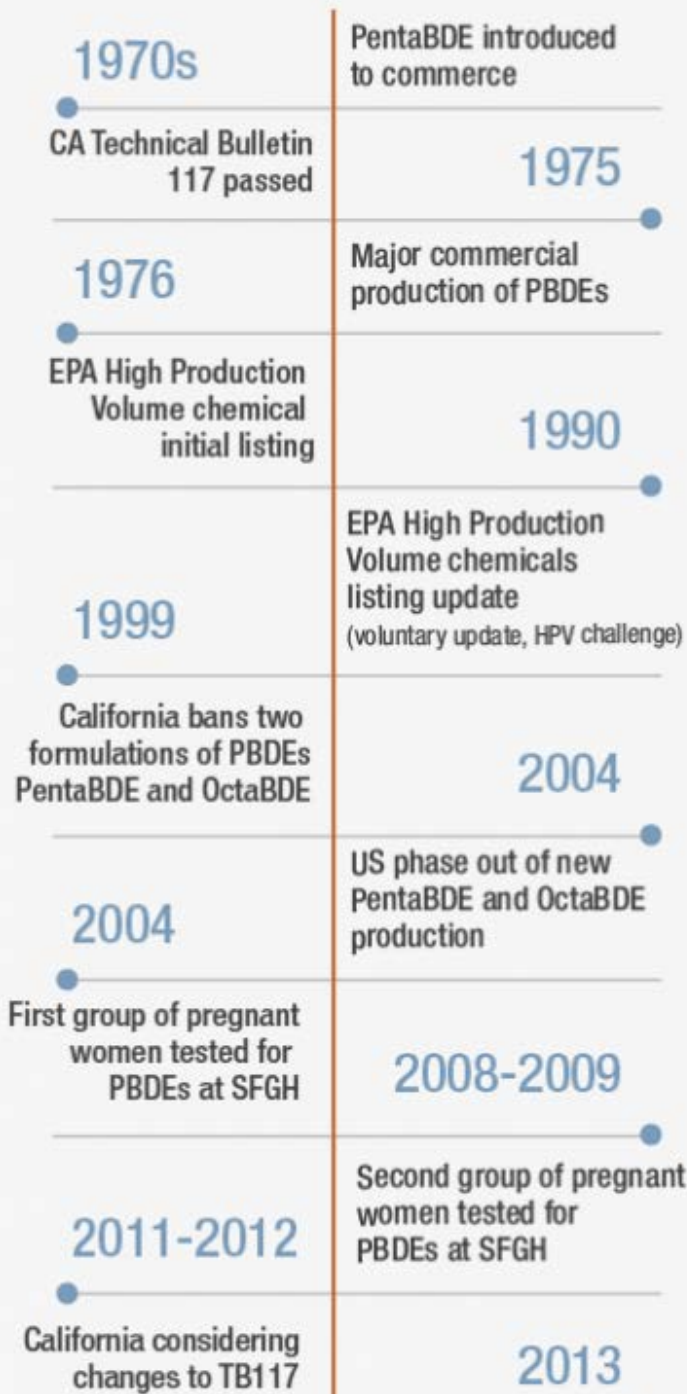
Strategies for environmental health prevention



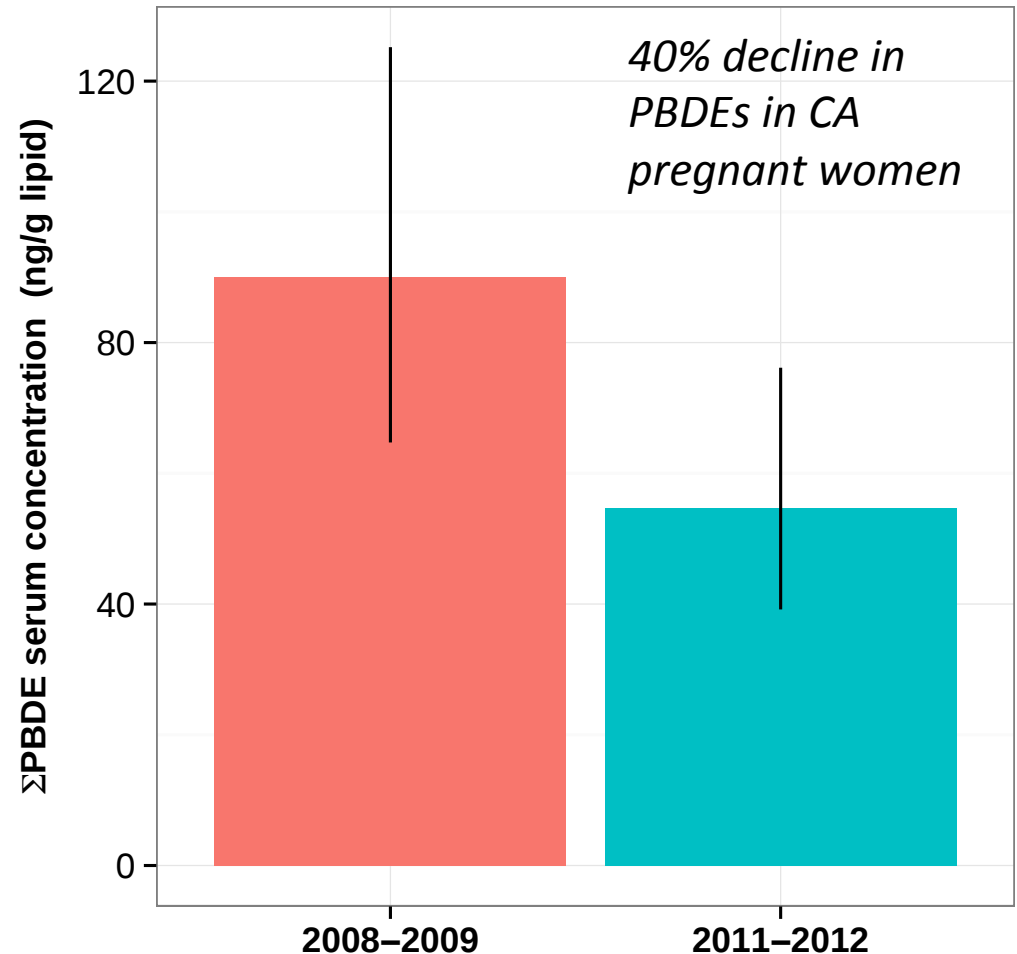


We Can't Just
"Shop Our Way"
out the Problem



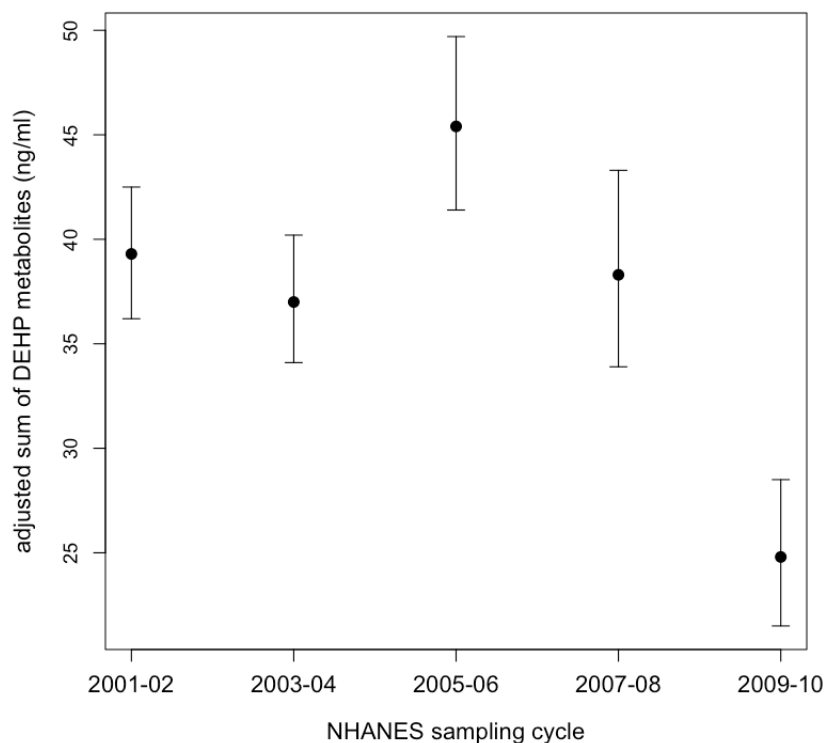


Good News: Collective action can reduce exposures

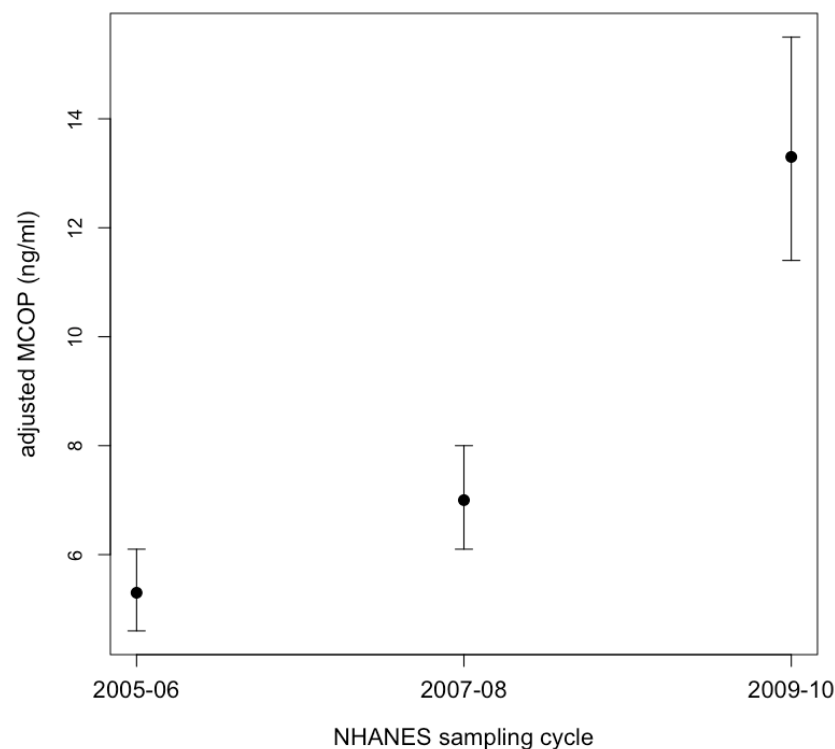


Bad News: Harmful chemicals are often replaced with problematic substitutes

DEHP exposure has
decreased by 37%



DiNP exposure has
increased by 149%





Office of Governor

Edmund G. Brown Jr.



FOR IMMEDIATE RELEASE:
Monday, June 18, 2012

Governor Brown Directs State Agencies to Revise Flammability Standards

TB117-2013 went into effect in January 2014

- ✓ Focus on fabric where fires actually start
- ✓ Flame retardants are not needed

Actions Matter

- Legislative briefings
- Webinars for Environmental Justice advocates
- Editorials

Public Health
Policy



Revising
Flammability
Standards



Social Policy



Improve
Health and
Development
of Vulnerable
Populations



Safer Chemicals, Healthy Families

A national effort to
protect families from
toxic chemicals.



In 2017, Target and
CVS have announced
efforts to remove
toxic chemicals from
their merchandise and
supply chains

- Home
- Get the Facts
- Act Now
- Blog
- Newsroom
- Mind the Store
- Who We Are
- Donate



Tell The Home Depot: DIY shouldn't spell danger

 **Take action**



How businesses are
responding to rising
demand for chemical
transparency



Home Depot: DIY shouldn't spell danger

Posted Mar 29, 2017



Calling all Costco members who support safer products

Posted Mar 24, 2017

-  **Why retailers?**
-  **Latest updates**
-  **Hazardous 100+**
-  **Top Retailers**
-  **For retailers**

International ObGyns Group Urges Greater Effort to Prevent Toxic Chemical Exposure



Right to Know: Ingredient disclosure in consumer products

**California passed flame
retardant labeling law
(SB 1019) in 2014**

NOTICE

THIS ARTICLE MEETS THE
FLAMMABILITY REQUIREMENTS
OF CALIFORNIA BUREAU OF
ELECTRONIC AND APPLIANCE
REPAIR, HOME FURNISHINGS
AND THERMAL INSULATION
TECHNICAL BULLETIN 117-2013.
CARE SHOULD BE EXERCISED
NEAR OPEN FLAME OR WITH
BURNING CIGARETTES.

The upholstery materials in this product:
_____ contain added flame retardant
chemicals
X contain NO added flame retardant
chemicals

The State of California has updated the
flammability standard and determined that
the fire safety requirements for this product
can be met without adding flame retardant
chemicals. The State has identified many
flame retardant chemicals as being known
to, or strongly suspected of, adversely
impacting human health or
development.

Others are in progress..

**Professional cosmetics
*California***



**Professional and
domestic cleaning
products
*New York, California***



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Thank you

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Relevant Publications

- **Zota A.R.**, Calafat A.M., and Woodruff T.J. Temporal trends in phthalate exposures: Findings from the National Health and Nutrition Examination Survey 2001-2010. *Environmental Health Perspectives* 2014, 122: 235–241.
- Branch F., Woodruff T.J., Mitro S.D., **Zota A.R.** Vaginal douching and racial/ethnic disparities in phthalates exposure among reproductive-aged women: National Health and Nutrition Examination Survey 2001-2004. *Environmental Health* 2015, 14(1):57
- **Zota A.R.**, Phillips C., and Mitro S.D. Recent fast food consumption and Bisphenol A and phthalates exposures among the US population in NHANES, 2003 – 2010. *Environmental Health Perspectives* 2016: 124(10):1521-1528
- James-Todd T.M., Chiu Y.H., and **Zota A.R.** Racial/ethnic disparities in environmental endocrine disrupting chemicals and women’s reproductive health outcomes: epidemiological examples across the life course. *Current Epidemiology Reports* 2016: 3(2): 161-180
- Mitro S.D., Dodson R.E., Singla V., Adamkiewicz G., Elmi A., Tilly M.K, **Zota A.R.** Consumer product chemicals in indoor dust: a quantitative meta-analysis of US. studies. *Environmental Science & Technology* 2016, 50(19):10661-10672.
- Varshavsky J.R., **Zota A.R.**, Woodruff T.J. A novel method for calculating potency-weighted cumulative phthalate exposure with implications for identifying racial/ethnic disparities among U.S. reproductive-aged women in NHANES 2001-2012. *Environmental Science & Technology* 2016, 50(19):10616-10624.

Do phthalates contribute to racial/ethnic differences in women's reproductive health outcomes?

- Systematic review of four health outcomes: puberty, uterine fibroids, infertility and pregnancy complications
- Accumulating evidence that phthalates may play a role in infertility and pregnancy complications.
- Limitations: Most studies only adjusted for race/ethnicity as a confounder and many studies were too racially homogenous to examine differential vulnerability.
- Recommendations: Need to examine effects of EDCs and women's health outcomes in more diverse populations and use appropriate analytical techniques to assess how disparities in exposure may influence disparities in health outcomes.

Demographics (N = 106)

Age (years)

18-25	35 (33.0%)
26-30	37 (34.9%)
31-42	34 (32.1%)

BMI

18.5 – 25	7 (6.9%)
25.1 – 30	50 (49.0%)
> 30	45 (44.1%)

% of Poverty

<=100%	45 (45.0%)
>100%	55 (55.0%)

Race

White	14 (13.3%)
African American	37 (35.2%)
Latina	33 (31.4%)

Parity

0	50 (47.2%)
>= 1	56 (52.8%)

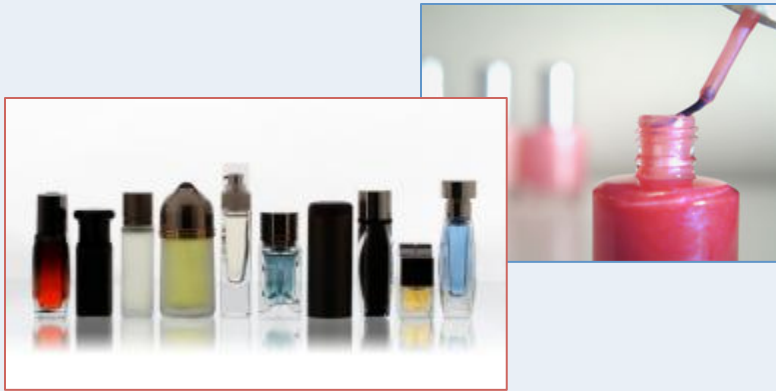
Smoking status

Current	5 (5.0%)
Past	43 (43.0%)
Never	52 (52.0%)

TPO antibody status (IU/mL)

Normal (<9)	72 (69.9%)
High (>= 9)	31 (30.1%)

Phthalates in Consumer Products



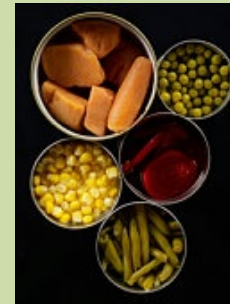
Cosmetics and fragrances



Toys and Home Furnishings



Medical Devices



Food and Food Packaging

Endocrine-disrupting chemicals: Potential Risk Factor for Uterine Fibroids

- Fibroids respond to estrogen and progesterone
- Phthalates, parabens, and BPA can interfere with hormone signaling
- Hair relaxer use associated with uterine fibroid risk in Black women
- microRNA regulation may be the target of EDC toxicity

