National Academies of Science
Why Indoor Chemistry Matters Workshop 3: Reaching Communities for Action

Working with Vulnerable Communities to Impact Change: An Applied Environmental Justice Framework for Exposure Science, Public Health, and Beyond

Lesliam Quirós-Alcalá, PhD, MSc

Department of Environmental Health and Engineering
Johns Hopkins University, Bloomberg School of Public Health

Johns Hopkins NIOSH ERC for Occupational Safety and Health, Faculty
Johns Hopkins TWH® POE Center, Outreach Core Co-Director

April 10, 2024
Washington, D.C.

JOHNS HOPKINS
BLOOMBERG SCHOOL
of PUBLIC HEALTH

My charge…

- Hairdressers as a vulnerable community to study in research
- Relationship building process and building trust
- Cultural considerations when conducting studies
- Data collected and findings
- Sharing of results
- Lessons learned on public health messaging, building community trust, and designing future studies

What is Environmental Justice?

The **fair treatment** and **meaningful involvement** of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

Source: International Encyclopedia of the Social & Behavioral Sciences, 2001

What do we mean by “fair treatment”?

… no group of people bears a disproportionate burden of environmental harms and risks, including those resulting from the negative environmental consequences of industrial, governmental, and commercial operations or programs and policies.

Source: https://www.epa.gov/sites/production/files/2015-02/documents/team-ej-lexicon.pdf

“Meaningful involvement” means …

(1) Affected communities can participate in decisions about activities that may affect their environment and/or health;

(2) Public's contribution can influence the regulatory agency's decision;

(3) Community concerns are considered in the decision-making process;

(4) Decision makers seek and facilitate involvement of those affected.

What do we mean by vulnerable community in the context of environmental exposures?

Those at risk of exposure to environmental hazards and that lack sufficient resources and knowledge to prepare for or cope with these risks.

Select factors contributing to vulnerability:

Residential (and work) location

(higher environmental exposures in low-income communities/communities of color due to practices rooted in structural/systemic racism (redlining); individuals in these communities hold more hazardous jobs)

Susceptibility to exposures

(life stage, pre-existing conditions, genetics)

Access to proper healthcare, healthy foods, and consumer products

Ability to anticipate, recognize, cope with, or recover from exposures

LABOR CORONAVIRUS ENVIRONMENTAL JUSTICE

Environmental Justice Is Essential in the Workplace and at Home

No worker should be forced to choose between an unsafe job and unemployment.

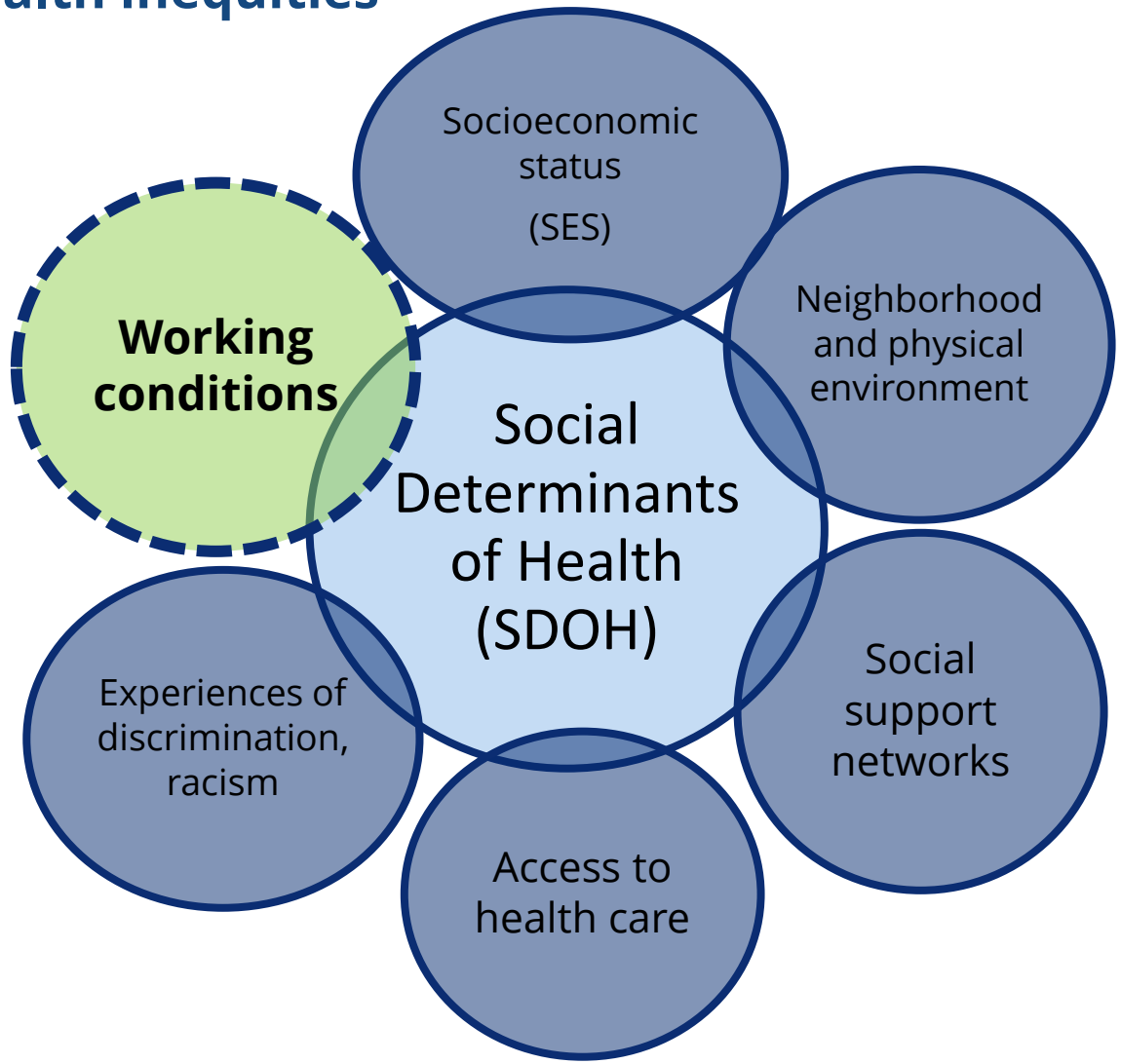
By David Michaels and Robert Bullard

OCTOBER 22, 2021

Work is a social determinant of health often neglected in public health research and interventions.

*"Social determinants of health (SDOH): conditions in which people are born, grow, **work**, live, and age, and the wider set of forces and systems shaping the conditions of daily life (WHO definition)."*

The workplace can increase differential vulnerabilities that may lead to health inequities



Accounts for 30-55% of health outcomes and inequities

Occupational Exposures in Hair Salons:

A Case Study on Hairdressers of Color as a Vulnerable Population

JOHNS HOPKINS
EDUCATION AND RESEARCH CENTER
FOR OCCUPATIONAL SAFETY AND HEALTH
ERC

What led to this work and selecting this population?

- Females have increased body burden to chemicals in personal care/beauty products (PCPs) compared to males (CDC Biomonitoring Data)

Image source: https://www.arabiaweddings.com/tips/fashion/5-bridal-inspiration-month-famous-instagram-accounts

What led to this work and selecting this population?

- Women of color (Black/Latina) have higher body burden of chemicals found in PCPs/cosmetics compared to non-Hispanic White women

- Likely due to sociocultural differences in product use (e.g., product type and frequency of use)

Source: Nguyen et al. 2020, Image source: https://dermavidualsny.com/

Beauty and its burden on women of color

- Racial/ethnic differences in beauty product use documented across multiple categories (e.g., skin care, hair care, and feminine hygiene).
- Use of select products influenced by societal pressures and socio-cultural norms to fit a euro centric beauty standard

TABLE
Examples of disproportionate beauty product exposures among vulnerable populations

External factors	Vulnerable populations	Product use	Chemical exposures	Potential adverse outcomes
Colorism	Dark skinned women (globally)	Skin-lightening creams	Mercury	Mercury poisoning, neurotoxicity, kidney damage
Hair texture preferences	African American women (United States)	Hair relaxers and other hair care products	Parabens and estrogenic chemicals from placenta	Uterine fibroid tumors, premature puberty, and endocrine disruption
Odor discrimination	African American women (United States)	Vaginal douches and other feminine care products	Phthalates and talc powder	Gynecologic cancers and endocrine disruption

Zota & Shamasunder. Beauty products, environmental chemicals, health disparities. Am J Obstet Gynecol 2017.

What about exposures and health risks among women of color who not only use products for personal use, but as part of their job?

- >700,000 hairdressers in the United States
- Predominantly female, low-wage workforce
- ~30% are women of color
- Average age ~38 years (reproductive age)
- Exposures may pose a women and children's health risk

Women of color, especially those in low-income communities and low-wage jobs, may be further susceptible and vulnerable to the effects of chemical exposures...

- Exposed to **multiple environmental and social risk factors** and are at increased risk of facing poorer health outcomes.
- Face barriers in accessing safety resources
- Unaware of workplace hazards

What do we know about chemical exposures among hairdressers?

Chemical exposures among hairdressers remain understudied and research to date is very limited

- Few studies on indoor contaminants in salons, particularly in the U.S.
  - Limited to a few volatile organic compounds (VOCs) and/or a hair services
- Epidemiologic studies limited and/or inconclusive
  - Most conducted in Europe
  - Relied on job title to assess exposure
  - Little information on chemical exposures
- Data on occupational exposures and health risks to workers serving racially ethnically diverse population lacking
- Products targeted to Black women contain many toxic chemicals

What did we do to begin addressing some of these gaps and inform larger studies?

In the photo:
Ms. Katrina Randolph
Tres Shadez Salon owner, stylist, community partner and pilot study participant

Indoor air monitoring:
Particulate matter (PM)
14 VOCs

Biomonitoring:
28 VOC biomarkers
9 Phthalate biomarkers
Untargeted analyses

- Characterized IAQ and concentrations of indoor air pollutants (PM, VOCs) in 6 hair salons mainly serving a Black/Latinx clientele
- Biomonitoring on 23-30 hairdressers of color (Black, Latina) and 17 office workers of similar race/ethnicity
- Assessed factors linked to exposures and obtained detailed health history (bilingual questionnaires)

Risk factors: assessed exposure determinants

Respiratory airway assessment:
Nasal microbiome

Health: Overall health and workplace symptoms

What did we find?

Study population characteristics

- Racially/ethnically comparable groups
- Average age: Hairdressers 40 yrs vs. Office workers 34 yrs
- Hairdressers earned lower income
- Mostly non-smokers (>80%)
- Outside of work, hairdressers used more beauty products and sought more salon services vs. office workers

Characteristic	Hairdressers (n=23)	Office Workers (n=17)
	N(%)	
Race/Ethnicity		
Hispanic/Latina	11 (47.8)	7 (41.2)
Non-Hispanic Black	11 (47.8)	7 (41.2)
Other	1 (4.4)	3 (17.6)
Income		
≤ $30,000	10 (52.6)	3 (17.7)
$30,001-$50,000	4 (21.1)	3 (17.7)
> $50,000	5 (26.3)	11 (64.7)
Current smoker		
No	19 (82.6)	16 (94.1)
Yes	4 (17.4)	1 (5.9)
Received salon services ≤ 12 months		
None	7 (30.4)	12 (70.6)
1 service	6 (26.1)	3 (17.7)
2-3 services	10 (43.5)	2 (11.8)
Characteristic	**Mean (SD)**	
Age (years)*	40.2 (10.6)	33.6 (7.9)
Work week hrs.	44.3 (18.7)	40.4 (10.4)
Personal use ≤48 hrs.		
Makeup	3.4 (3.1)	2.5 (2.1)
Hair products	2.1 (1.5)	1.5 (1.1)
Other PCPs	10.5 (4.7)	10.6 (2.0)

Study population characteristics

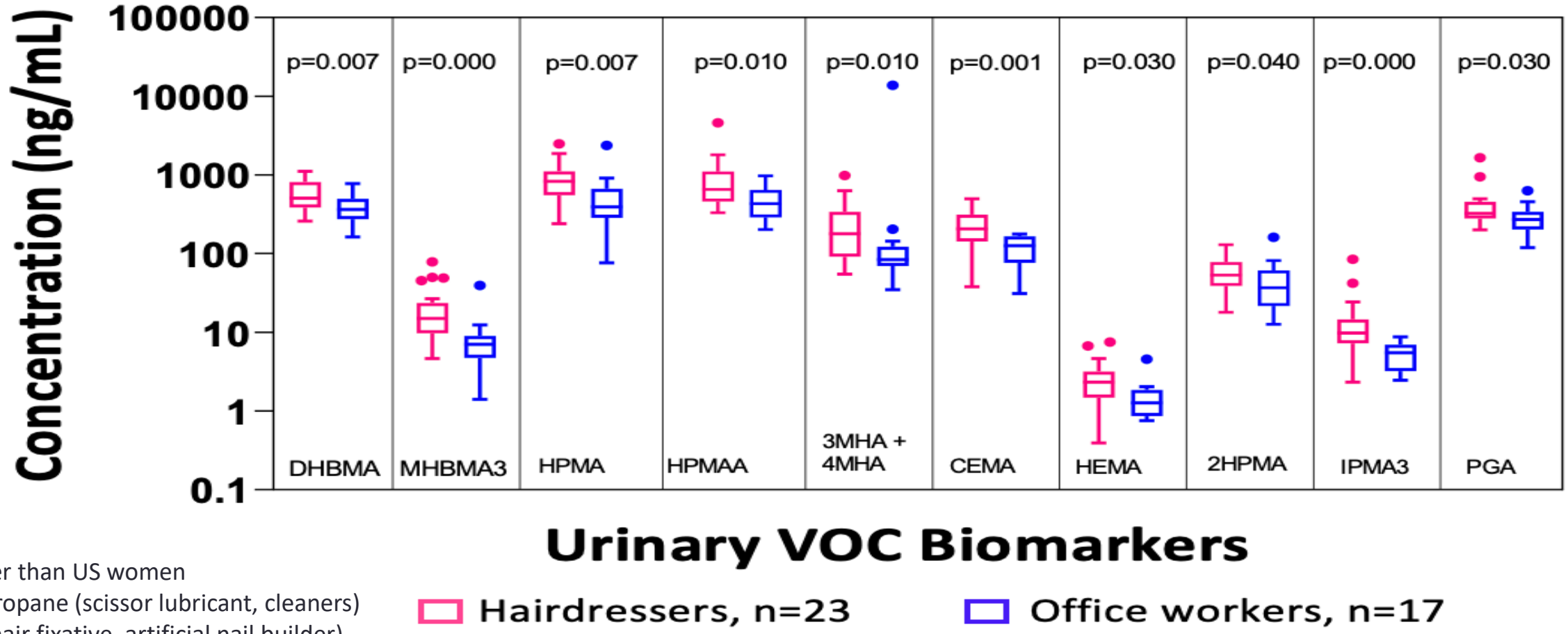
- Among hairdressers
  - ~50% worked while pregnant
  - 2 were in their 3rd trimester

Select indoor air results:

- VOC median concentrations 2-175 times higher in salons vs. office spaces
- Breakthrough reached for several VOCs (i.e., levels measured exceeded maximum detectable concentrations): acetone, n-butyl acetate, tetrachloroethylene)
- Particulate matter (PM) concentrations higher in salons serving Latina/Black clientele vs. all Black clientele

Urine Biomonitoring Results

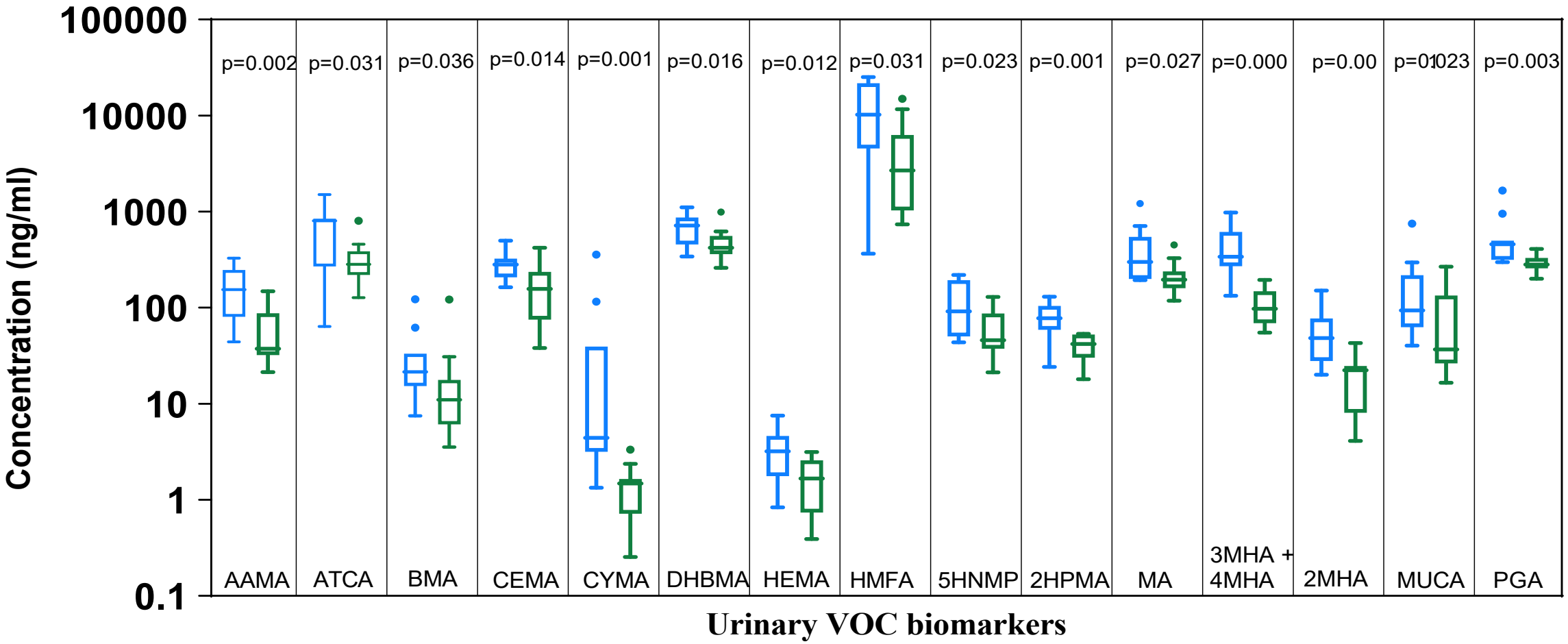
Higher VOC biomarker concentrations in hairdressers vs. office workers



>4Xs higher than US women
1-bromopropane (scissor lubricant, cleaners)
Acrolein (hair fixative, artificial nail builder)
1,3-butadiene (hair fixers, shampoo)

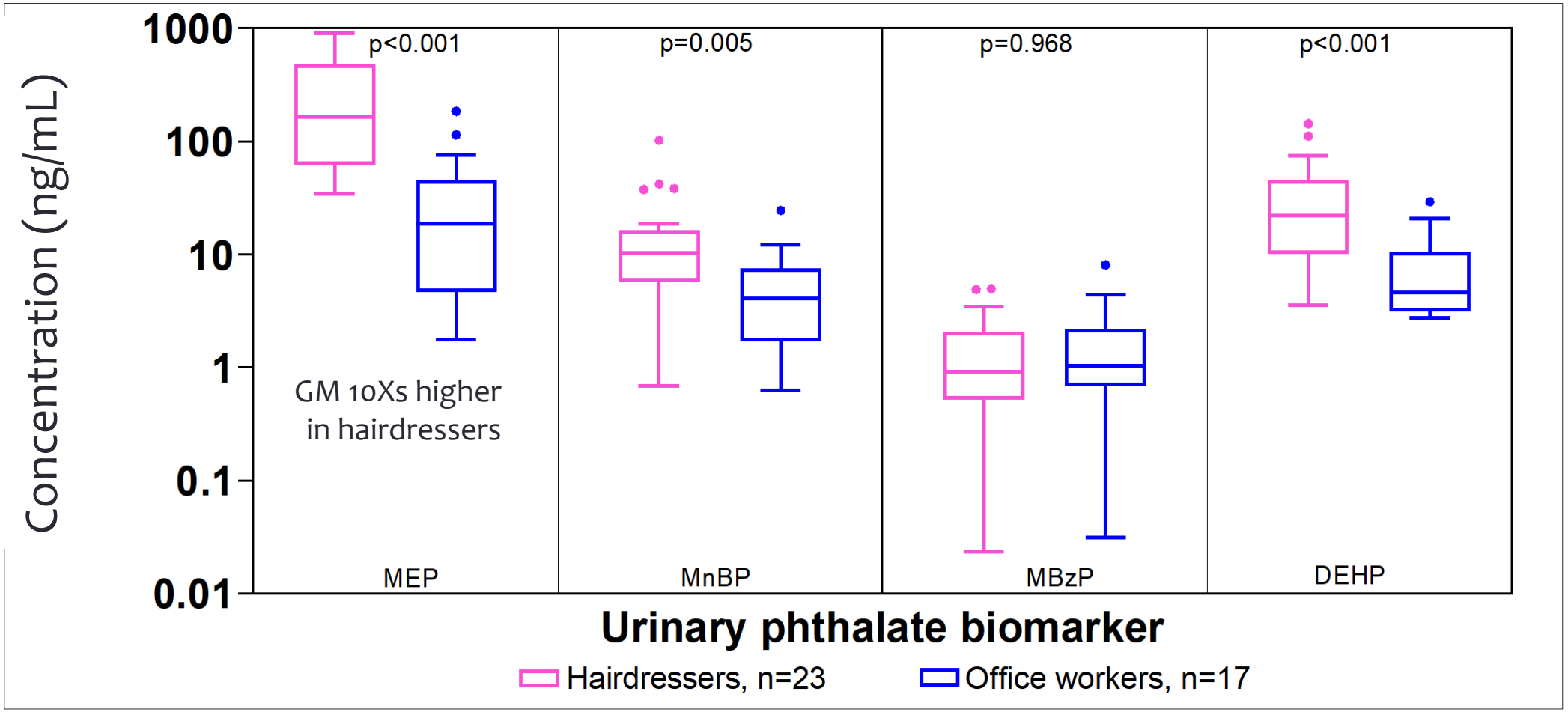
Louis et al. 2021

Differences in VOC exposures observed between clientele served in salons



Louis et al. 21021

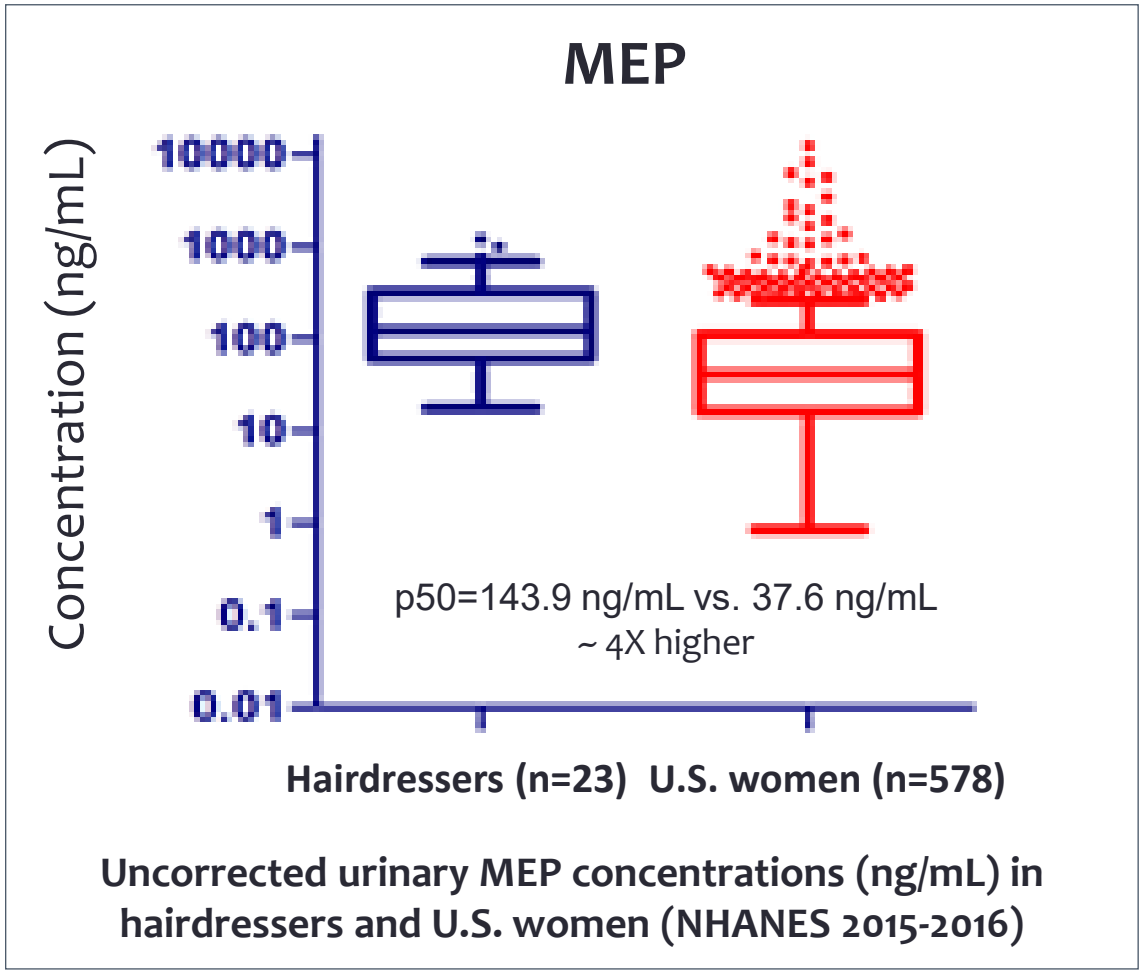
Higher phthalate biomarker concentrations in hairdressers vs. office workers



Specific gravity corrected urinary concentrations for select phthalate biomarkers in hairdressers vs. office workers

Boyle et al. 2021

Higher MEP biomarker concentrations in hairdressers vs. women in the US general population



Uncorrected urinary MEP concentrations (ng/mL) in hairdressers and U.S. women (NHANES 2015-2016)

*Compared to other studies among non-pregnant women of reproductive age, hairdressers in our study had **2-41Xs** higher **median** MEP levels*

Prenatal exposures linked with:

- Preterm birth
- Decreased anogenital distance in male infants
- Pregnancy complications

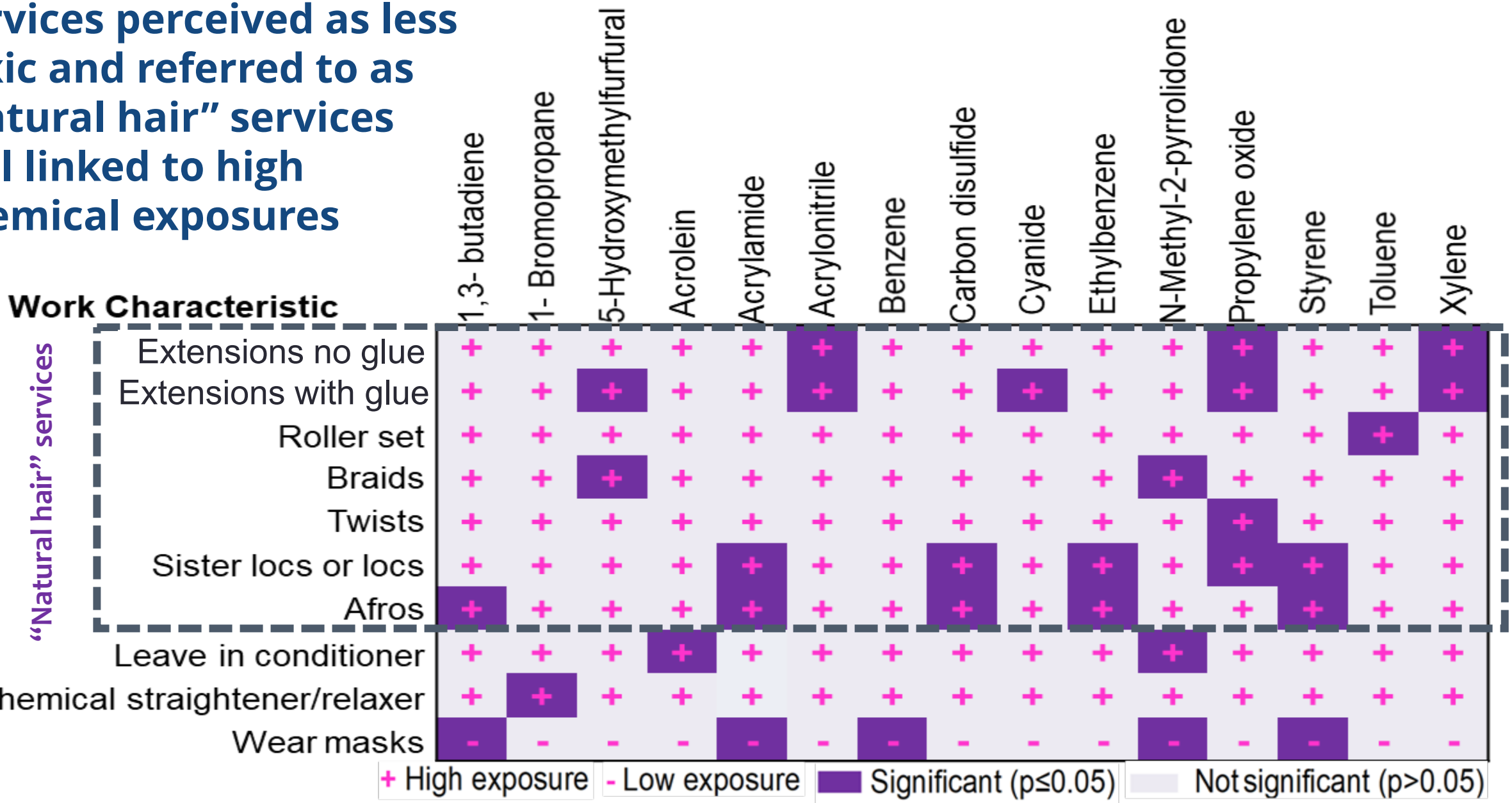
Sources: **Cosmetics/personal care products** (fixative for fragrances, various hair sprays as a solvent to avoid stiffness and allows having a flexible film on the hair, nail polishes), insecticides, and aspirin, toys, and food packaging

Boyle et al. 2021

Higher biomarker concentrations in hairdressers reporting use of select products or providing select services vs those that did not

Louis et al 2021; Boyle et al. 2021

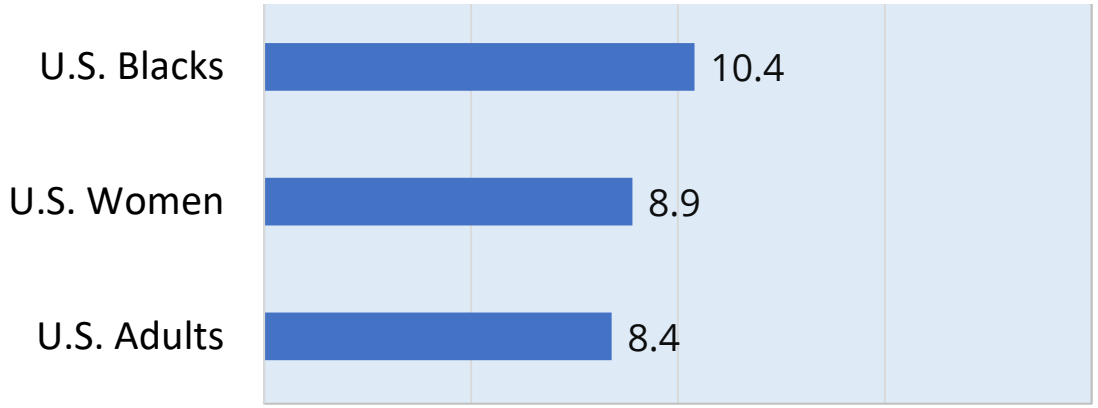
Services perceived as less toxic and referred to as “natural hair” services still linked to high chemical exposures



Health History

Respiratory disease development and control is of concern among hairdressers

Prevalence (%) of asthma among hairdressers and U.S. population (CDC 2020)

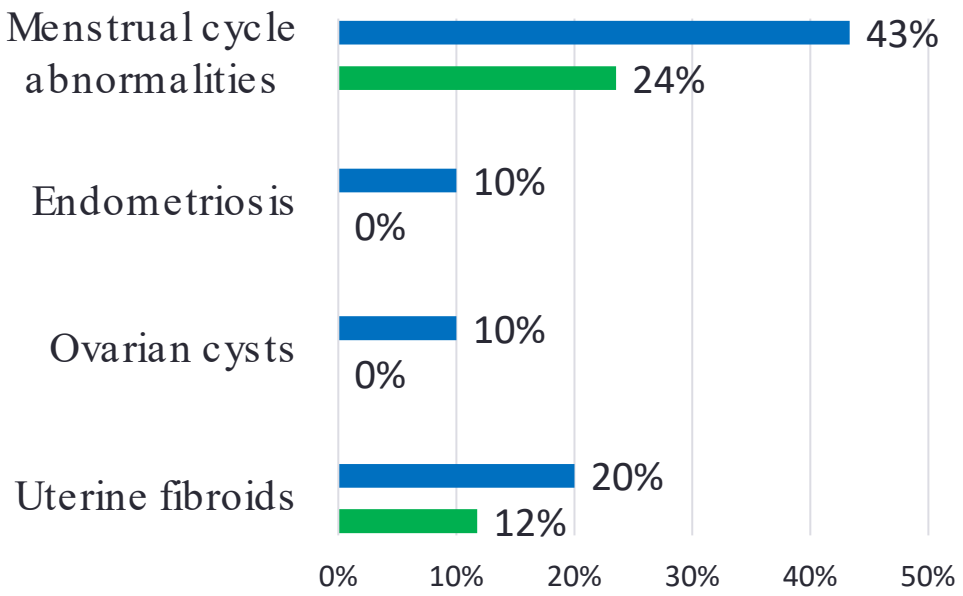


- Higher asthma prevalence in hairdressers
- 75% diagnosed while employed
- 50% had an urgent care visit in the prior year
- Symptoms reported:
  - nasal irritation: 35%
  - trouble breathing at night: 14%
  - wheeze: 9%

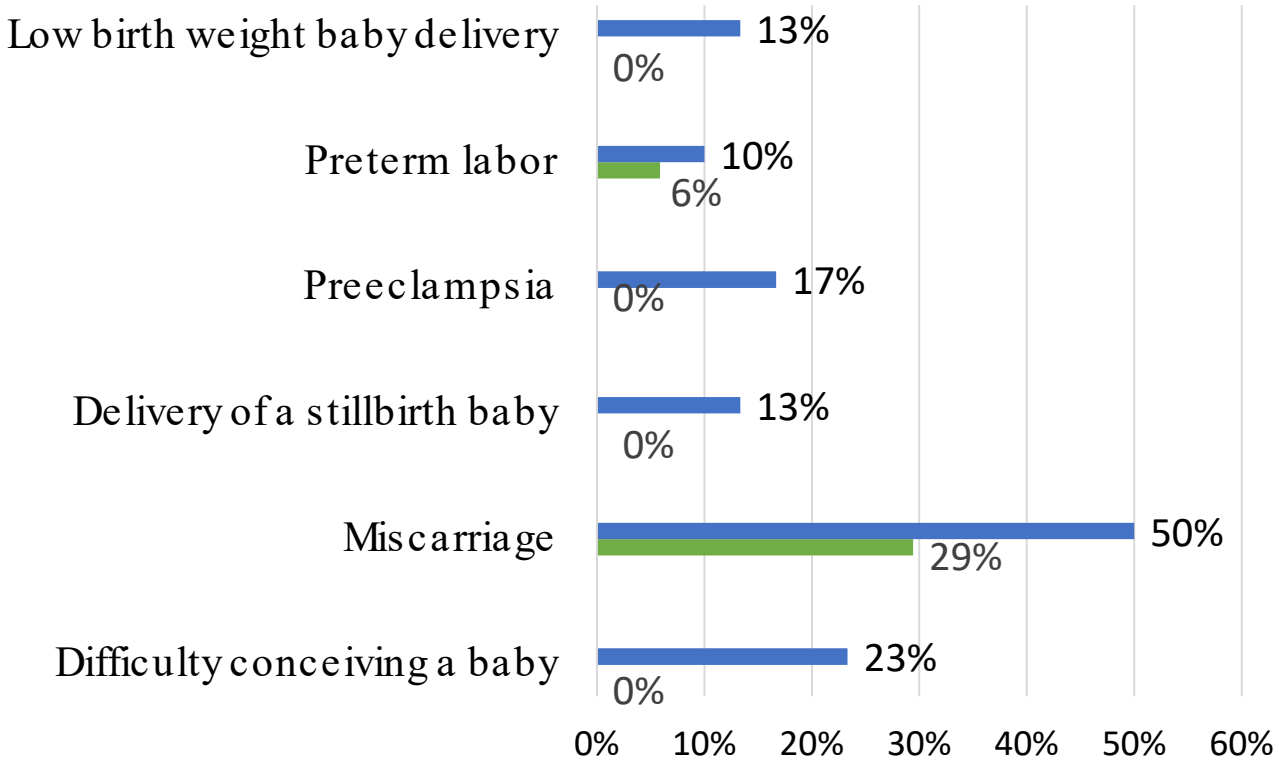
Hairdressers cannot stop working and risk wage loss despite ongoing concerns and symptoms. Will continue this work (R01HL171490)

Increased prevalence of adverse gynecologic/reproductive health markers and birth outcomes in hairdressers

Gynecologic conditions



Adverse pregnancy conditions and birth outcomes



Hairdressers, n=30 (data from 2 pilot studies)

Office workers, n=17

Journal of Exposure Science & Environmental Epidemiology

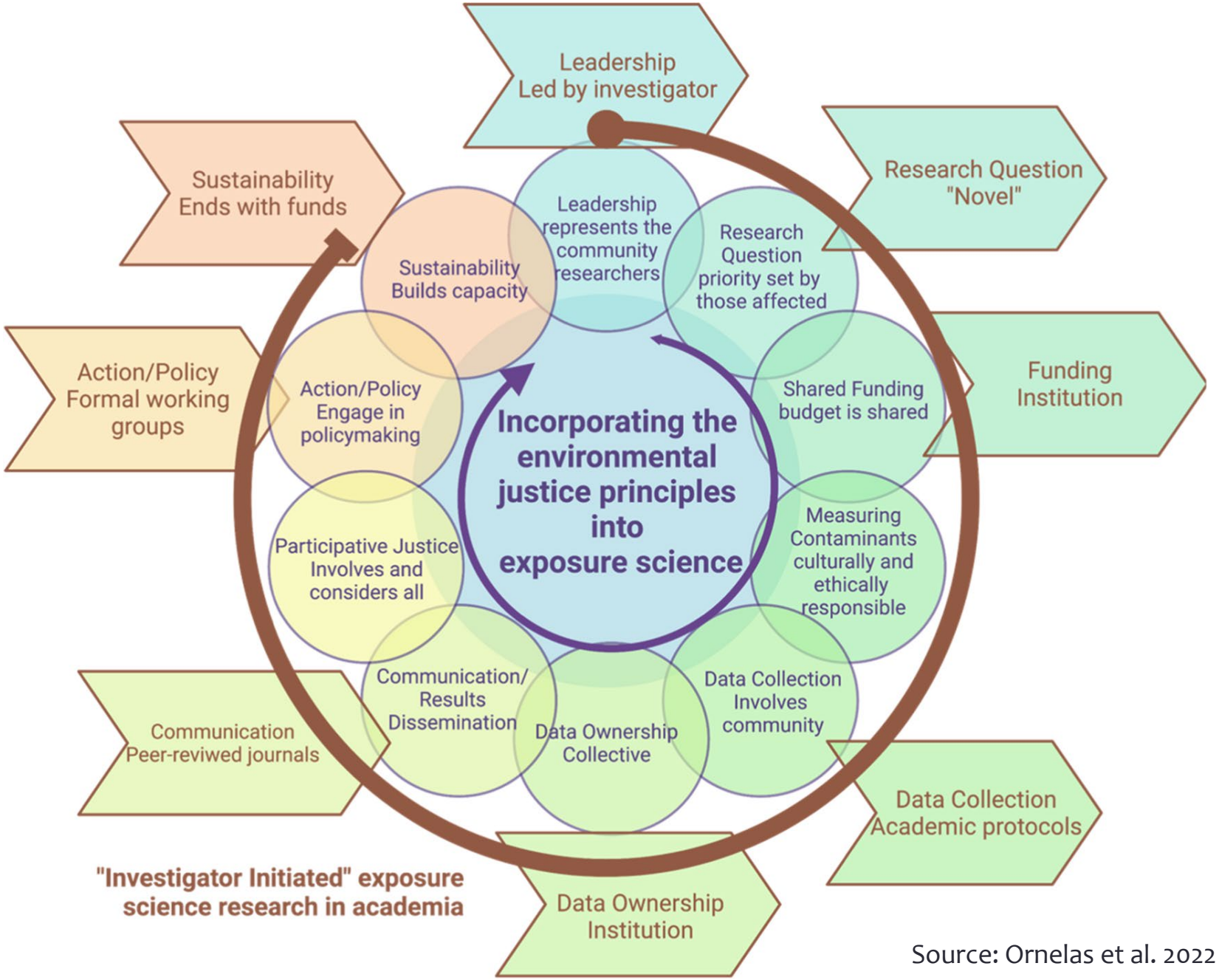
www.nature.com/jes

PERSPECTIVE

An applied environmental justice framework for exposure science

Yoshira Ornelas Van Horne[1,10]✉, Cecilia S. Alcala[2,10], Richard E. Peltier[3], Penelope J. E. Quintana[4], Edmund Seto[5], Melissa Gonzales[6], Jill E. Johnston[1], Lupita D. Montoya[7], Lesliam Quirós-Alcalá[8,11] and Paloma I. Beamer[9,11]

10 concepts that can serve as a roadmap for redefining how to conduct exposure science in a more just, inclusive, and equitable manner (inner circles)



Source: Ornelas et al. 2022

1. Leadership - represents the community

CAF
CENTRO DE APOYO FAMILIAR

Lived experience is key in establishing trust with the community partners

Community partners were key

Diversity in leadership is essential

- research led by scientists/staff that represents the communities with which they engage
  - Academic/community research team racially/ethnically diverse
- community concerns may be dismissed otherwise

2. Priority of research questions set by those most affected

- Communities proximal to the environment are experts too
- Communities can inform research questions and priorities
- Community engaged/community driven models are effective to advance public health and more likely to be sustained when grounded in local systems and culture
- **Challenges**
  - balance between community concerns and pressing public health concerns to inform research and policies
  - lack of knowledge on exposures
  - lack of surveillance

3. Shared funding— shared budget

- Compensation of community partners

Challenge: sustained funding post project completion

Hairdresser Pilot Study:

- salon owners and stylists received compensation for participating
- connected them with other local resources

4. Measuring contaminants in a culturally and ethically responsible manner

- Ensure that data collection team is trusted by the target population
- Study instruments are informed and piloted with the target population first
- Prioritize exposures of concern that could be linked to suspected health effects concerns reported by the community
- Considerations for biospecimen collection and biobanking (consent, returning results, permission for future use, etc.)

5. Data collection involves impacted community

- Establish and build trust prior to data and sample collection; local/cultural knowledge is key
- Tailor research toward needs of target population and consider environmental factors, population characteristics, and health behavioral/outcomes when designing the study.
- Genuine partnerships are key
  - Involve target population in the research and monitoring process (design, execution, dissemination of results)
- Not enough to document injustices and exposure disparities. Research should inform action/policies to protect impacted populations even when "more research is needed" (e.g., share results)

6. Data ownership

- Ensure data collection through an equitable lens
  - Impacted population has a voice on what the information can/cannot be used for
  - Processes in place to ensure shared governance

- Involve community partners in the dissemination of results (e.g., manuscripts, presentations, sharing of results)
  - Hairdresser study: publication and presentation authorship, results disseminated

7. Communication/results dissemination

- Critical for impacted community to be engaged in the dissemination strategy
- Translation of data into accessible knowledge to inform action and interventions is valuable and necessary
- Sharing results in an ethical manner is key to increase knowledge within the communities and promote evidence-based policy for optimal health outcomes
- Sometimes challenging when we are not certain what levels mean
- Dissemination to the community conducted prior to publications

8. Participative justice – involves and considers all

- Participatory justice refers to direct participation of those most affected by a particular decision or policy.

- Our pilot studies were informed by hairdressers and results, which further informed our recently funded R01.

9. Engagement in action/policies

- Engages key stakeholders at all levels toward actual change
- Not enough for public health professionals to recommend individual reduction exposure behaviors; the field must evolve, identify, and demand structural changes.
- Takes considerable time and resources

10. Sustainability and Capacity Building

- Long term sustainability of interventions and exposure mitigation strategies aimed at reducing risk of harm and adverse health effects is paramount (meets present needs, but does not compromise ability of future generations)

- Establishing partnerships and building trust is key and takes time

- Successful research teams
  - recruit participants from EJ communities for their research studies
  - hire community members as part of their staff
  - sustainability is built-in and equips impacted communities

Public health messaging including dissemination of results should be…

- Clear
- Concise
- Actionable
- Culturally appropriate and accessible
- Informed by the community

Cultural considerations are key

- Inform study instruments (questionnaires, report back materials, etc.)
- Incentives of value to the community
- Inform sustainable interventions
- Essential to build trust
- Study team members (staff, researchers, community partners) should have representation from the target population

Challenges and lessons learned moving forward

Community partnerships are key for every phase of the study and policy implementations

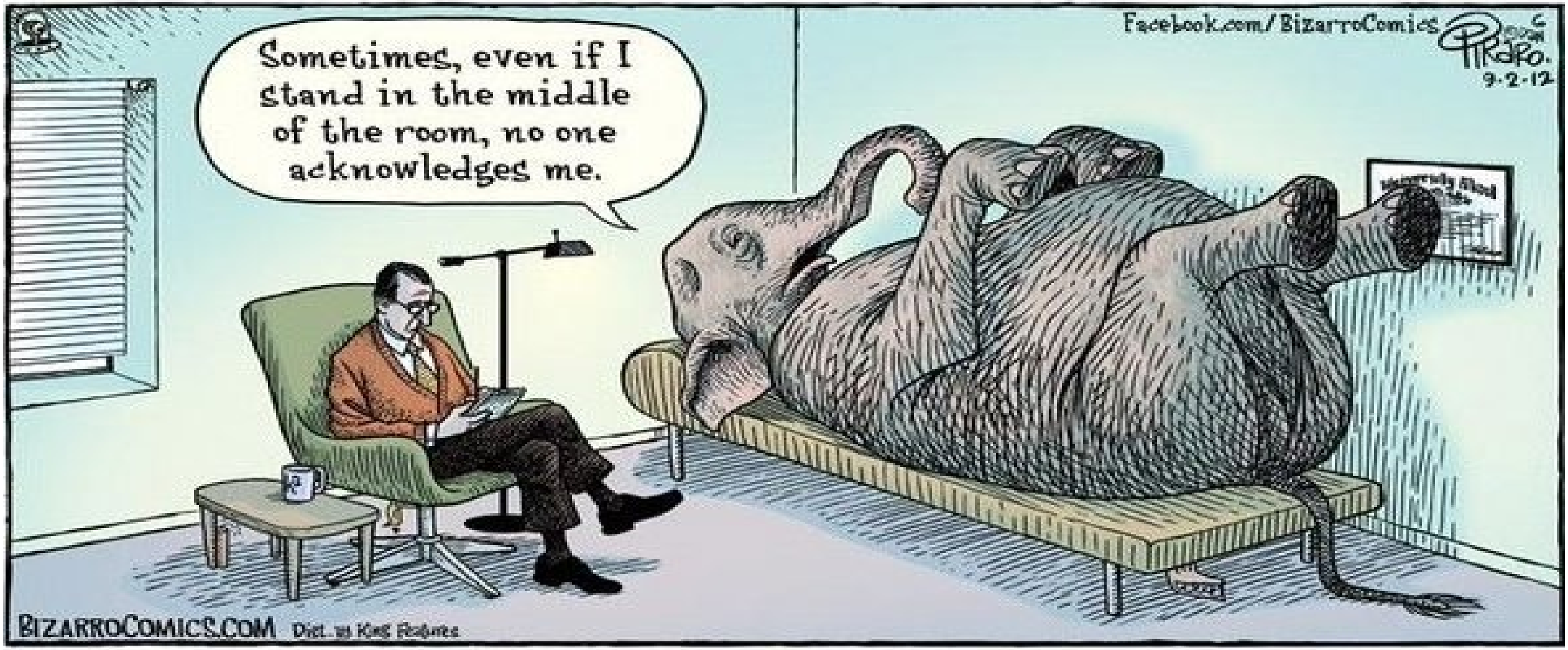
Building trust in affected communities is paramount

Sustainable interventions will be necessary

How do we equip vulnerable communities with the tools necessary to have a voice

Understanding how structural racism plays a role on exposure/disease relationships is key

Until we address systemic/structural issues we will continue to see health inequities with those most vulnerable suffering the burden! We cannot work in silos and ignore this…




It takes a village and genuine intent to protect the most vulnerable and ensure everyone's right to health equity…

Acknowledgements

Funders

Johns Hopkins Education and Research Center for Occupational Safety and Health ERC

Alfred P. Sloan Foundation

Wait Family Scholarship

Dr. Paula Olsiewski

CDC Centers for Disease Control and Prevention

Research Team

Walkiria Pool, MSc
Katrina Randolph
Meleah Boyle, PhD
Lydia Louis, PhD
Lucy Kavi, MSc
Ana M. Rule, PhD
Yuan Shao, PhD
Amir Sapkota, PhD
Victor de Jesus, PhD
Stephen Thomas, PhD
Sacoby M. Wilson, PhD
Carsten Prasse, PhD
Gurumurthy Ramachandran, PhD
Melissa DeSantiago, MPH
Grant Tore, MPH
Matthew Newmeyer, PhD
Anna Pollack, PhD
Paloma Beamer, PhD
Kelly Palmer, PhD
Magdalena Fandino, PhD
Joanna Marroquin, MPH

Salon owners/Study participants

Community Partners

CAF Centro de Apoyo Familiar

uRADMonitor global environmental monitoring network

Students Interns

Farida Abubakar
Lucy Aistis
Mireim Alibrahim
Ruth Cachola
Raia Contractor
Seyrona McLean
Kevin Miller
Angela Sun

Lesliam Quirós-Alcalá, PhD, MSc

Department of Environmental Health & Engineering
Johns Hopkins University
Bloomberg School of Public Health

lquiros@jhu.edu