HARVARD T.H. CHAN
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Racial/ethnic disparities in early life exposure to endocrine-disrupting chemicals commonly used in personal care products

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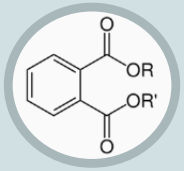
OVERVIEW

Endocrine disrupting chemicals (EDCs)



- *Definition:* Exogenous substances that interfere with the body's hormonal processes (e.g. synthesis, secretion, transport) [1]
- EDCs are used in a variety of personal care and consumer products for their desired properties as preservatives, anti-bacterial agents, component of "fragrance", among other uses [1,2-4]
- Many EDCs in personal care products (PCPs) are ubiquitous in our environment and studies have reported detection frequencies >90% [2, 5-6]

Early life EDC exposure

- The prenatal period is a critical window of development and vulnerable to exposures [7,8]

- Studies report that higher exposure to early life EDCs have been linked to a number of adverse health outcomes
  - Birth weight [9]
  - Gestational age/preterm birth [10]
  - Glucose intolerance and gestational diabetes [11, 12]

- Studies are also linking PCP use to health outcomes later in life
  - Obesity [13-15]
  - Early onset of puberty [16-18]
  - Neurobehavioral, asthma, and allergic disease outcomes [8, 19, 20]

Racial/ethnic differences

- Personal care products are an important source of many EDCs; risk factor for environmental health disparities [21-24].
- Patterns of personal care product use differ by race/ethnicity--cultural or social drivers [21, 24]
- A number of studies have evaluated EDCs commonly used in personal care products as it relates to race/ethnicity in non-pregnant populations [1, 25-29]
- Maternal and child health outcomes are found to burden certain racial/ethnic groups [8, 13-20]

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Literature Review Aims

1. Summarize the literature that examines early life exposure to 8 chemicals or classes of chemicals: phthalates, parabens, benzophenone-3, triclosan, cyclic volatile methylsiloxanes, formaldehyde-releasing preservatives, 1,4-dioxane, and diethanolamine among women of different racial/ethnic backgrounds in the U.S. and Puerto Rico

2. Review articles that report stratified data on early life exposure to the 8 chemicals or classes of concern, but do not examine the racial/ethnic disparities in health outcomes

3. Provide recommendations for research needed to fill the gap in the literature on EDC-associated personal care product use as an important contributor to racial/ethnic maternal and child environmental health disparities.

Methods

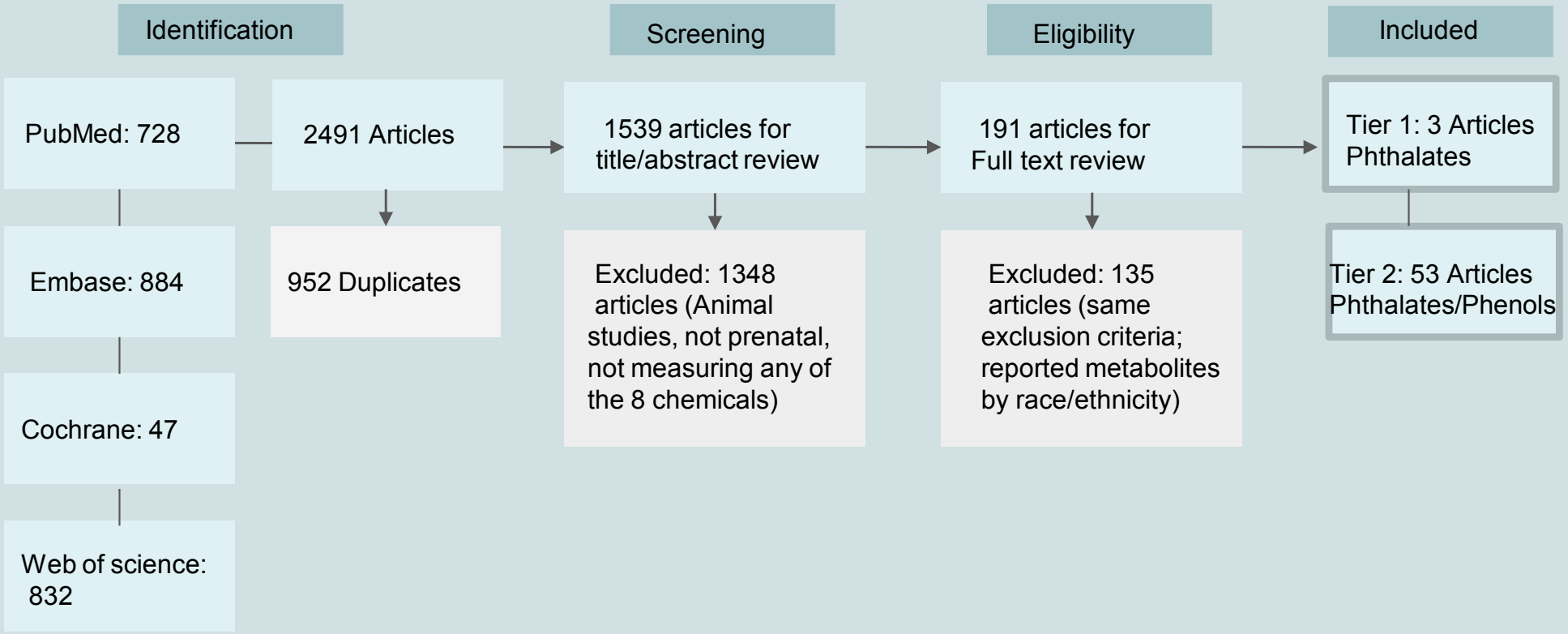
Search strategy

- Prenatal exposure
- 8 chemicals or classes of chemicals
- Biomonitoring (e.g. urine, blood)
- US based
- Chemical concentrations by race/ethnicity
- Exclude animal studies

Databases searched from inception through March 2020

- PubMed/Medline (National Library of Medicine),
- EMBASE (Elsevier),
- Web of Science Core Collection, including the Science Citation Index and Conference Proceedings Citation Index- Science (Thomson Reuters),
- and the Cochrane Central Register of Controlled Trials

Results



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Tier 1:

3 articles examined racial/ethnic differences

Phthalates

Cohorts	Author, Year	Race/ethnicity	Chemical measured	Main findings
LIFECODES	James-Todd et al. 2017	White, Black, Asian, Hispanic, Other	9 phthalate metabolites	- Highest metabolites (MBP, MiBP, MBzP, and MEP) among NH Blacks, Hispanics, and "Other" - MEP decreased throughout pregnancy for Hispanic women while increased in late pregnancy for NH Black women
Delivery at the Medical University of South Carolina (MUSC)	Bloom et al. 2019, Wenzel et al. 2018	White, Black	8 phthalate metabolites	- NH Black women had significantly higher urinary concentrations of MBP, MiBP, MBzP, and MEP compared to NH White women

NH- non-Hispanic
MBP- Monobutyl phthalate
MiBP- Mono-isobutyl phthalate
MBzP Monobenzyl phthalate
MEP- Monoethyl phthalate

Tier 2

40 articles presented racial/ethnic stratified exposure data; primary aim not to examine differences

Phthalates (1)

Cohorts	Manuscripts	Race/ethnicity	Comparison to NHANES	
Columbia Center for Children's Environmental Health (CCCEH)	12	African American, Dominican	=	Metabolite concentrations generally comparable
Center for the Health Assessment of Mothers and Children of Salinas (CHAMACOS)	13	Hispanic	=	Metabolite concentrations generally comparable (slightly higher)
Delivery at MUSC	Wenzel et al. 2018	White, Black	X	No comparison
Environment and Reproductive Health Study (EARTH)	Mínguez-Alarcón et al. 2019	White, Black/Asian/Other	X	No comparison

Tier 2

40 articles presented racial/ethnic stratified exposure data; primary aim not to examine differences

Phthalates (2)

Cohorts	Manuscripts	Race/ethnicity	Comparison to NHANES	
Healthy Start	Polinski et al. 2018	White, Hispanic, Black, Other	↑/↓	Average concentrations of MBP, MBzP, MEP, MEHP, MEHHP, MEOHP and MECPP were lower and MiBP concentrations were higher
Health Outcomes and Measures of the Environment Study (HOME)	Werner et al. 2015	White, non-White	X	No comparison
LIFECODES	3	White, Black, Other	X	No comparison--MEHP and other DEHP metabolites higher in Black participants
Puerto Rico Testsite for Exploring Contamination Threats (PROTECT)	6	Puerto Rican	↑	Majority of metabolites greater than NHANES
The Infant Development and Environment Study (TIDES)	Martino-Andrade et al. 2016; Serrano et al. 2014	White, Other White, Asian, Black, Other, Multi	=	Metabolite concentrations generally comparable

MEHP- mono-(2-ethyl-5-hexyl) phthalate
MEHHP- mono-(2-ethyl-5-hydroxyhexyl) phthalate
MEOHP mono-(2-ethyl-5-oxohexyl) phthalate
MECPP- mono-(2-ethyl-5-carboxypentyl) phthalate
DEHP-Di-2-ethylhexyl phthalate

Tier 2

17 articles presented racial/ethnic stratified exposure data; primary aim not to examine differences

Phenols (1)

Cohorts	Manuscripts	Chemical	Race/ethnicity	Comparison to NHANES	
CHAMACOS	Harley et al. 2019; Berger et al. 2018	Methyl-, propyl-, and butyl paraben, triclosan, benzophenone-3 (BP3)	Hispanic	↑/=	Higher methyl paraben concentration, others comparable to NHANES
Healthy Start	Polinski et al. 2018	Methyl- and propyl paraben, triclosan, BP3	White, Hispanic, Black, Other	↑/↓/=	Higher BP3 concentration, lower triclosan, similar methyl- and propyl paraben
EARTH	Mínguez-Alarcón et al. 2019	Methyl paraben and propyl paraben	White, Other (Black, Asian, Other)	X	No comparison
HOME	Kalloo et al. 2018, Etzel et al. 2017, Stacy et al. 2017	Triclosan	White, Black, Other	=	Comparable to NHANES
LIFECODES	Aung et al. 2019	Methyl-, ethyl-, propyl-, and butyl paraben, Triclosan, BP3	White, Black, Other	=	Comparable to NHANES (slightly higher methyl- and propyl paraben)

Tier 2

17 articles presented racial/ethnic stratified exposure data; primary aim not to examine differences

Phenols (2)

Cohorts	Manuscripts	Chemical	Race/ethnicity	Comparison to NHANES	
National Children's Study (NCS)	Mortensen et al. 2014	Methyl- and propyl paraben, triclosan, BP3	Hispanic	=	Comparable to NHANES
PROTECT	4	methyl-, ethyl-, butyl,- and propyl-paraben, triclosan, BP3	Puerto RIco	↑	Higher concentrations compared to NHANES
Vitamin D Antenatal Asthma Reduction Trial (VDAART)	Lee-Sarwar et al. 2018	Methyl- and propyl paraben, triclosan	Black, White, Hispanic, Other	X	No comparison
Recruited from University Hospital of Brooklyn Prenatal Clinic	Geer et al. 2017, Pycke et al. 2015, Pycke et al. 2014	Methyl-, ethyl-, propyl-, butyl-, and benzyl paraben, triclosan	Black (African American, Caribbean, African), Hispanic, Other	↑	Higher concentration of triclosan and ethyl- and butyl paraben

Call for Action

Future Research

- Increased research examining early life EDCs as a plausible risk factor for racial/ethnic disparities in maternal and child health outcomes
- Examination of PCP chemical exposure in racially/ethnically diverse populations/cohorts
- Inclusion of results stratified by race/ethnicity when reporting EDC concentrations
- Examination of early life exposure to PCP chemicals that have not been studied (e.g. cyclosiloxanes, formaldehyde releasing preservatives, 1,4-dioxane, diethanolamine)
- Assessment of PCPs and other sources of EDCs in the same studies to understand the degree to which PCPs and other sources contribute to existing disparities
- Examination of sociocultural and socioeconomic determinants of disparities in exposure and how they interact with race/ethnicity

CONCLUSION

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The majority of research adjusts for race/ethnicity--examining exposures by race/ethnicity may reveal populations at risk and lead to modifiable risk factors which can inform interventions

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