

# Patterns of phenol, paraben & phthalate exposure in NYC women

Elizabeth A. Gibson<sup>1,†</sup>, MJ Spratlen, R Colgan, J Wright, J Goldsmith, FP Perera, P Factor-Litvak, JB Herbstman, M-A Kioumourtzoglou

<sup>1</sup>Environmental Health Sciences Dept, Mailman School of Public Health, Columbia University; <sup>†</sup>e.a.gibson@columbia.edu

## Introduction

- Women disproportionately exposed to chemicals in personal care products.
  - Endocrine disruptors → adverse health outcomes.
  - Exposure in pregnancy → fetal and child development.
- ⇒ Identification of exposure patterns can inform design of targeted policies and interventions.
- Objective:** To identify exposure patterns of phenols, parabens, and phthalates and characterize their association with personal care product use in pregnant women.

## Methods

### Study Population

- Mothers and Newborns Cohort
  - 342 pregnant women aged 18-35 from New York
- Exposure Assessment:
  - Spot urine samples collected during the third trimester.
  - 5 phenols, 3 parabens, and 9 phthalates metabolites measured.
  - All measurements adjusted for specific gravity.
  - Personal care product use assessed via questionnaire.

### Statistical Analysis

1. Principal Component Pursuit (PCP)
  - Novel and robust pattern recognition and dimensionality reduction technique adapted from computer vision.
  - Simultaneously identifies consistent patterns of chemical exposure and isolates unique exposure events.
  - Exposure concentrations standardized (centered and scaled).
2. Regressed pattern scores on personal care product use, adjusting for maternal age and race/ethnicity.

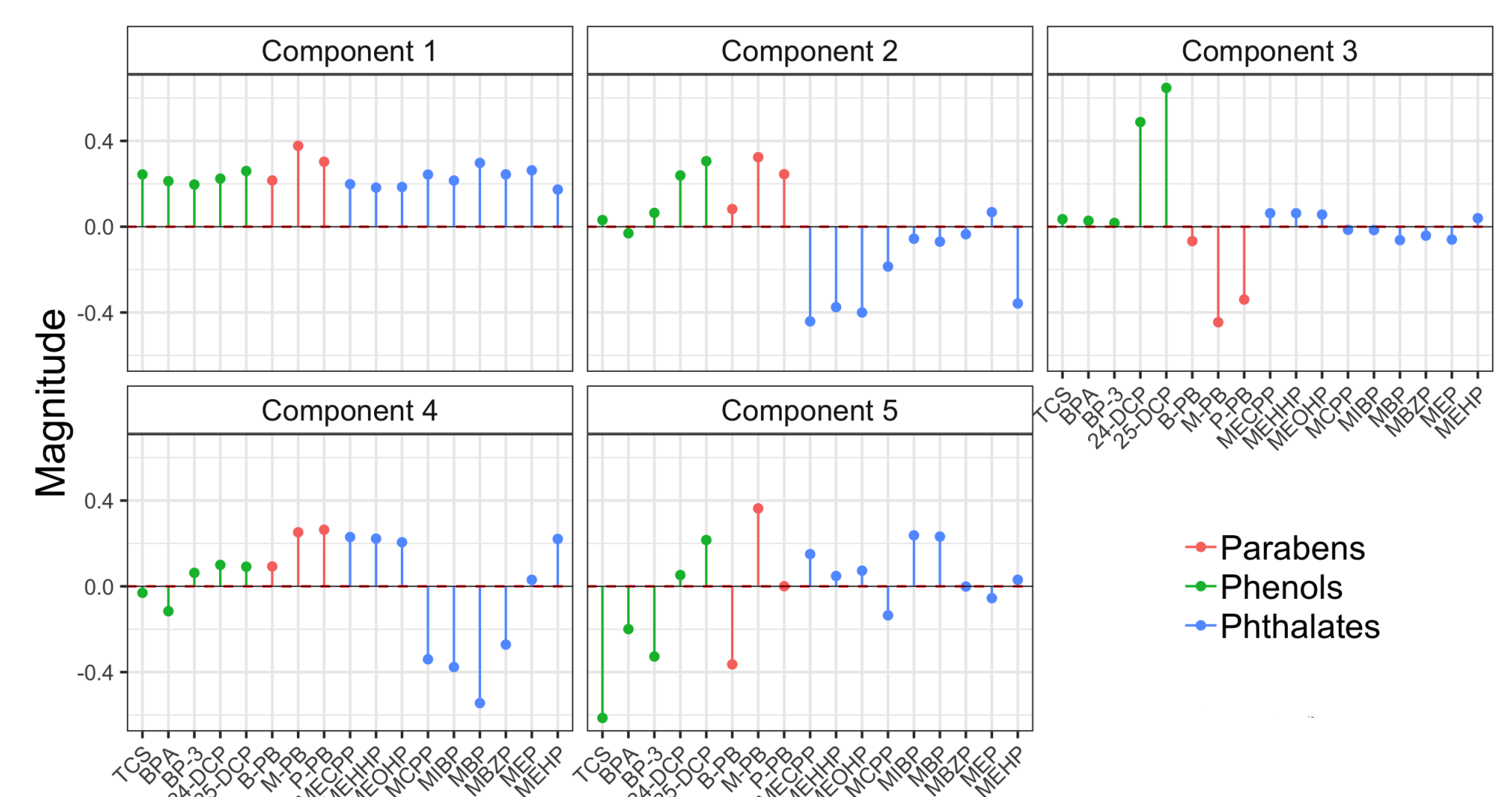
## Results

**Table 1:** Descriptive statistics of chemical exposures ( $\mu\text{g}/\text{mL}$ )

	>LOD	Mean $\pm$ SD	Q1	Median	Q3	Max
<b>Phenols</b>						
TCS	81%	71.8 $\pm$ 161.4	3.1	8.8	47.7	1000.0
BPA	94%	3.0 $\pm$ 4.2	1.0	1.8	3.5	47.2
BP-3	99%	67.5 $\pm$ 186.2	4.4	9.40	27.6	1000.0
24-DCP	99%	9.6 $\pm$ 18.6	1.4	3.20	7.1	100.0
25-DCP	100%	218.4 $\pm$ 297.0	37.0	90.2	245.8	1000.0
<b>Parabens</b>						
B-PB	62%	3.2 $\pm$ 9.2	0.1	0.4	1.8	106.0
M-PB	100%	265.1 $\pm$ 304.7	41.3	119.0	397.0	1000.0
P-PB	100%	80.4 $\pm$ 159.9	5.2	22.7	68.0	1000.0
<b>Phthalates</b>						
MBP	100%	62.8 $\pm$ 83.5	20.4	36.9	78.1	1110.0
MBZP	100%	33.2 $\pm$ 68.2	5.6	13.7	31.2	663.8
MCP	94%	3.2 $\pm$ 3.5	1.1	2.2	3.9	32.7
MECPP	100%	82.4 $\pm$ 177.8	18.7	35.6	77.8	1840.0
MEHHP	100%	58.8 $\pm$ 163.6	10.4	21.3	46.1	1750.0
MEHP	84%	15.1 $\pm$ 45.3	1.9	4.9	12.4	613.0
MEOHP	100%	44.3 $\pm$ 114.4	8.7	17.9	37.6	1320.0
MEP	100%	404.5 $\pm$ 791.9	70.8	139.2	331.9	6223.8
MIBP	99%	14.7 $\pm$ 23.4	4.9	8.9	17.2	374.4

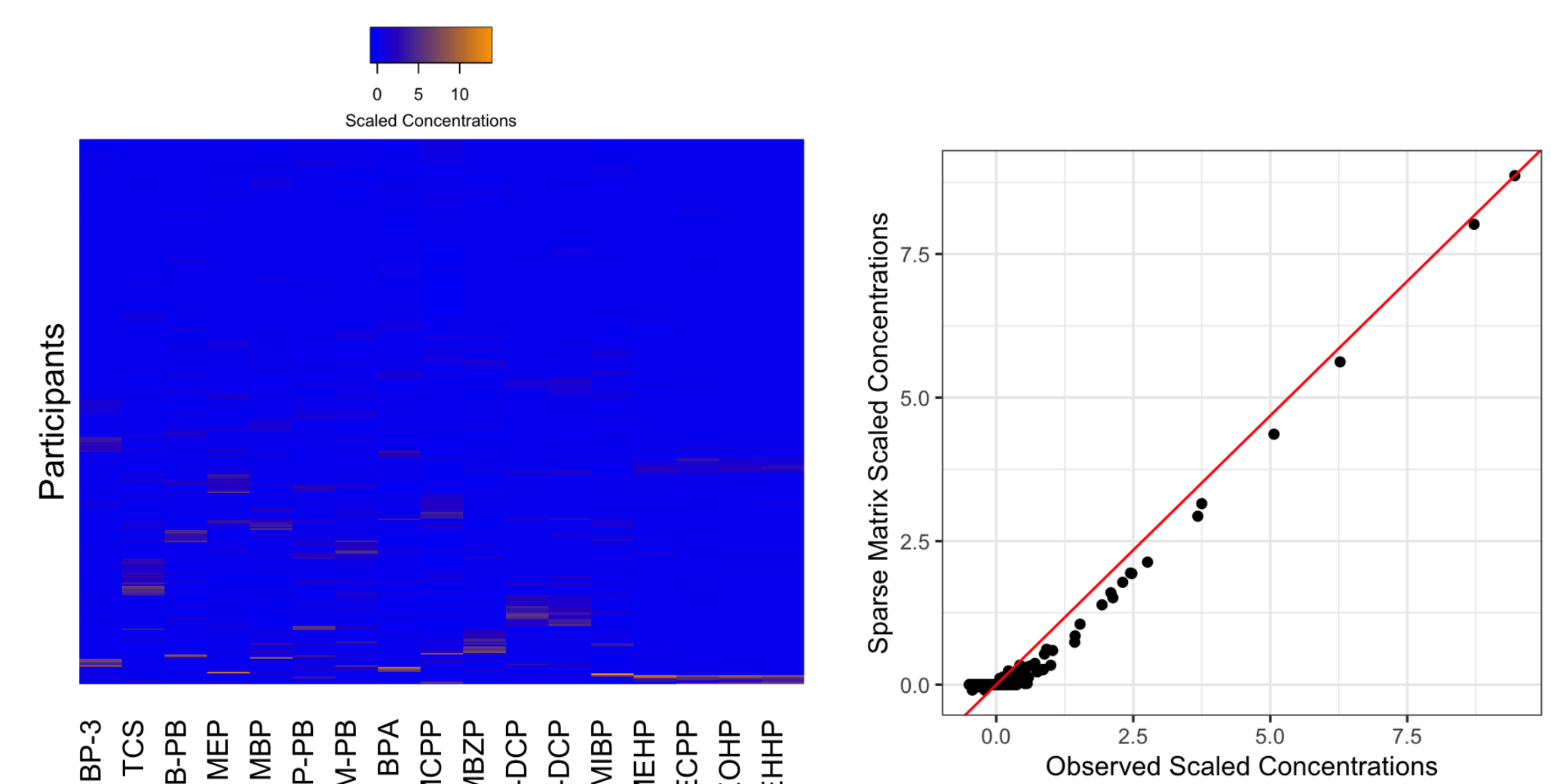
- Separating variance due to extreme events from common patterns, PCP explained 81% of the variance in exposure.

## Results (cont'd)



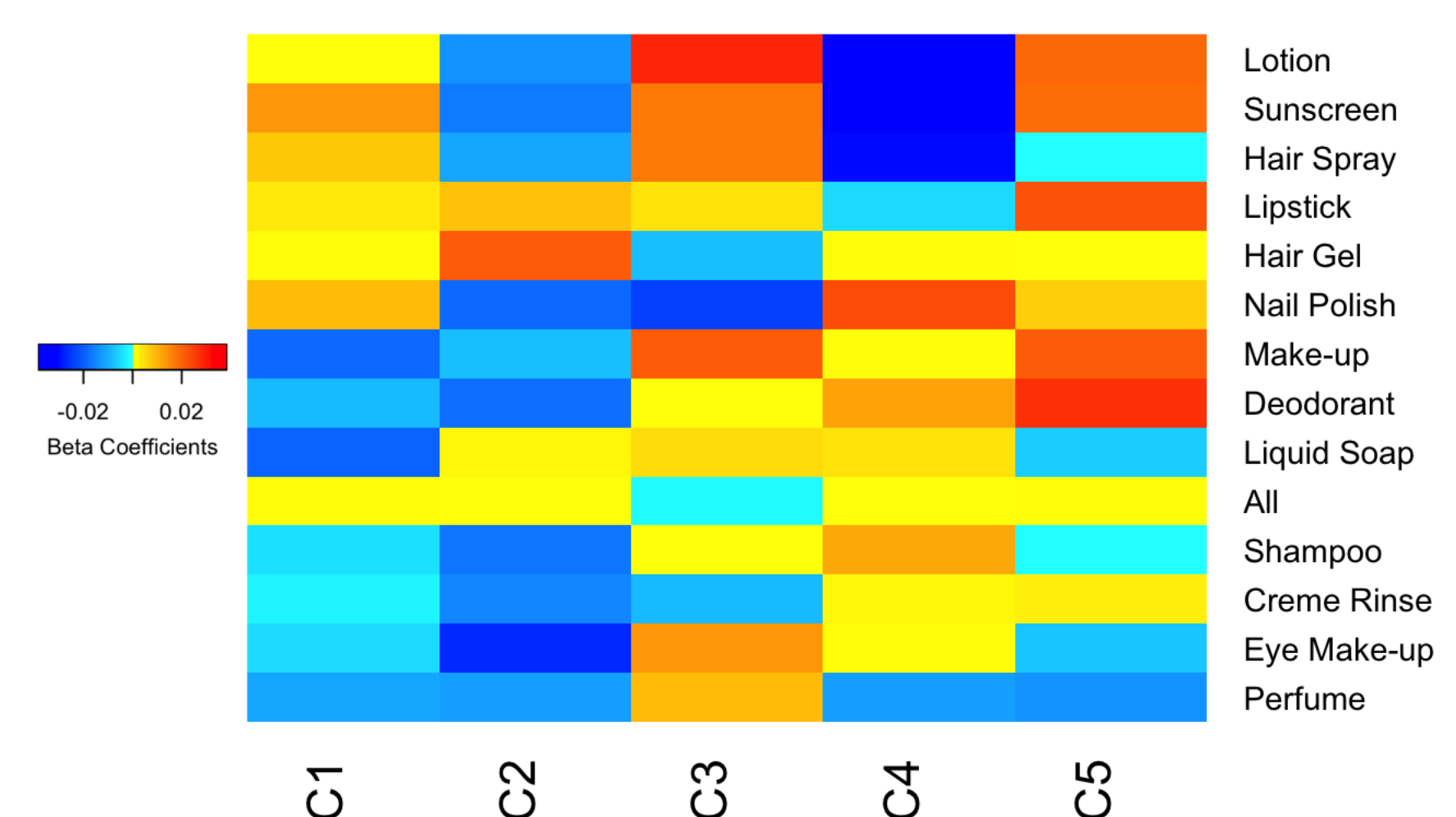
**Fig. 1:** Component loadings for the 5 PCP-identified exposure patterns.

- We identified five exposure patterns that:
  1. Represent overall exposure.
  2. Separate phthalates from phenols and parabens.
  3. Separate two phenols and two parabens.
  4. Separate di(2-ethylhexyl) metabolites from other phthalates.
  5. Represent disproportionately high triclosan exposure.



**Fig. 2:** Left: Sparse solution matrix; Right: Original values vs. sparse solution for MECPP (Red line indicates 1:1 relationship).

- 61% of sparse solution matrix → zero.
- 6 women had high exposures to 5 phthalates, but these were not explained by consistent patterns across the study population.



**Fig. 3:** Associations between personal care product use and PCP-identified patterns of exposure.

- Pattern 1** (–) Make-up; perfume; liquid soap
- Pattern 2** (–) Eye make-up; (+) hair gel
- Pattern 3** (+) Lotion
- Pattern 4** (–) Lotion; hair spray; sunscreen
- Pattern 5** (+) Lipstick; deodorant; make-up

## Discussion & Conclusion

- Identified exposure patterns linked to personal care product use.
  - If patterns linked to adverse health → targeted interventions.
- PCP as useful tool to aggregate exposures into consistent patterns.