PRE- AND POSTNATAL URBAN EXPOSURE PATTERNS AND CHILDHOOD NEUROBEHAVIOR

Exposome data challenge event

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1. INTRODUCTION

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1. INTRODUCTION

Research questions

Context

- Several studies have reported detrimental neurobehavioral effects of urban air pollution in children and protective effects of access to green space
- However, the influence of the urban exposome on children's
 neurobehavior remains largely unexplored

Research questions

- Are there any consistent pre- and postnatal patterns in the urban exposome?
- Are these identified-patterns associated with adverse
 neurobehavior in children?

2. METHODS

2. METHODOLOGY

Children neurobehavior & urban exposome

Urban exposome Æ





Patterns



Unique exposure events



Covariates and

confounders



Health models

(GAM and LASSO)

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2. METHODOLOGY

Principal Component Pursuit (PCP)

Original



Low-rank (L)





Sparse (S)



• PCP decomposes the exposure matrix into:

- a **low-rank matrix** to identify consistent exposure patterns
- **sparse matrix** to isolate unique exposure events
- Main advantages:
 - not influenced by outlying values
 - it can still recover the low-rank matrix in presence of **missingness in the data**

Pre- and postnatal health models

 Evaluating the association between PCP-identified patterns and children neurobehavior adjusting for potential confounders.



- Outcome: CBCL Total Problem Score
- Covariates and confounders: cohort, gestational age, child age child sex, mother education and age, parity, native parents, family affluence, mother smoking.

3. RESULTS



2. METHODOLOGY

Principal Component Pursuit (PCP)



- PCP identified **cohort patterns** in raw urban exposome
- Urban exposome regressed by cohort and residuals used for the PCP run
- PCP L matrix into Factor Analysis

PCP + FA prenatal patterns



PCP + FA postnatal patterns



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3. RESULTS PCP + FA Patterns & Children neurobehavior



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PCP - unique exposure events



3. RESULTS PCP unique events & Children neurobehavior



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^{3. RESULTS} PCP unique events & Children neurobehavior



^{3. RESULTS} PCP unique events & Children neurobehavior



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4. DISCUSSION & CONCLUSIONS

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Discussion

- Protective effect of PCP patterns in children neurobehavior
- Similar results for single-exposure models (e.g., PM_{2.5})
- Unique/extreme exposure events not explained by the identifiedpatterns (traffic-related exposures, indoor air pollution concentrations) associated with detrimental effects on children neurobehavior

Conclusions

- PCP identified consistent pre- and postnatal exposure patterns.
 - Ongoing work: making code accessible to wider community and apply to new datasets
- Unique exposure events identified through sparse matrix included in LASSO
 - Ongoing work: exploring interpretable and robust ways to include these results in health models

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THANK YOU

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^{3. RESULTS} PCP + FA Patterns & Children neurobehavior



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Outcome's distribution

Histogram of outcomes\$hs_Gen_Tot



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Factors' distribution



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Factors' correlation



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Prenatal L matrix Correlation

L matrix (Pearson Correlation Matrix)

PMabs



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Postnatal L matrix Correlation

L matrix (Pearson Correlation Matrix)



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5. CONCLUSIONS

Prenatal S matrix Correlation

Prenatal S matrix: Pearson correlation

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Postnatal S matrix Correlation

Postnatal S matrix: Pearson correlation

Traffic_ne Trafficload NDVI_school NDVI_home UV.month. T.month. Hum..month0.1 BTEX_in -0.1 PM2.5_in NO2 in Benzene in PMabs_in Population_school Land use school 0.2 0.1 Facility_dens_school 0.0 Connectivity school -0.1 -0.2 Building_school_school Access_stops_school Walkability Population Land use-0.1 -0.1 Facility_dens0.2 Connectivity0.1 -0.1 Building home Access_stops_home PMabs.year. PM2.5.yearD. PM10.year. NO2.year.-0.1 -0.1

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5. CONCLUSIONS

Factors' distribution



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