PRE- AND POSTNATAL URBAN EXPOSURE PATTERNS AND CHILDHOOD NEUROBEHAVIOR

Exposome data challenge event

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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

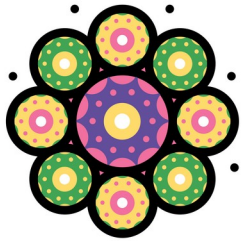
- Are there any consistent **pre- and postnatal patterns** in the urban exposome?
- Are these identified-patterns **associated with adverse neurobehavior** in children?

2. METHODS

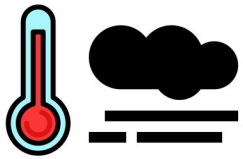
Children neurobehavior & urban exposome

Urban exposome

Principal Component Pursuit (PCP) + Factor Analysis (FA)

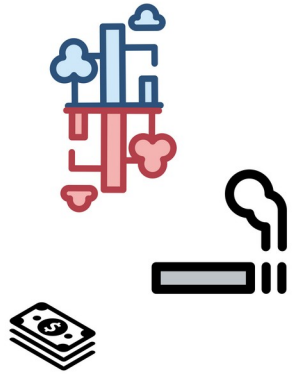


Patterns

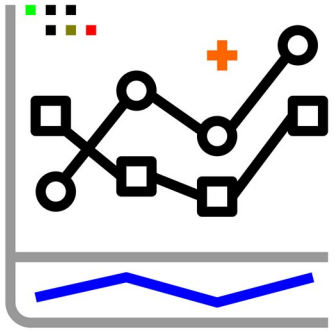


Unique exposure events

Covariates and confounders



Health models (GAM and LASSO)



Outcome

Icons from svgrepo.com

Principal Component Pursuit (PCP)

Original

Low-rank (L)

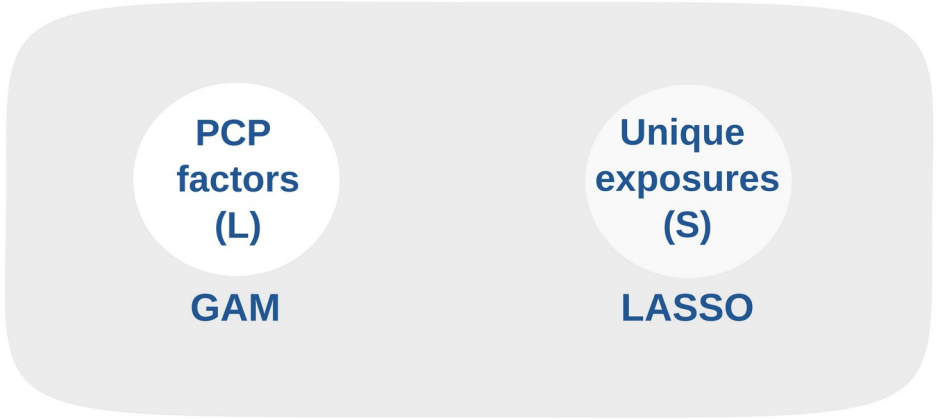
Sparse (S)

- 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.

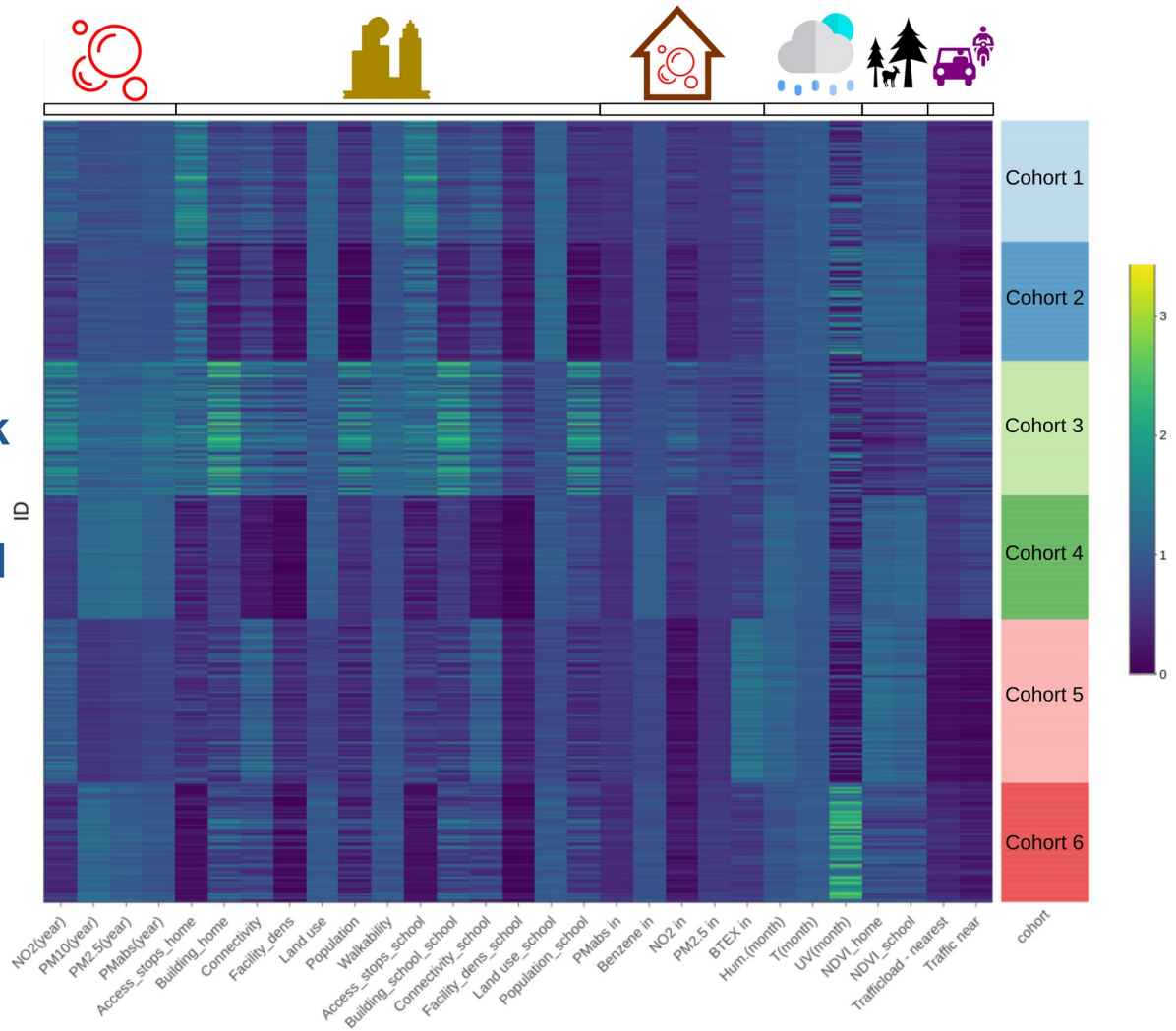


- **Outcome**: **CBCL Total Problem Score**
- **Covariates and confounders**: cohort, gestational age, child age child sex, mother education and age, parity, native parents, family affluence, mother smoking.

3. RESULTS

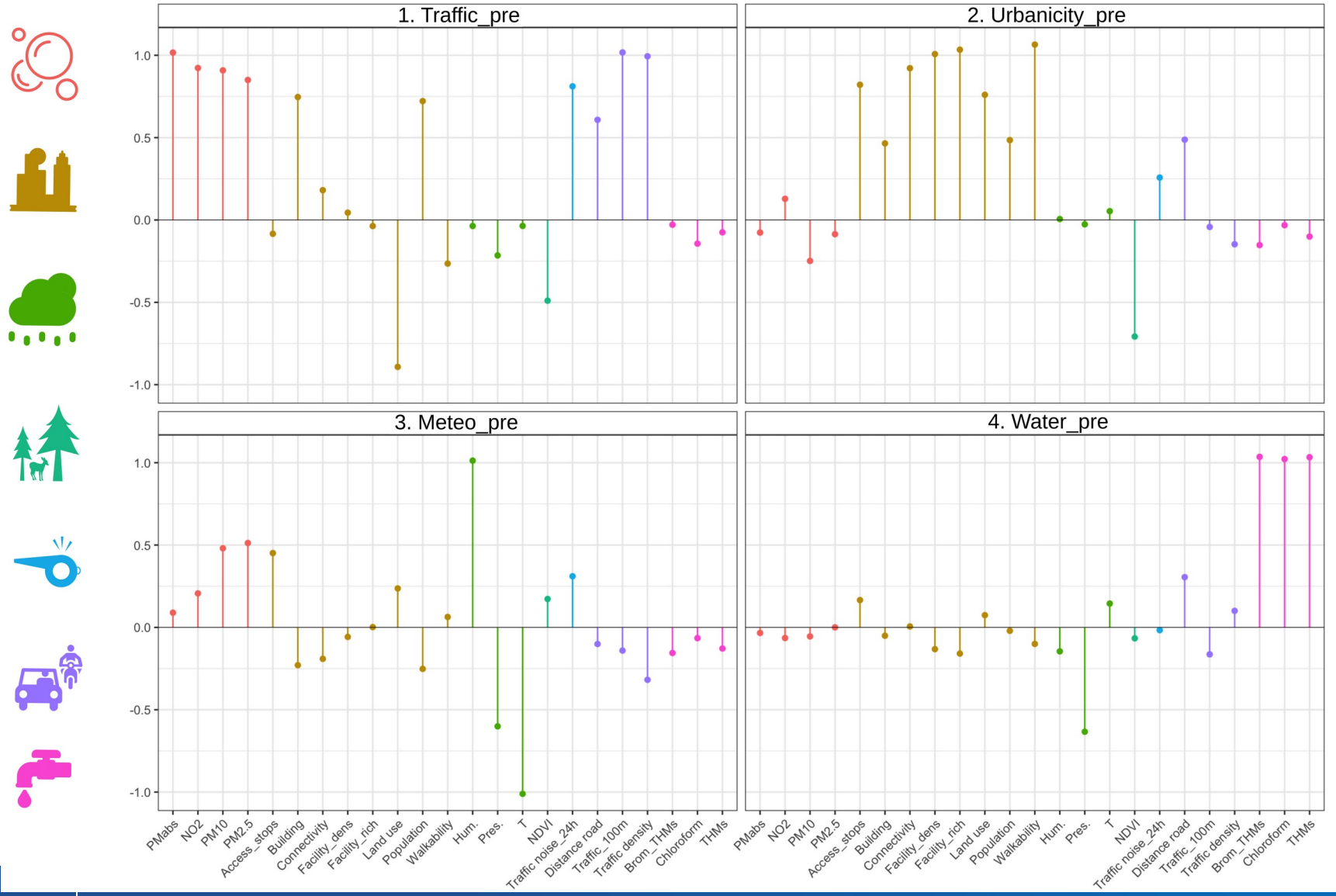
Principal Component Pursuit (PCP)

Low-rank (L) Postnatal

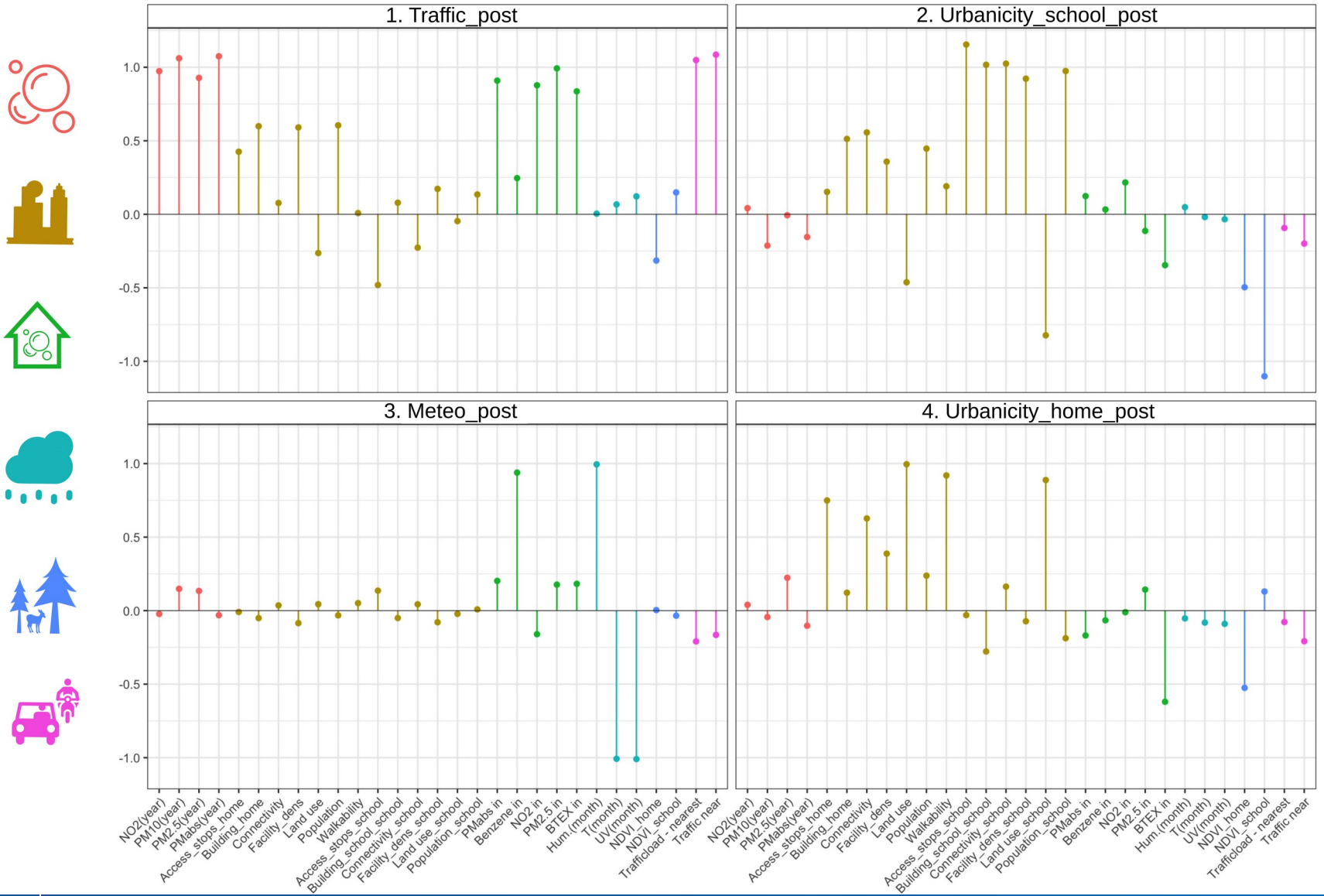


- PCP identified **cohort patterns** in raw urban exposome
- Urban exposome **regressed on cohort** and residuals used for the PCP run
- **PCP L matrix** into **Factor Analysis**

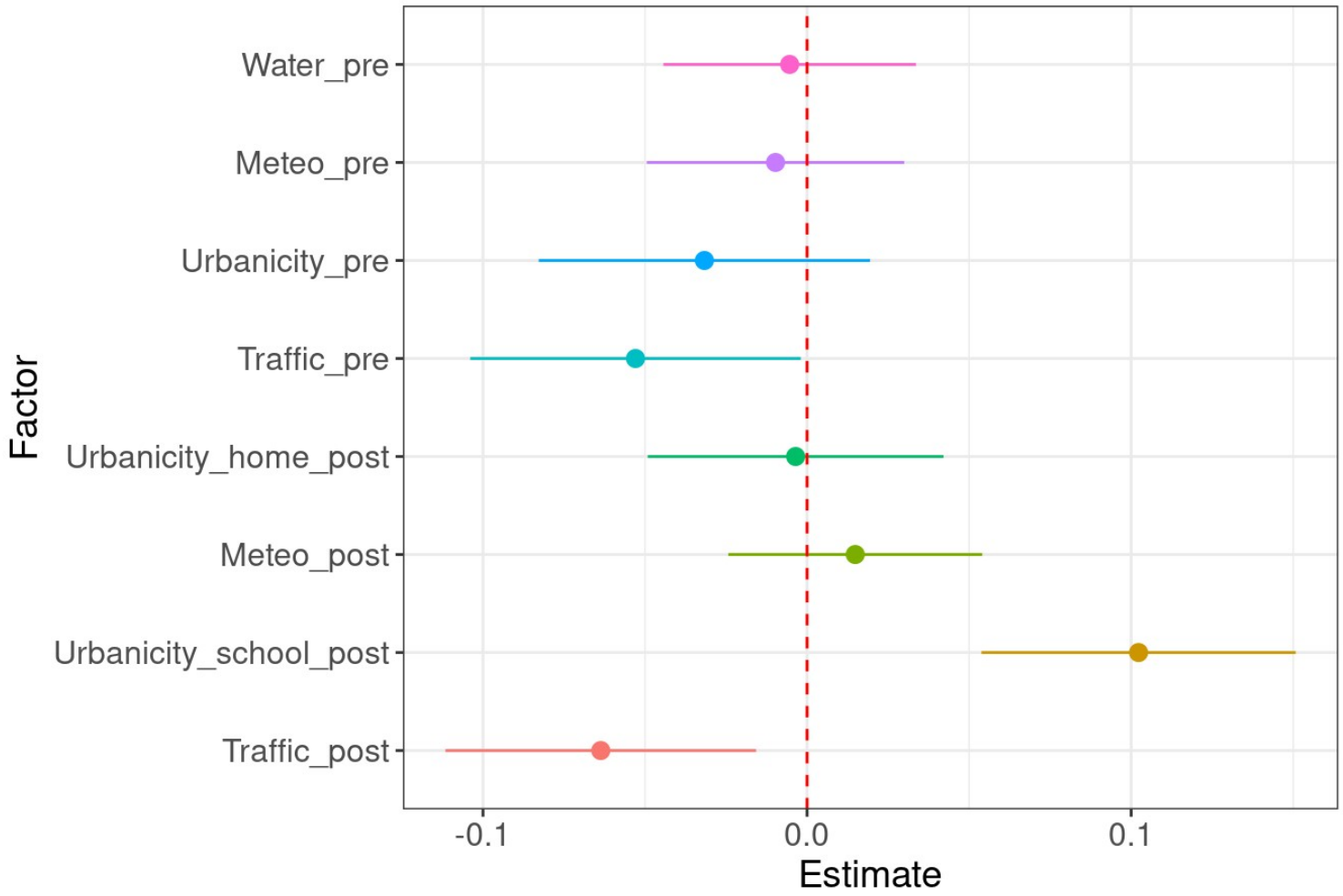
PCP + FA prenatal patterns



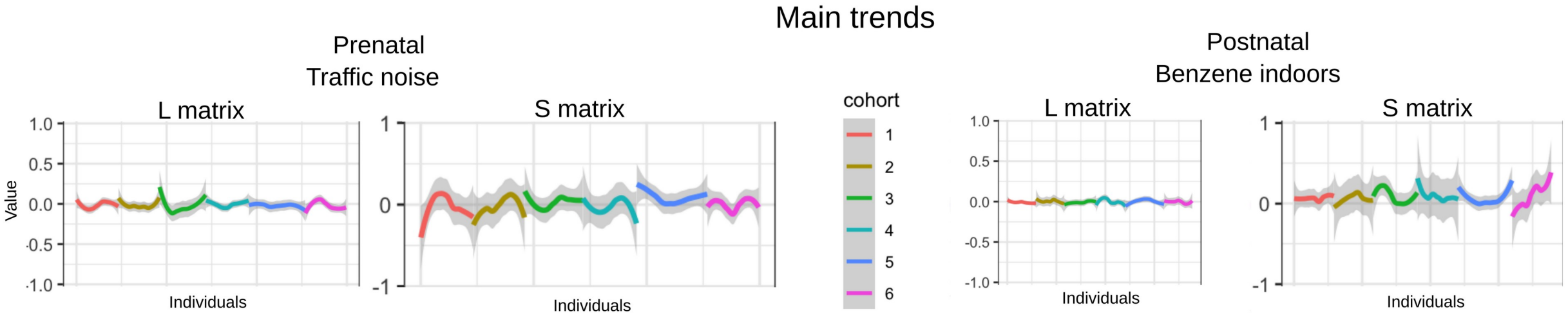
PCP + FA postnatal patterns



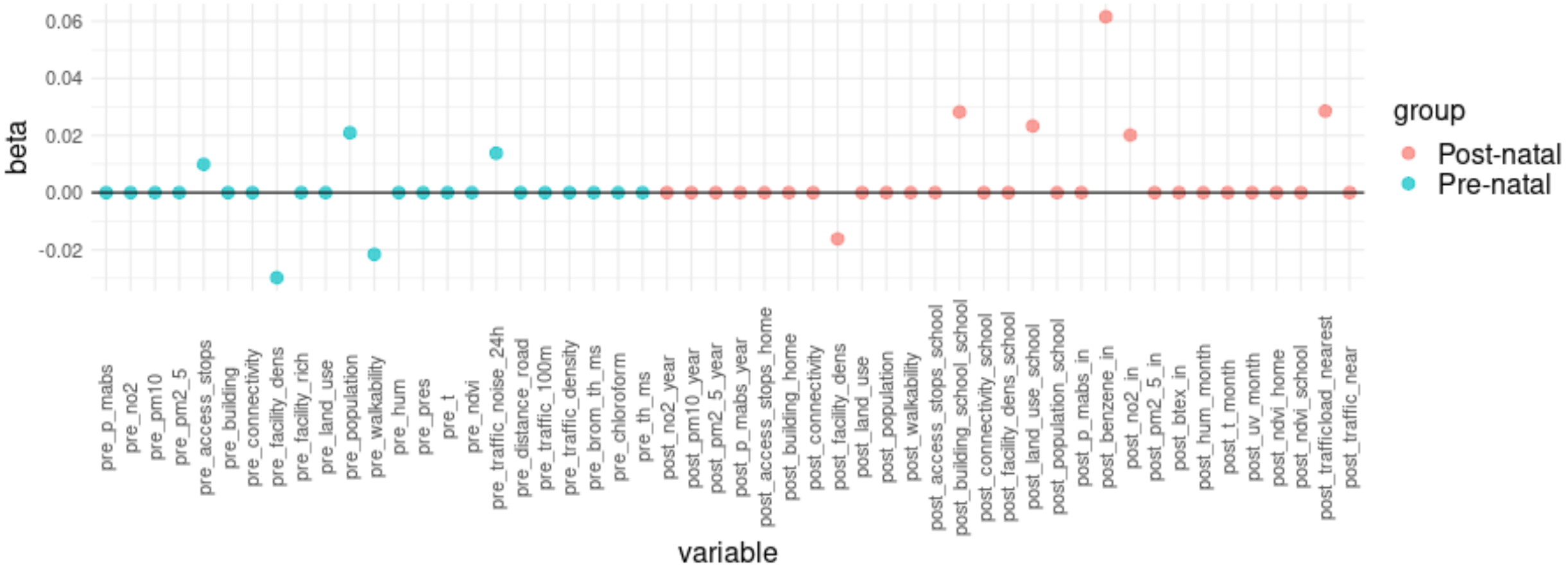
PCP + FA Patterns & Children neurobehavior



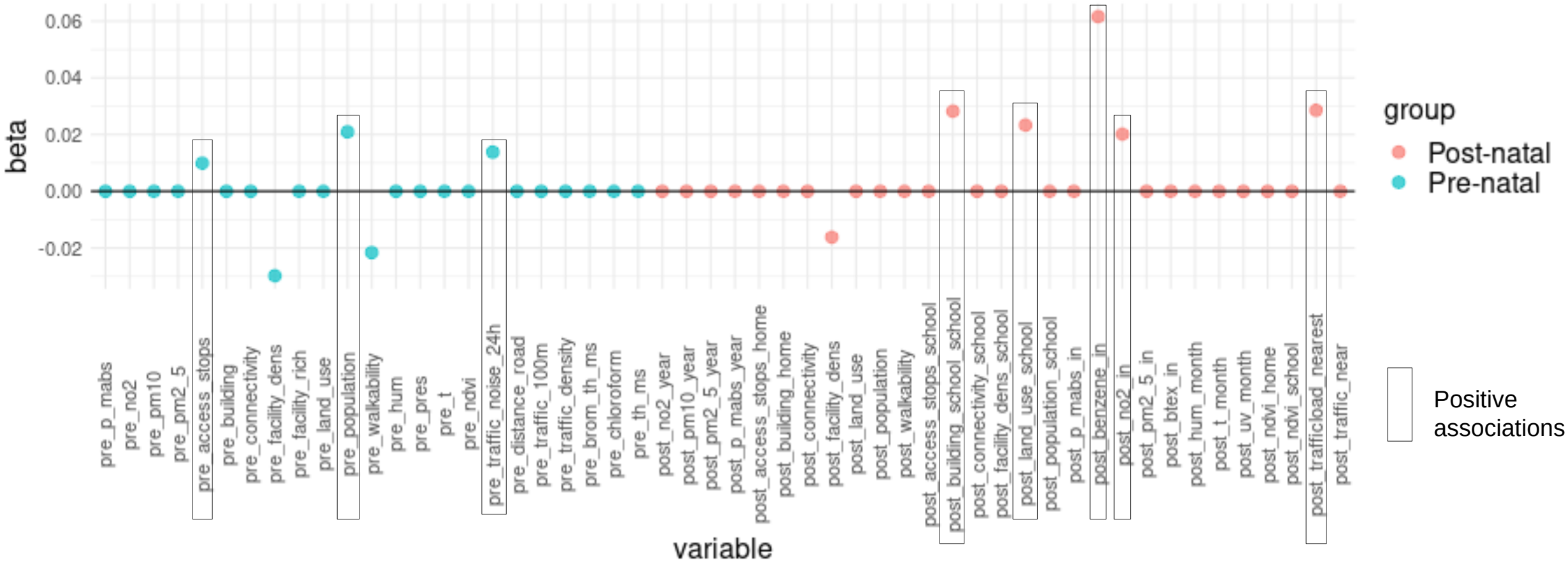
PCP - unique exposure events



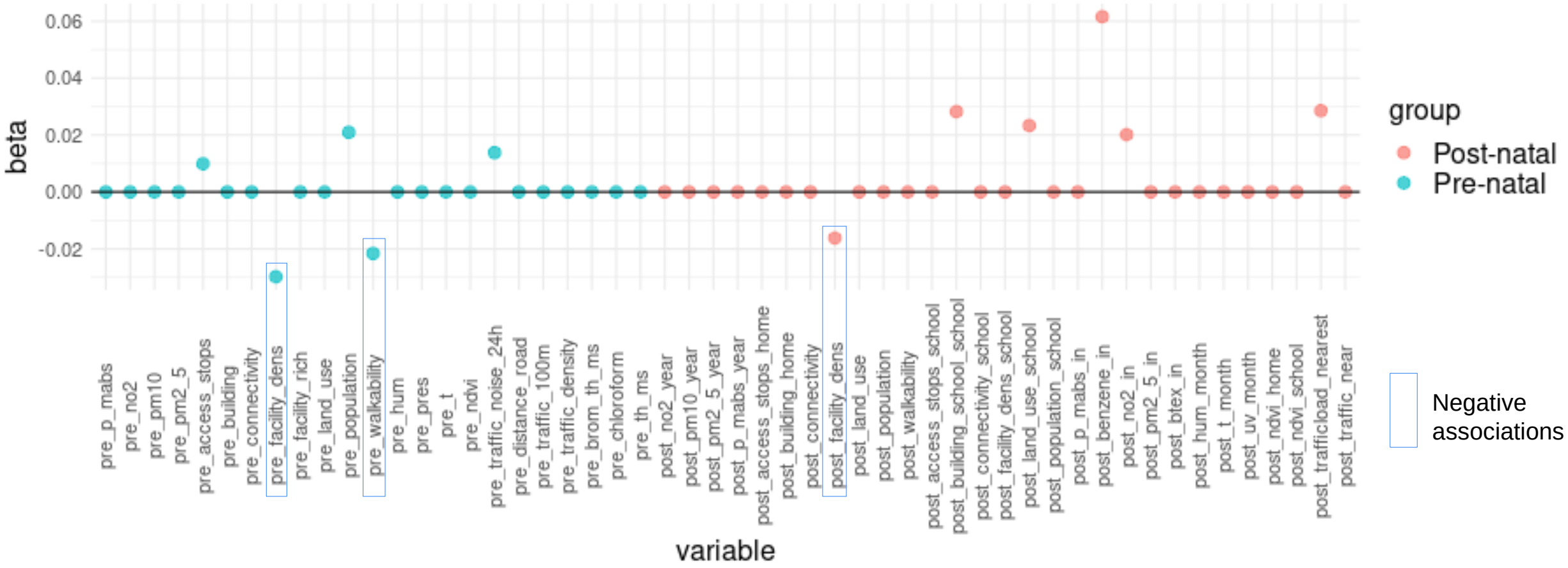
PCP unique events & Children neurobehavior



PCP unique events & Children neurobehavior



PCP unique events & Children neurobehavior



4. DISCUSSION & CONCLUSIONS

Discussion

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

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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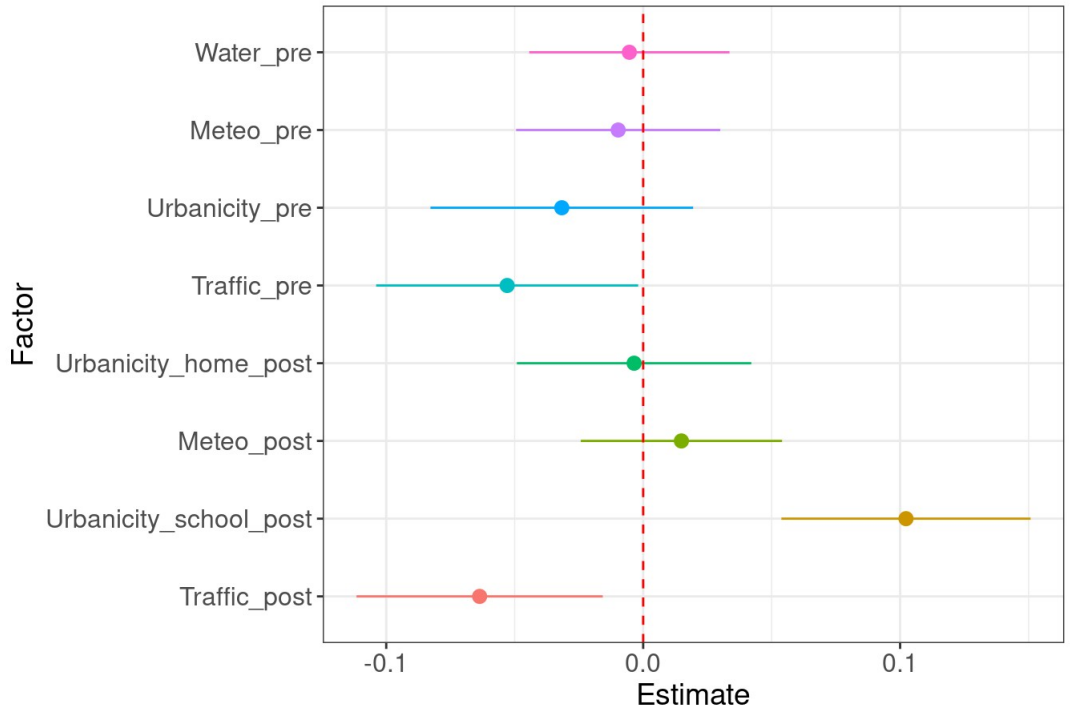
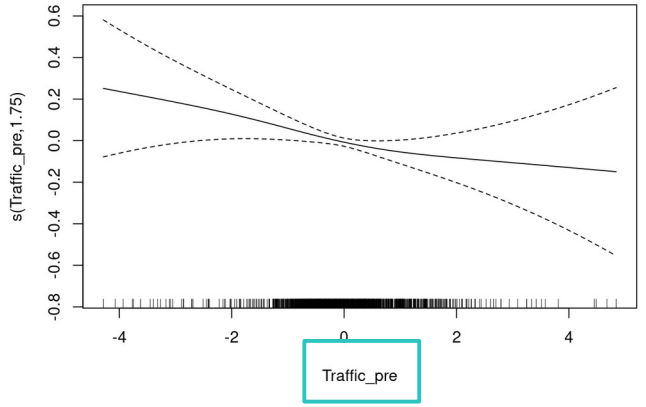
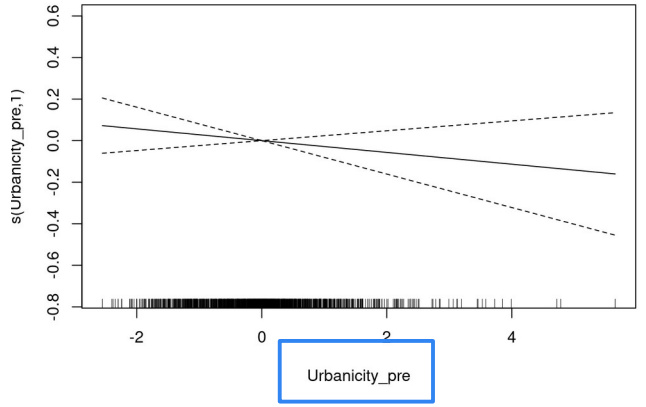
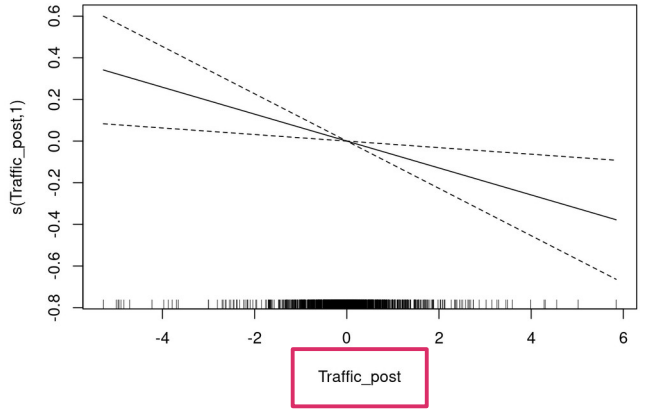
Patterns in raw data: Separating by cohort

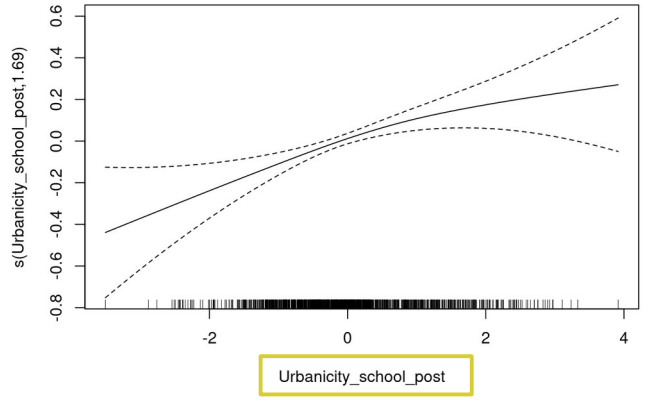
PCP + FA Patterns & Children neurobehavior



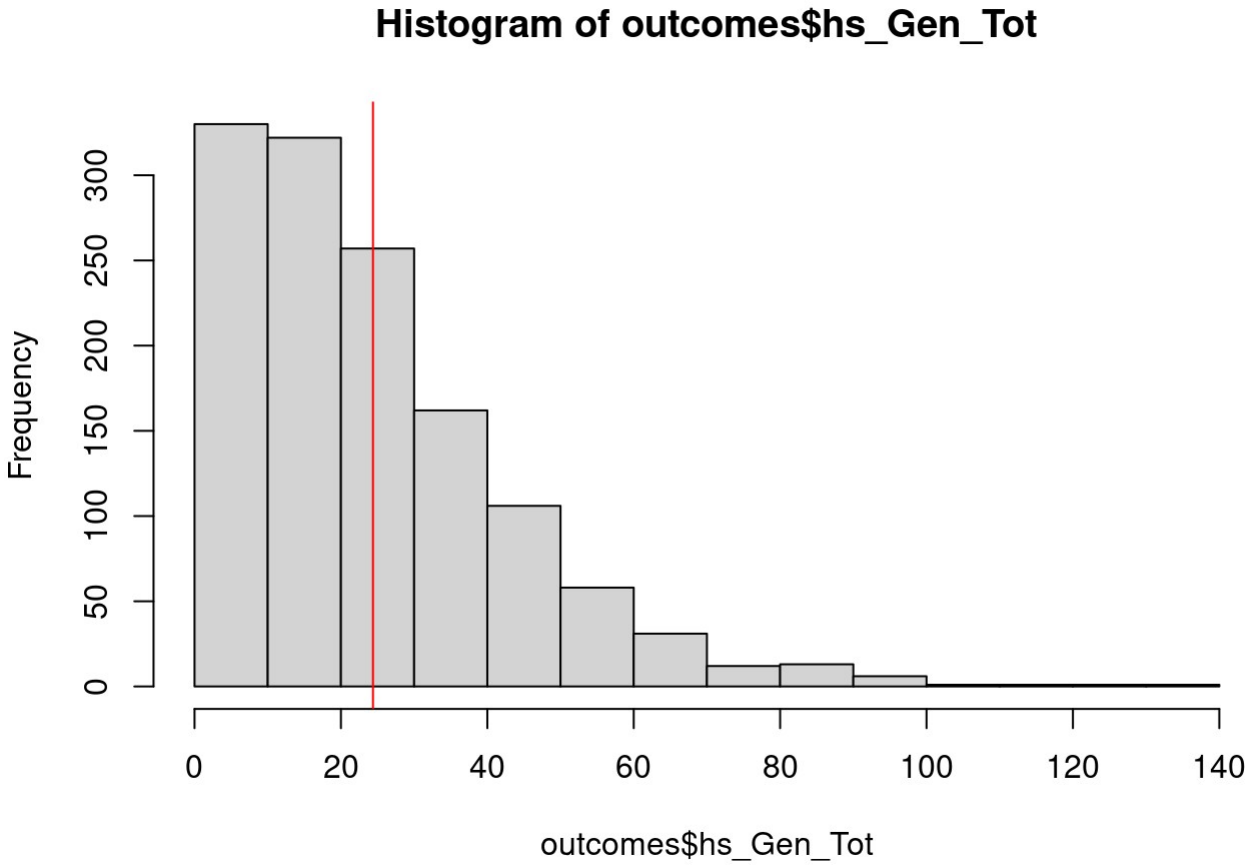




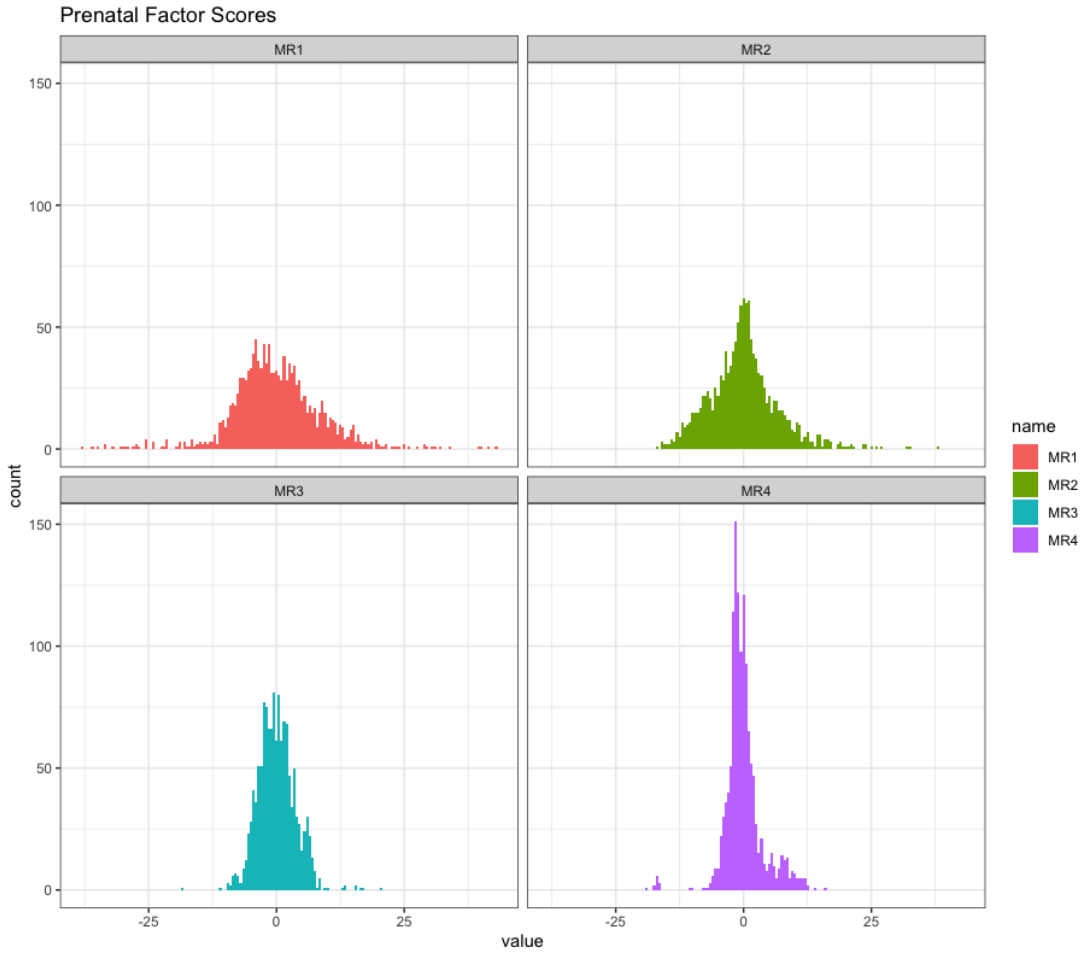


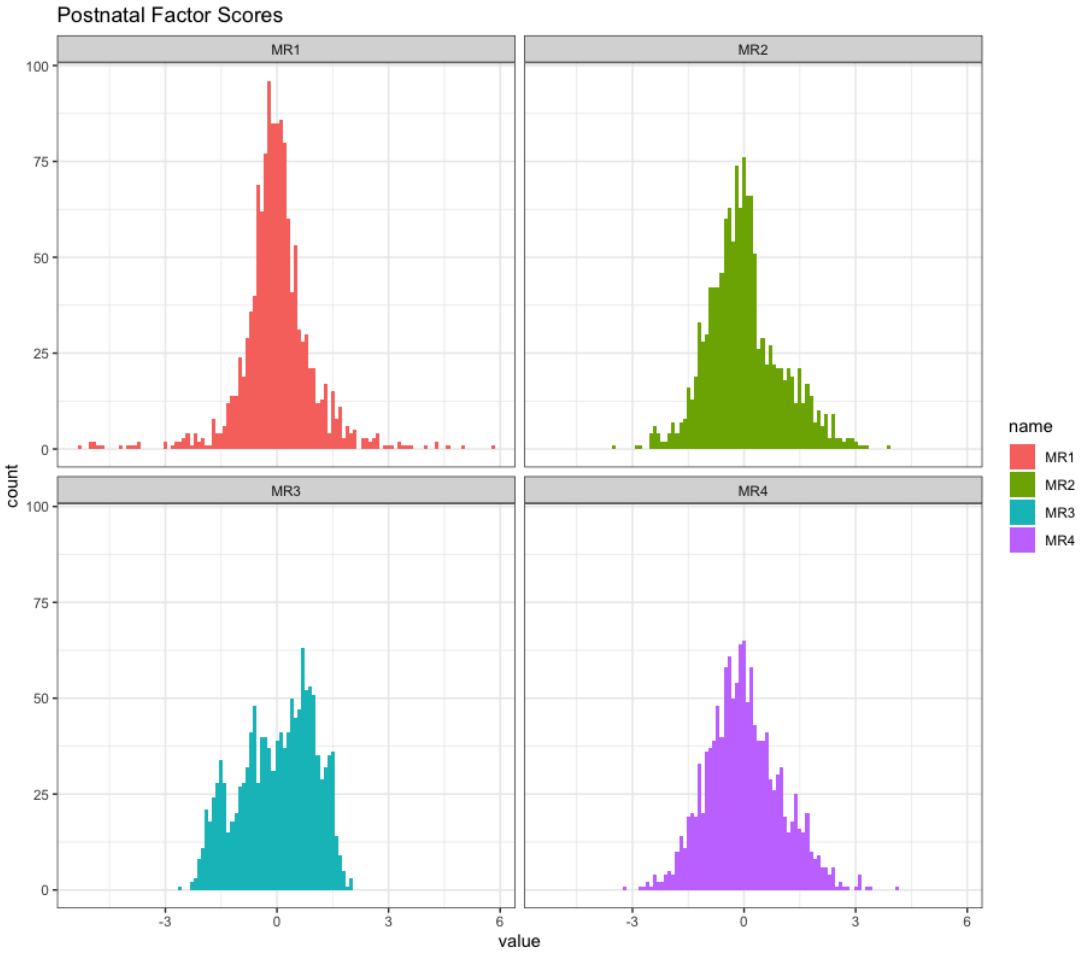


Outcome's distribution

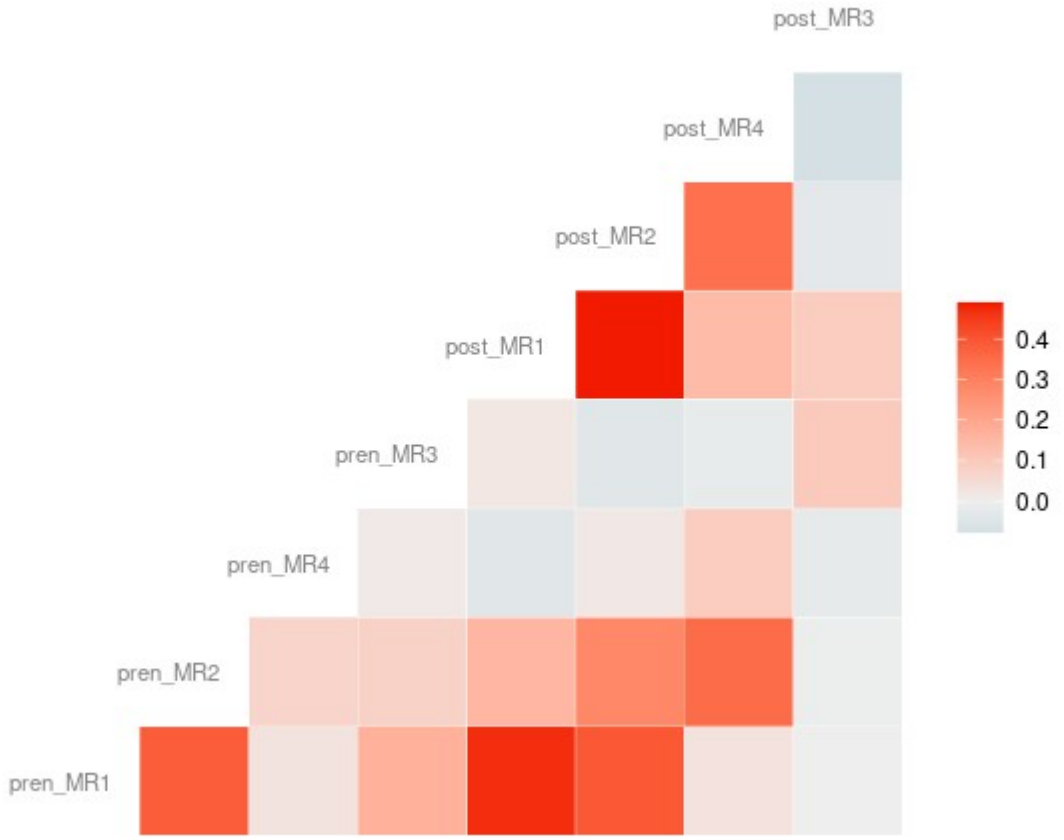


Factors' distribution

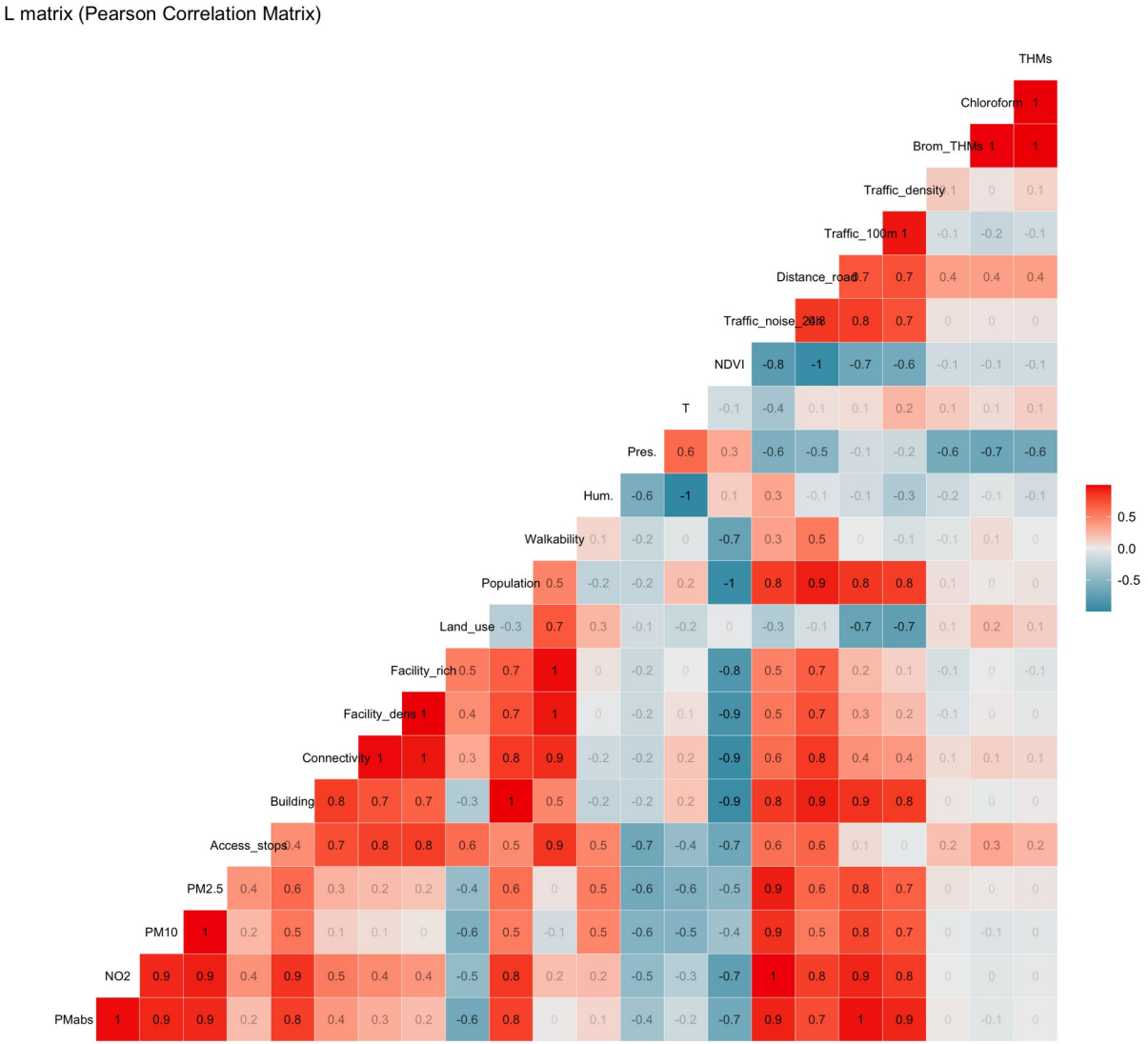




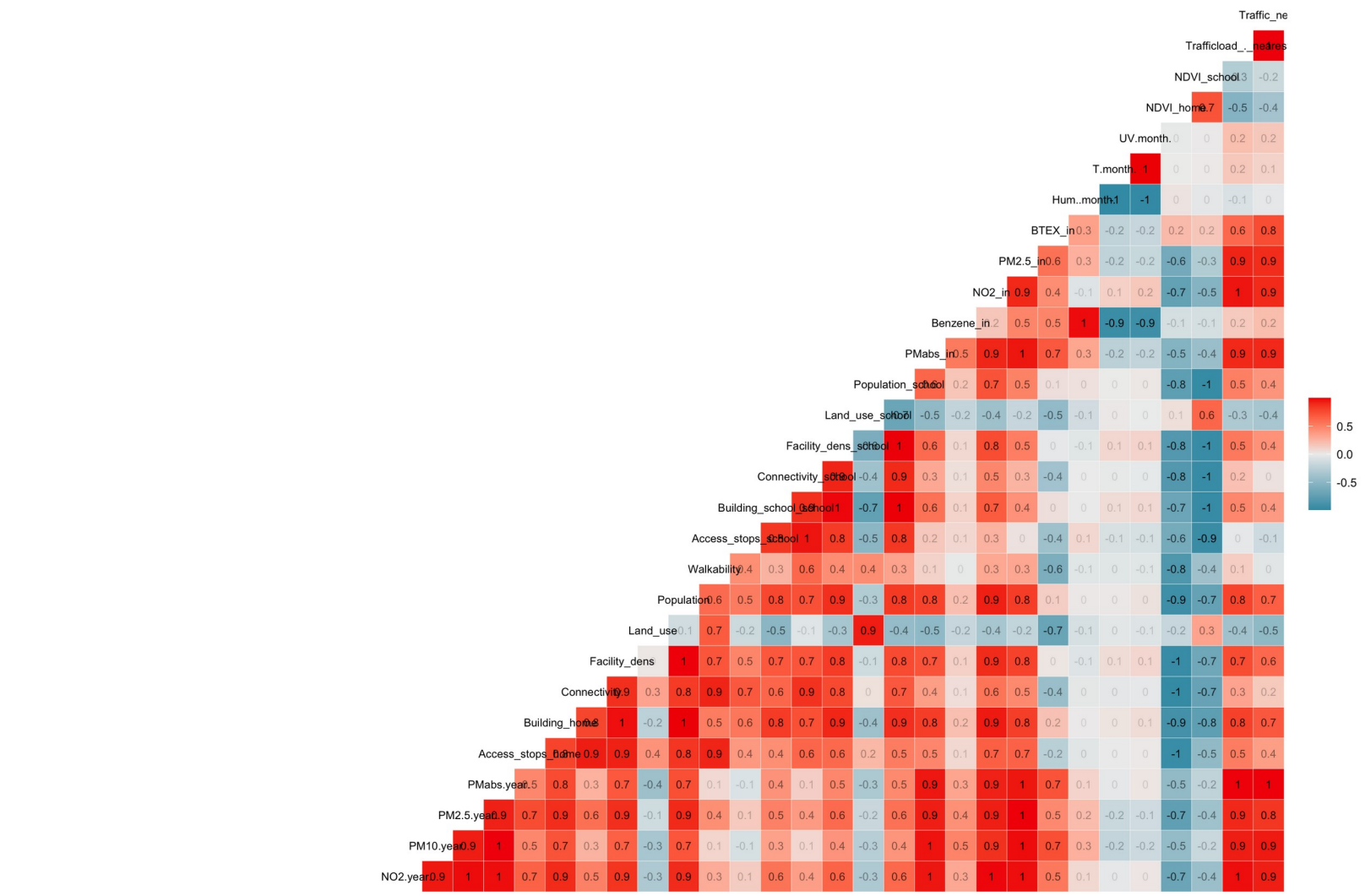
Factors' correlation



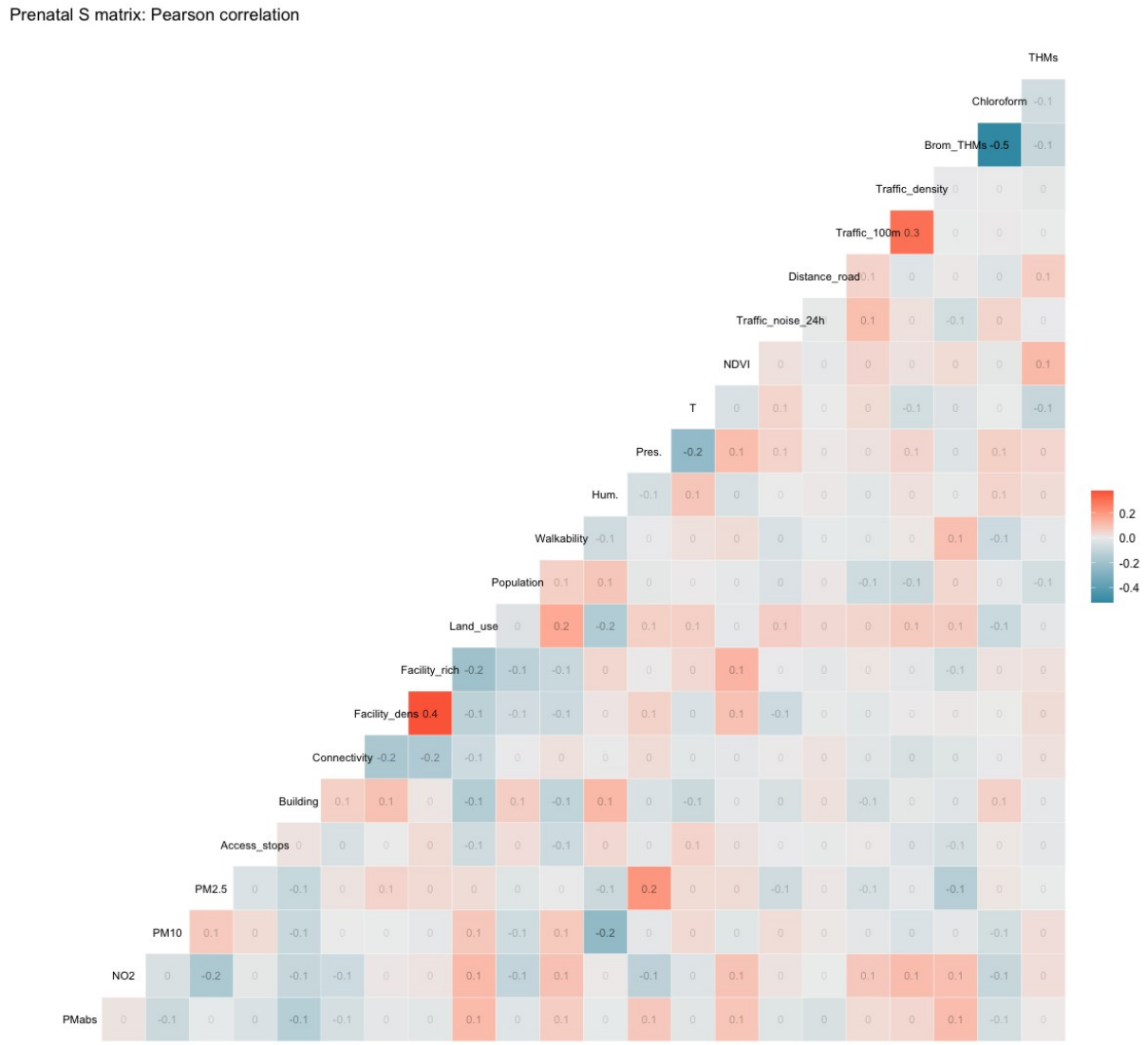
Prenatal L matrix Correlation



Postnatal L matrix Correlation



Prenatal S matrix Correlation



Postnatal S matrix Correlation