

Does the city shape children's minds?

Urban exposome and emotional and behavioral difficulties in children and adolescents across European cohorts

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Background

Childhood and adolescence are vulnerable periods in which mental health problems frequently emerge.

Environmental factors have been shown to be key determinants of emotional and behavioral problems; yet most studies examine single exposures or outcomes.

(Kessler et al., 2005; Barch, 2022; Sheng et al., 2025)

This work **aims** to identify the socio-environmental exposure profiles, within the exposome framework, most strongly associated with emotional and behavioral difficulties during key stages of development.

Methods

We analyzed harmonized data from **four cohorts**: ABCD (Amsterdam), BiB (Bradford) and BREATHE (Barcelona) for childhood; ABCD (Amsterdam) and WALNTUS (Barcelona) for adolescence.

The **urban exposome** (33 determinants) was characterized using GIS-based data, environmental modeling, local statistics bureaus, and questionnaires.

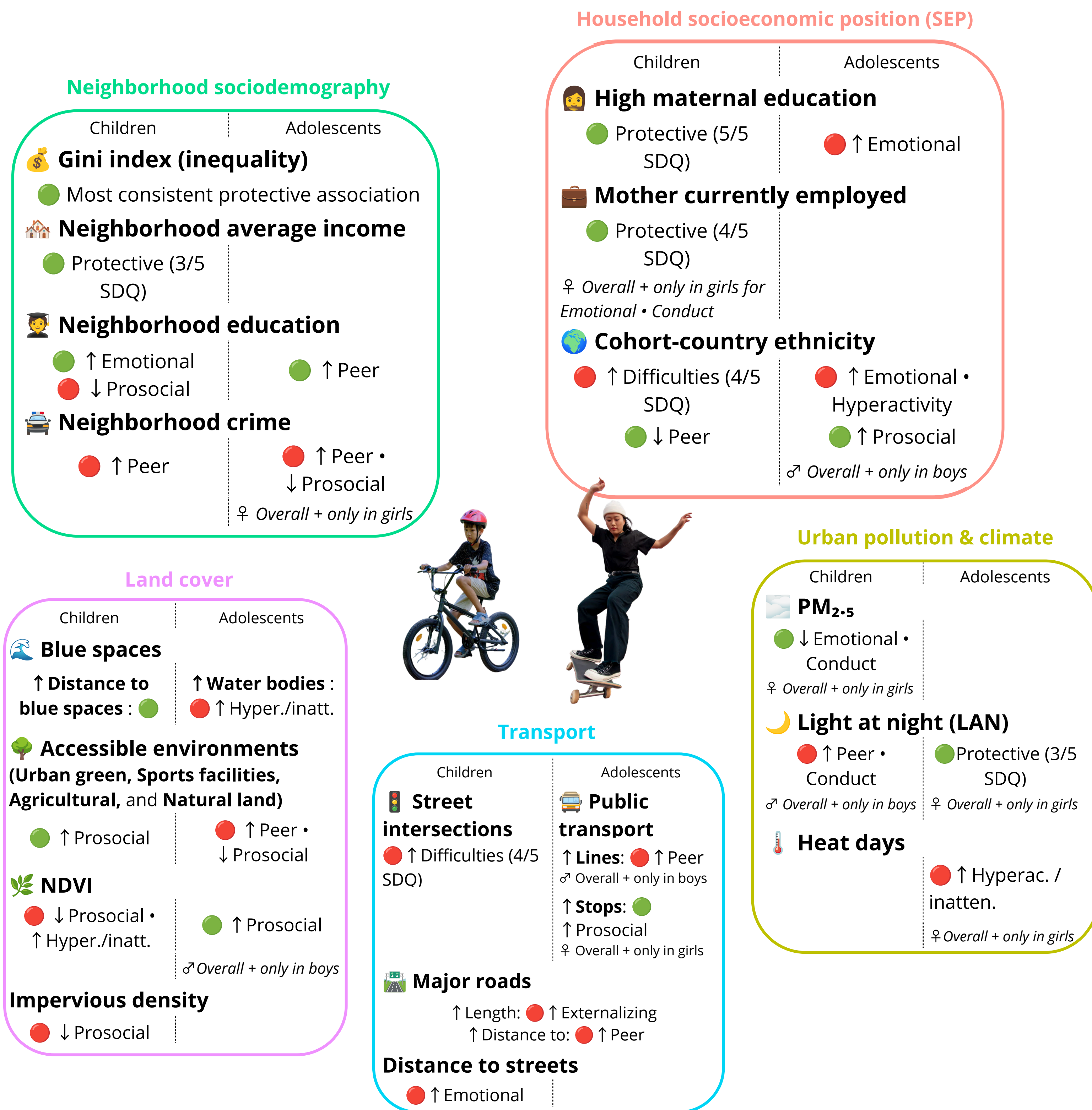
Parent- and self-reports from the Strengths and Difficulties Questionnaire (**SDQ**) assessed five subscales: emotional problems, peer relationship problems, conduct problems, hyperactivity/inattention, and prosocial behavior.

(Goodman R., 1997)

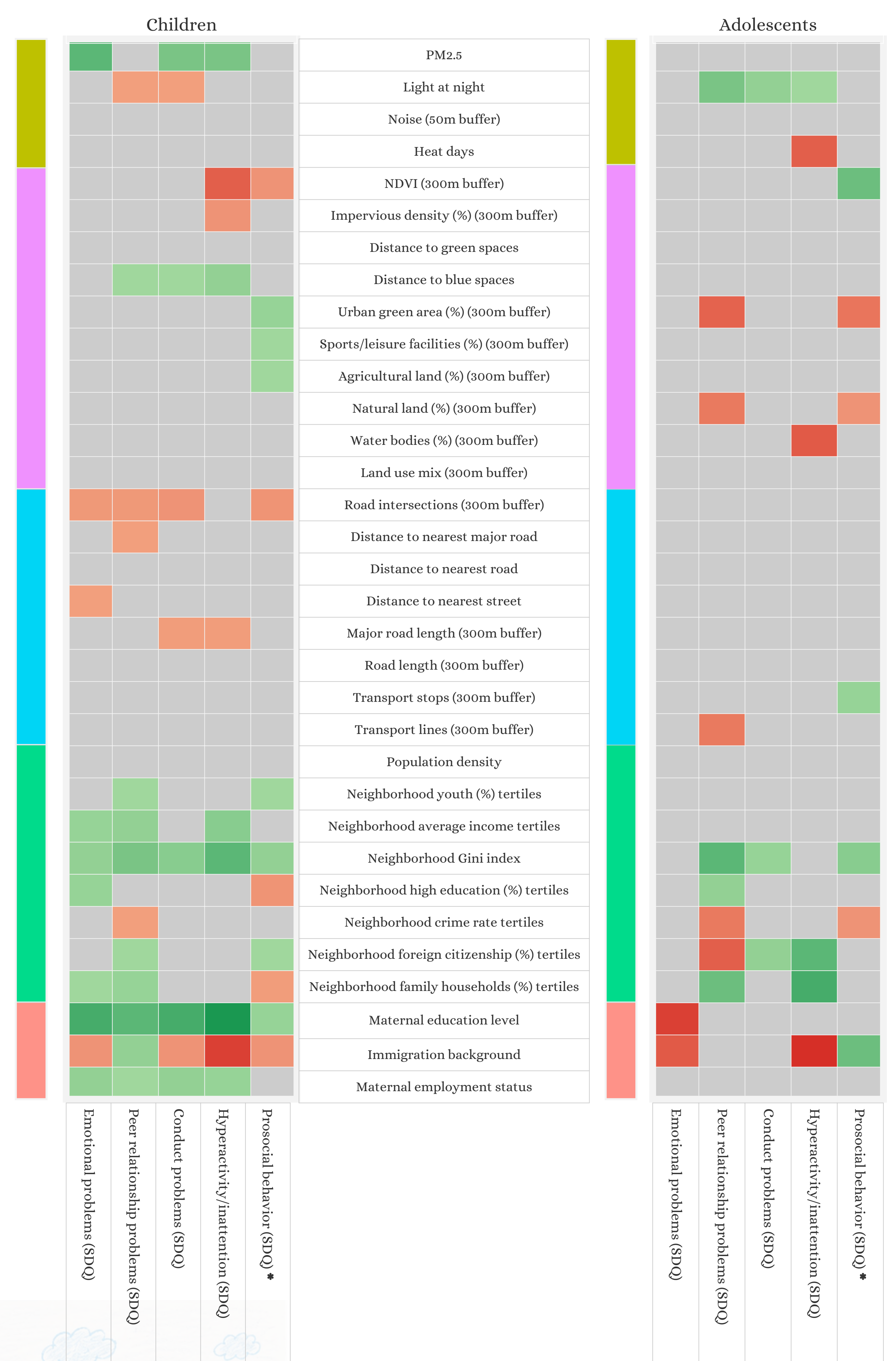
Outcome-wide association analysis using mixed-response sparse reduced-rank regression (**msRRR**) was applied, adjusted for age, sex, and cohort. Childhood and adolescent analyses were done cross-sectionally.



Results



Heatmap of standardized regression coefficients estimated by the final msRRR model after bootstrap selection stability and directional consistency:



*Prosocial behavior scale was reversed to indicate worse difficulties with higher values.

Conclusions

In general, a lack of comparability was observed between children and adolescents in terms of the selection and directionality of the associations.

Household socioeconomic factors, especially maternal education and immigration background, were the most robust and consistent predictors, mostly in children.

Neighborhood sociodemography was consistent among children and adolescents: high inequality (Gini) was the most protective for all emotional and behavioral difficulties.

Peer relationship problems were the outcome most consistently linked to urban exposures.

Limitations

The ABCD cohort has a much higher sample size than the WALNTUS cohort, and as a result the adolescent sample is dominated by the ABCD cohort.

Besides, the BiB cohort could not be included for the adolescent analyses.

References

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