Residential Greenness and Mental Well-being: Insights from the LIFE-Adult Cohort

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Background

Evidence: Systematic reviews suggest that residential green spaces are associated with better mental health outcomes

Rationale & Motivation

- Urban green environments may support mental well-being through stress reduction, psychological restoration and opportunities for physical and social activity
- Associations may vary by greenness measure, residential buffer size and socioeconomic context



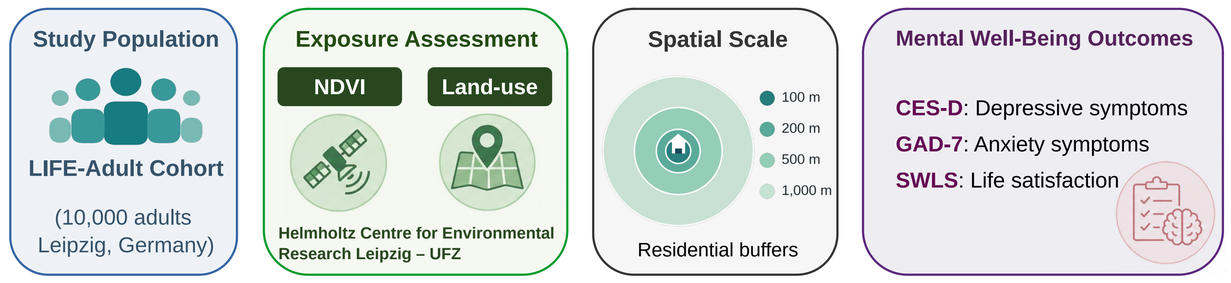
Investigating the associations of environmental factors with psychological well-being in the LIFE-Adult Cohort Study in Leipzig, Germany

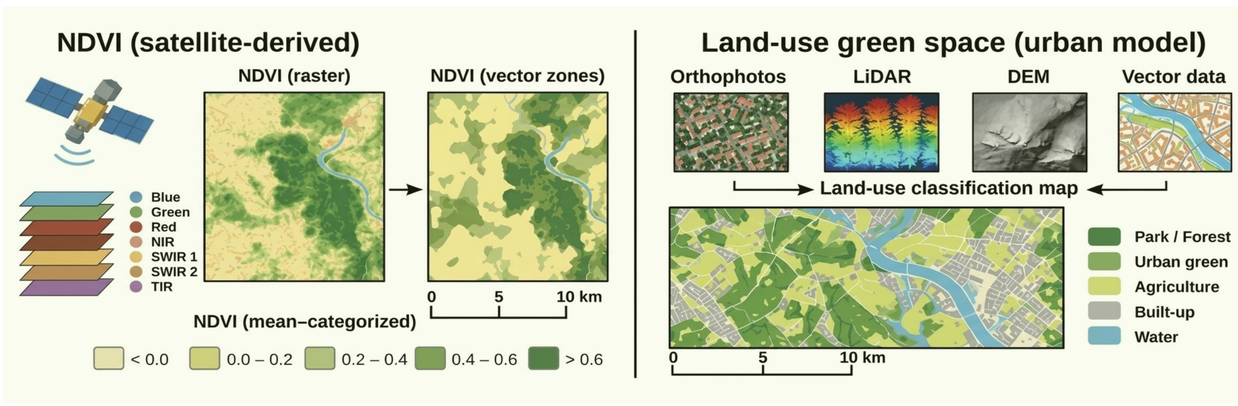
- *Is residential proximity to urban green spaces associated with better mental well-being?*
- *Are these associations evident among adults in Leipzig participating in the LIFE-Adult cohort?*

Objective: To investigate associations between residential greenness and mental well-being across exposure metrics, residential buffer sizes and socioeconomic groups

Methods

Cross-sectional analysis of LIFE-Adult baseline data





Normalized Difference Vegetation Index (NDVI)

$$NDVI = \frac{Near\ Infrared - Red}{Near\ Infrared + Red}$$

Vegetation

- **absorbs** red light
- **reflects** near-infrared

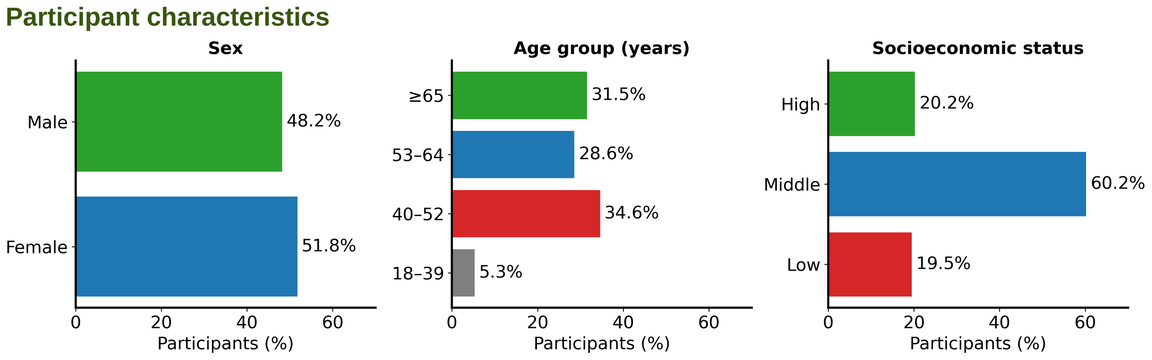
-1 ---------- 0 ---------- +1
Water Built/Bare Vegetation

Statistical analysis

- Multivariate adjusted regression models
- Adjustment for age, sex and socioeconomic status
- Analyses across residential buffer sizes
- Socioeconomic stratified analyses

Results & Discussion

Participant characteristics



Distribution of participants by sex, age group and socioeconomic status (CES-D, n = 9,567)

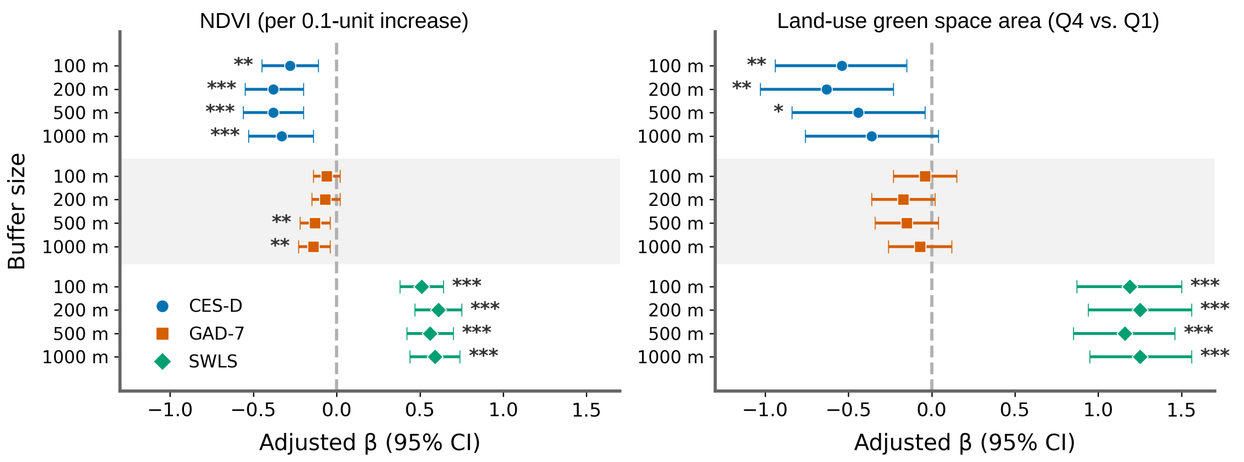
Descriptive statistics of mental well-being outcomes

	Participants (n)	Mean (SD)
Depressive symptoms (CES-D)	9,567	10.94 (7.07)
Anxiety symptoms (GAD-7)	9,726	3.56 (3.37)
Life satisfaction (SWLS)	9,748	26.46 (5.55)

CES-D: Center for Epidemiologic Studies Depression Scale
GAD-7: Generalized Anxiety Disorder-7
SWLS, Satisfaction with Life Scale

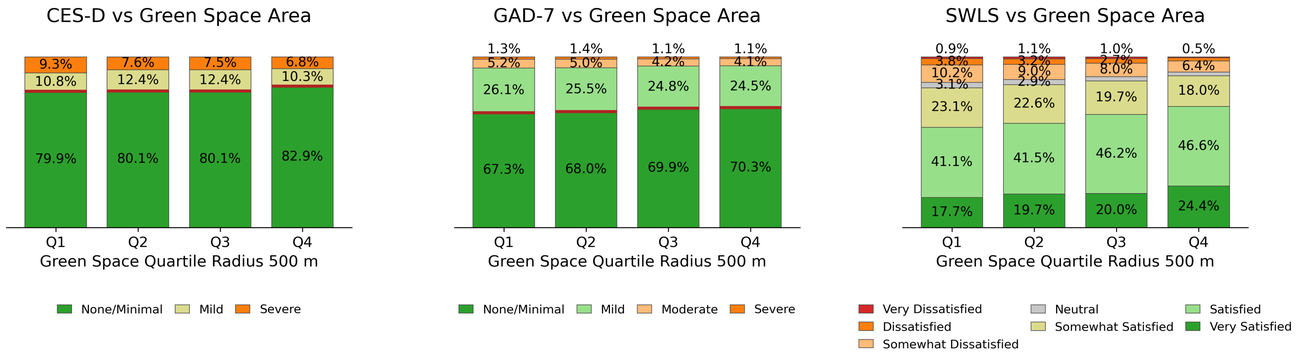
Sample sizes differ due to missing data

Associations between residential greenness and mental health across residential buffer sizes



- Models were adjusted for sex, age and socioeconomic status; Estimates represent different exposure contrasts
- Higher CES-D and GAD-7 scores indicate more symptoms, whereas higher SWLS scores indicate greater life satisfaction

Mental well-being categories across land-use green space quartiles (Q1 = least green ... Q4 = most green)



Depression symptoms: 20.1% in Q1 vs. 17.1% in Q4 (15% relative decrease)

Anxiety symptoms: 32.7% in Q1 vs. 29.7% in Q4 (9% relative decrease)

Life satisfaction: 58.8% in Q1 vs. 71.0% in Q4 reported satisfaction or high satisfaction (21% relative increase). Dissatisfaction decreased from 14.9% to 8.8%

Severe symptoms: Severe depressive symptoms were approximately 27% less prevalent in Q4 than in Q1

- **NDVI showed consistent associations**
- **Associations depended on the exposure metric**
- **Socioeconomic context mattered**

- Stronger associations among socioeconomically disadvantaged participants highlight the potential relevance of equitable access to urban green environments

Residential greenness associated with multiple dimensions of mental well-being

Exposure metrics (NDVI vs. land-use)

Associations differed between NDVI & land-use green space

Spatial scale (100–1000 m)

NDVI associations were generally consistent across buffer sizes, whereas land-use associations varied more by spatial scale

Socioeconomic context

Stronger inverse associations with depressive and anxiety symptoms were observed among participants with lower SES

Implication: Equitable access to residential green space may be relevant to mental well-being

Urban planning should consider both the amount and distribution of residential greenness across socioeconomic groups