

Characteristics of Urban Neighbourhood Environments and Cognitive Age in Mid-Age and Older Adults

Maria V. Soloveva¹; Govinda Poudel¹; Anthony Barnett¹; Jonathan E. Shaw^{3,5,6}; Erika Martino⁷; Luke D. Knibbs^{8,9}; Kaarin J. Anstey^{10,11,12}; & Ester Cerin^{1,2,3,4}



BACKGROUND

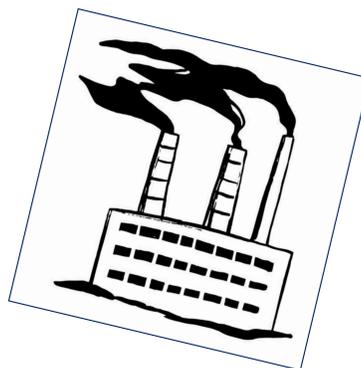
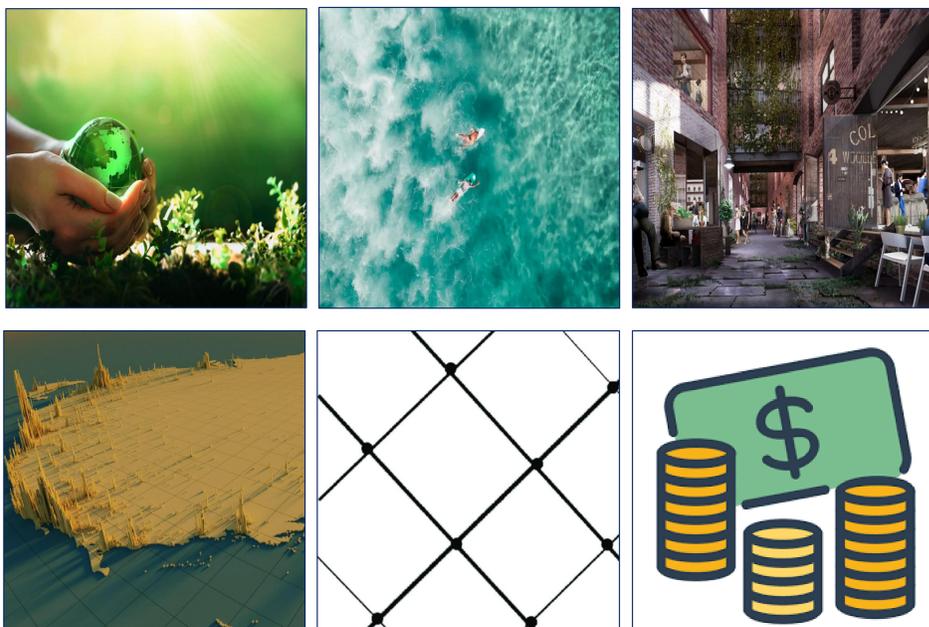
- Urban environments that support an activity-stimulating lifestyle may be beneficial for cognitive health.
- Existing studies on the associations of aspects of natural, built and socio-economic neighbourhood and cognitive health are scarce.
- Trajectories of cognitive decline vary across adults.
- Predicted cognitive age is estimated using machine learning (ML) techniques, an analytical approach that builds regression models from cognitive tests.
- ML offers greater predictive accuracy in comparison to traditional statistical regression models. ML accounts for complex relationships between factors that relate to cognitive age.
- The cognitive age gap (CAG) is the difference between an individual's chronological age and their predicted cognitive age, and it can be a reliable marker of cognitive health.
- We examined the extent to which features of the neighbourhood natural, built and socio-economic environments were related to cognitive age gap in older adults.

METHODS

Participants

We analysed cross-sectional data from the third wave (2011-2012) of the Australian Diabetes, Obesity and Lifestyle Study (AusDiab). Participants were adults aged 34 years and over (N = 4141), recruited from 42 randomly selected census collection districts including 1,286 Statistical Areas Level 1 (SA1) across Australia. The average age of participants used in analyses of environment-CAG associations was 61 years (SD = 11, range: 34-97 years, 55.6% female).

Environmental Measures



Neighbourhood environmental measures included:

- Parkland and blue space (%);
- Commercial land use (%);
- Population density (persons/hectare);
- Street intersection density (intersections/km²) within 1 km residential buffers;
- Annual mean concentrations of nitrogen dioxide (NO₂);
- Annual mean concentrations of fine particulate matter (<2.5 μm, PM_{2.5});
- Index of Relative Socio-Economic Advantage and Disadvantage (IRSAD).

Cognitive Measures

Symbol Digit Modalities Test (SDMT) assessed processing speed.

The California Verbal Learning Test (CVLT) assessed memory.

Spot the Word Test (STWT) assessed premorbid intelligence.

Outcome Measure

Cognitive age gap was computed for each individual by subtracting chronological age from their predicted cognitive age (estimated from assessments of processing speed, memory and premorbid intelligence).

RESULTS AND CONCLUSIONS

- In the total-effect models, higher percentage of parkland in a 1 km residential buffer and higher area-level socio-economic status were associated with smaller CAG scores in older adults.
- Parkland availability and neighbourhood socio-economic status showed positive direct effects on CAG in older adults.
- Older adults **living in affluent neighbourhoods** with **greater parkland** availability are **cognitively younger** than their counterparts.
- Urban environments that support a cognitively-stimulating lifestyle may be beneficial for cognitive health. Specifically, **green space exposure can be a feasible population-level approach to preserve cognitive health** in ageing populations.
- Future longitudinal studies are needed to delineate the impact of urbanicity on cognitive age gap.

Affiliations

¹Mary MacKillop Institute for Health Research, Australian Catholic University, Melbourne, VIC 3000, Australia
²School of Public Health, The University of Hong Kong, Hong Kong, China
³The Baker Heart and Diabetes Institute, Melbourne, VIC 3004, Australia
⁴Department of Community Medicine, UiT The Arctic University of Norway, 9019 Tromsø, Norway
⁵School of Public Health and Preventive Medicine, Monash University, Melbourne, VIC 3004, Australia
⁶School of Life Sciences, La Trobe University, Melbourne, VIC 3086, Australia
⁷School of Population and Global Health, University of Melbourne, Melbourne, VIC 3053, Australia
⁸Sydney School of Public Health, The University of Sydney, Camperdown, NSW 2006, Australia
⁹Public Health Unit, Sydney Local Health District, Camperdown, NSW 2050, Australia
¹⁰School of Psychology, University of New South Wales, Kensington, NSW 2052, Australia
¹¹Neuroscience Research Australia (NeuRA), Sydney, NSW 2031, Australia
¹²UNSW Ageing Futures Institute, Kensington, NSW 2052, Australia