International Mind, Activities and Urban Places (iMAP) study: methods of a cohort study on environmental and lifestyle influences on brain and cognitive health
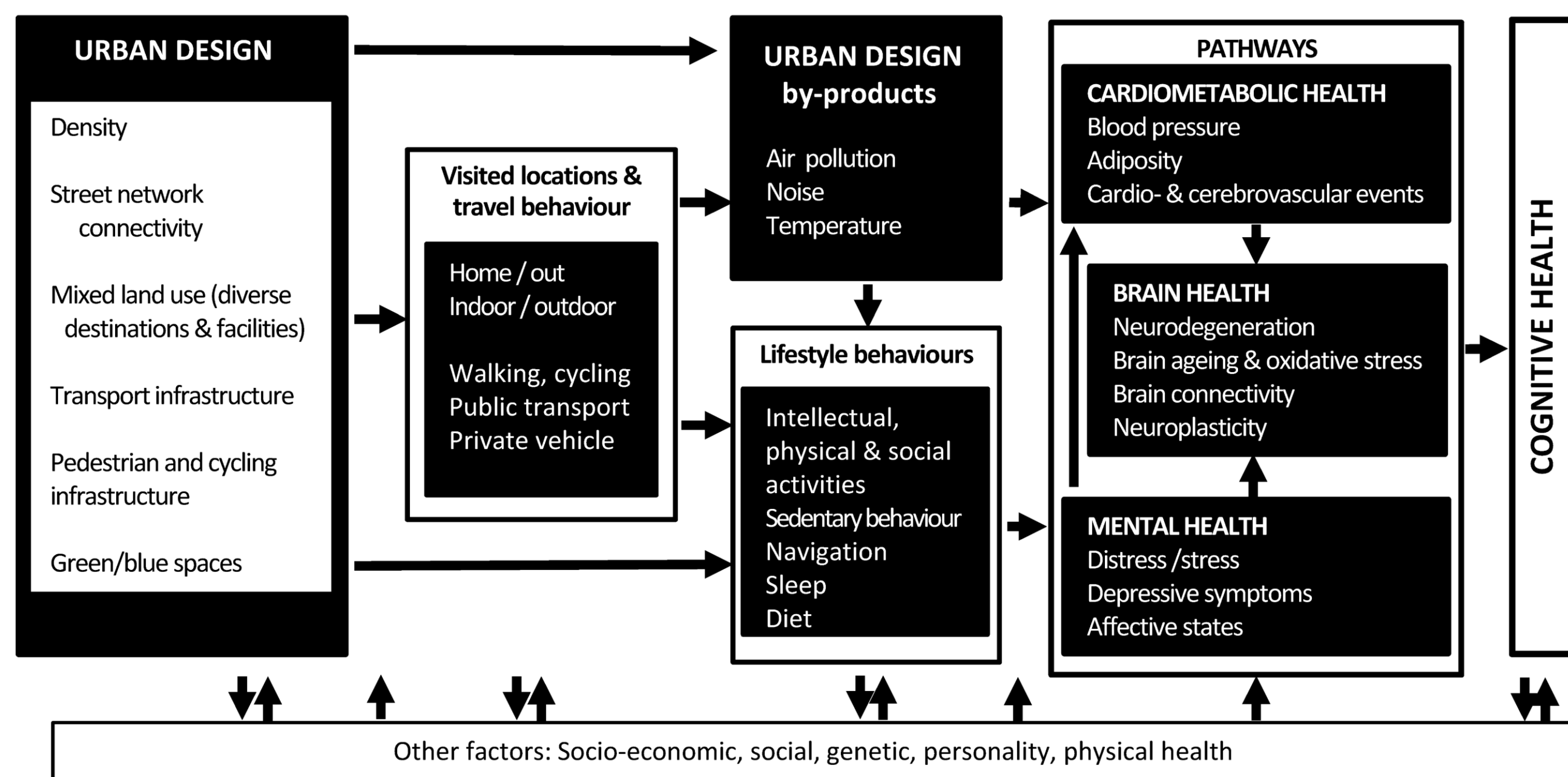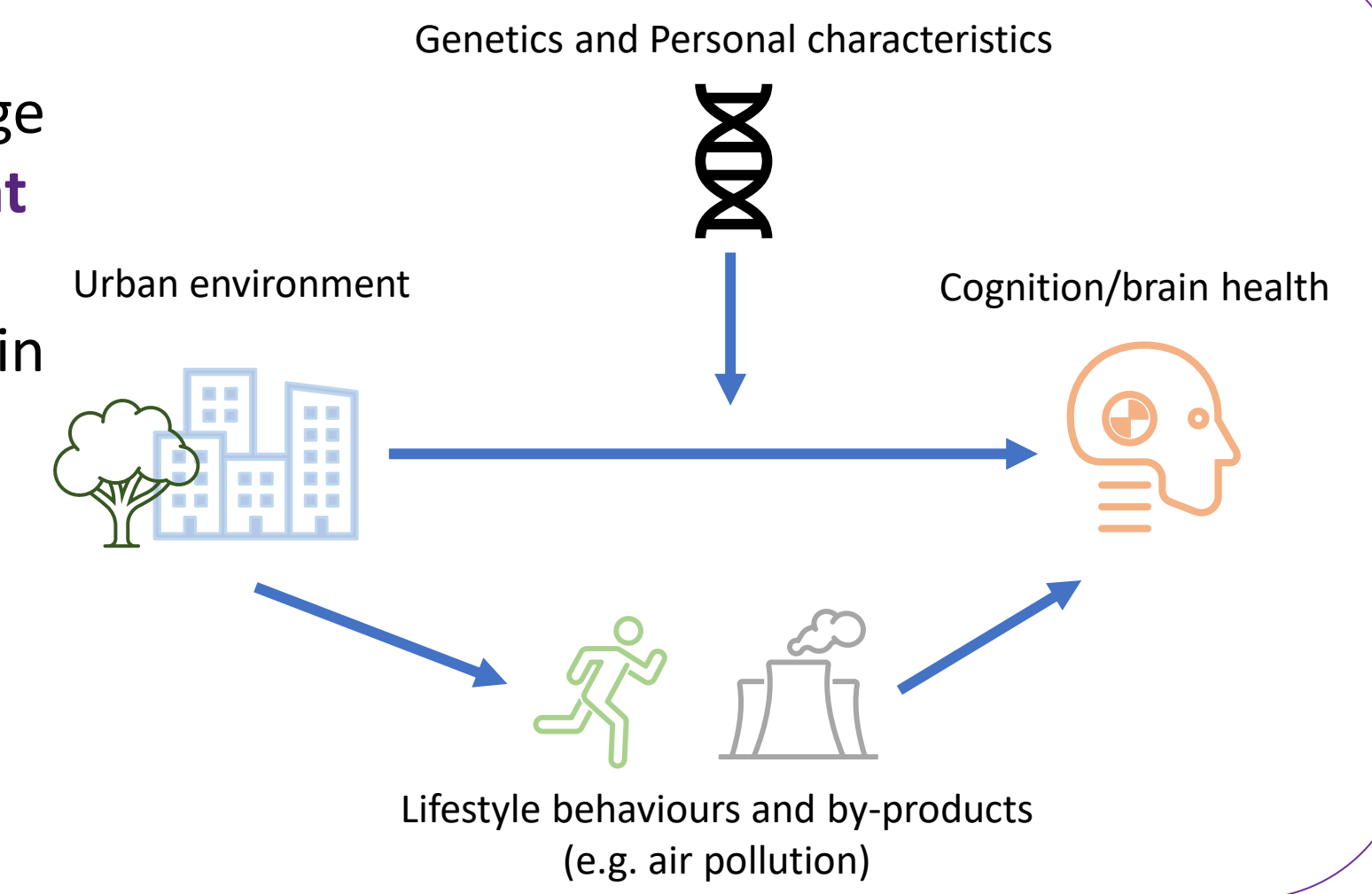
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BACKGROUND

- As we age the likelihood of experiencing **cognitive decline** - the decline in our ability to think, learn, reason, and remember – **increases.** This can result in **substantial disability** for the individual, increased **healthcare costs** and can negatively affect our **quality of life.**
- Several **lifestyle and environmental factors**, (physical and social activity, pollution, etc.) can **influence brain** and **cognitive health** in **mid- to late life**
- The influence of aspects of the **built and natural environment** on **cognitive health** can be direct or act via **by-product**s (e.g., air pollution or noise) and **lifestyle behaviors** influenced by said environment.

RESEARCH QUESTION

- **How** and to **what extent**, a wide range of **features of the urban environment** and their **by-products** and **lifestyle behaviours**, impact **cognitive health** in mid-to older aged adults.
- Does an individual's **genetics** impact the **relationship** between the urban environment and cognition

Genetics and Personal characteristics — Urban environment — Cognition/brain health — Lifestyle behaviours and by-products (e.g. air pollution)

Ecological model of cognitive health. Highlights the factors and by-products that are influenced by urban environments and that may affect **cognitive health.**

METHODS

	Melbourne (Australia)	Hong Kong (China)	Barcelona (Spain)
Population density in urban areas (people/km^2)	3,200	25,900	16,000
Street intersection density (intersections/km^2)	70	55	223
Land use mix (entropy index; range: 0–1)	0.15	0.50	0.19
Mean annual concentration of PM$_{2.5}$ (µg/m^3)	8	63	14
Mean annual concentration of nitrogen dioxide (µg/m^3)	16	95	50
Prevalence of health-enhancing physical activity	55%	85%	77%
Prevalence of dementia	9.0%	3.3%	2.4%

- **600 participants** recruited from each city, aged between **50-79yrs** (1800 in total)
- Each of these environments comes with **different urban living exposures -** allows results to guide **national** and **international** policy changes
- Baseline assessment (2019/2022) followed by follow-up assessment 2yrs later (2021/2024) to examine changes in brain and cognitive health

Measures

Exposures

- **Environmental characteristics** of visited locations including built and natural environment (e.g., street connectivity, green/blue space, transport) and their by-products (e.g., air pollution (NO$_2$ and PM$_{2.5}$) and noise)
 - **Objective measurements** - using Geographical Information Systems and Microscale Audit of Pedestrian Streetscapes (MAPS) Global
  - **Self reported measures** of visited locations- using Visualization and Evaluation of Route Itineraries, Travel destinations and Activity Spaces (VERITAS), an interactive map-based questionnaire developed for iMAP
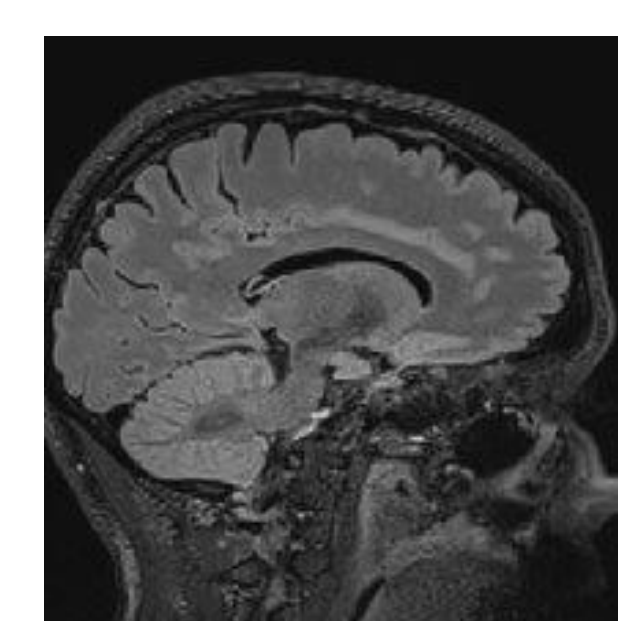
Moderators and Mediators

- **Lifestyle behaviours** (e.g. physical and social behaviours)
- **Participant characteristics** (e.g. socio-demographics, chronic health conditions)
- **Genetics** - APOE genotype
  - APOE gene is a risk factor for dementia

7- day assessment of lifestyle activities: physical activity, sedentary and mobility behaviours, sleep (Wearing equipment)
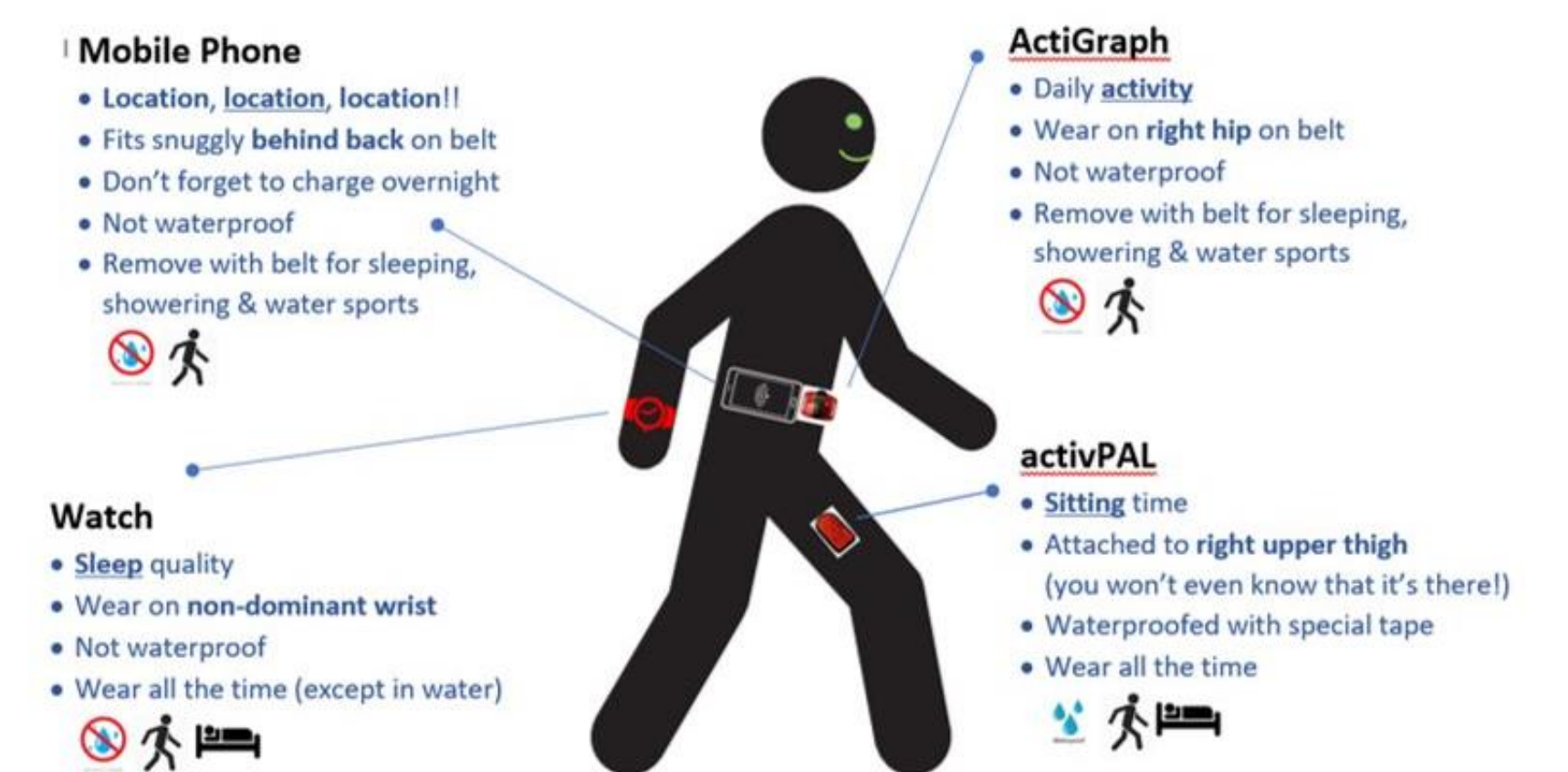
Outcomes

- **Cognitive function** – Tests evaluating cognitive functions such as memory, speed, attention and language will be used
- **Brain health** – MRI scans will examine the brain for any detrimental structural changes and assess brain health

DISTRIBUTION OF FINDINGS

- Dissemination of study methods and findings will be designed to impact both **science** and **policy**
- Results will be communicated to **practitioners** and **policy makers**, targeting especially health, urban design/planning, housing and transport sectors.
- Delivery modes:

Website — Policy Briefs — Press Releases — Webinars — Conference Presentations — Consultations

POTENTIAL IMPACT

- iMAP study is the **first of its kind** to examine the effects of **urban environments** on the **brain** and **cognitive health** across **different geographical locations**
- **3 diverse cities** = study **maximizes environmental variability** = more accurate estimation of the relationship between the **urban environment, lifestyle behaviors**, and **cognitive health**
- **Wide variability** in exposures = results could be **generalised** across countries
- Data can be used to ensure that **urban living** is better orientated towards **improving** and **maintaining** an individual's **cognitive health** and **wellbeing** to help **minimise** our chances of experiencing **cognitive decline**

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