A meta-analytic umbrella review assessing urban environment exposures and cognitive health.

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BACKGROUND

The population is ageing. With figures indicating that by 2050 the population aged >60years will double to 2.1 billion. A population ageing at this rapidity poses unique challenges for society particularly regarding the economy and the potentially unprecedented burden on the healthcare system and its services.

Furthermore, when an ageing population is considered within the context of urbanization, unique challenges and opportunities arise regarding investigations into the mechanistic pathways involving cognitive health. Examinations are required to investigate the interactions between the urban environment and cognitive health to design, development, and implementation of effective public health strategies.

Considering the number of existing reviews in this field, and the need to efficiently harness a remarkable wealth of evidence to inform future research, policy, and practice, it was determined that an umbrella review to identify and synthesize the existing review base would be implemented.

METHODS

Three databases (Pubmed, Embase, PyscINFO) were searched to identify systematic reviews that assessed relationships between the urban environment and cognitive health.

Studies were screened for inclusion by two reviewers and a quality appraisal of the studies was conducted.

A statistical umbrella review was implemented (a meta-analysis needed to report primary study data for all included studies and have more than one primary study per outcome).

With all included reviews also being discussed in a narrative synthesis.

RESULTS

4,639 manuscripts were identified (1,019 duplicates), 3,620 were screened by title/abstract, with 254 selected for full text review. 58 reviews were included: five high, 44 moderate and nine low quality.

A total of 257 outcomes were extracted: 31 reviews (outcomes=147) examined environmental by-products, 26 reviewed the social environment, 5 reviewed urban design (outcomes=31) and 1 examined travel behaviours (outcome=1).

Meta-analytic results			
Level of evidence	Urban design	Social environment	Environmental by products
Convincing		1	1
Highly probable	2	6	11
Probable		3	3
Suggestive		1	1
Not significant	3	5	16

- Over half of the reviews identified (31/58) assessed environmental by-products and cognitive decline and dementia.

- Of the environmental by-product reviews, 47% were classified as probable, highly probable and convincing, with exposures including $PM_{2.5}$, NO_2 CO and noise pollution.

- 63% of social environment reviews were classified as probable, highly probable and convincing, with exposures including educational attainment, social participation and social contact.

- 40% of urban design reviews were classified as highly probable, with exposures including greenness and land use/land cover.

DISCUSSION

Findings indicate that several environmental by-products were associated with cognitive decline and dementia. Regarding specific pollutants, findings highlighted the association between $PM_{2.5}$ and dementia, vascular dementia, Alzheimer's disease, and cognitive impairment; and NO_2 and dementia and vascular dementia. Potential mechanisms include inflammation, oxygen related and/or neuroendocrine stress responses, or activation of the hypothalamic-pituitary-adrenal axis.

Education, social contact and a reduction of social isolation were found to be protective factors for cognitive impairment and dementia as they were found to enhance cognitive reserves and encourage the participation in healthful behaviours.

RECOMMENDATIONS (research)

Further investigations: PM_{10}, NO_x, O_3, indoor air pollution, electromagnetic fields, pesticides, climate, rural versus urban living and potential mediators.