GREEN SPACE AS A PATHWAY TO HEALTHY URBAN LIVING

Mark J Nieuwenhuijsen

ISGlobal Barcelona Institute for Global Health

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The New Coronavirus: Some Answers and Man Questions

TRANSMISSION REDUCTION MEASURES

Hygiene/hand washing

Physical distancing (1.5 meters)

Mask use

Self isolation when ill

Light to severe lockdown measures

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IMPACTS

	Barcelona/Catalonia
Reduced physical activity	-40%
Increase in poor mental health	+20%
Domestic violence	+20%
Reduced traffic	70-80%
Reduced air pollution (NO2)	70-90%
Reduced noise	-9Db(a)
Green space visits	-90%

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County-Level Exposures to Greenness and Associations with COVID-19 Incidence and Mortality in the United States

21 Pages • Posted: 4 Oct 2020

Jochem O. Klompmaker
Harvard University - Department of Environmental Health

Jaime E. Hart
Harvard University - Department of Environmental Health

Special Issue: COVID-19

Green space and the compact city: planning issues for a 'new normal'

Mick Lennon

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Download citation https://doi.org/10.1080/23748834.2020.1778843 Check for updates

ABSTRACT

The paper traces the emergence of urban public green space as an issue of concern for planning. This is used as a platform to discuss the emergence of the compact city idea and how this conceives the design and use of such spaces. The paper then identifies a series of issues that need to be prioritised in future research for the planning of urban green space in the 'new normal' of social distancing consequent on COVID-19. Issues requiring attention and a series of outline examples of potential solutions are grouped beneath four categories: form & features, distribution, connectivity and resilience.

KEYWORDS: Green space, urban density, planning, social distancing

GREEN AND LIVEABLE

- Greening cities has many health benefits including longer life expectancy, fewer mental health problems, better cognitive function, better mood and healthier babies
- It mitigates air pollution, heat and noise levels.
- CO2 sequestration
- Replacing roads and parking with green environments can be one way forward to change an environment from detrimental to beneficial.

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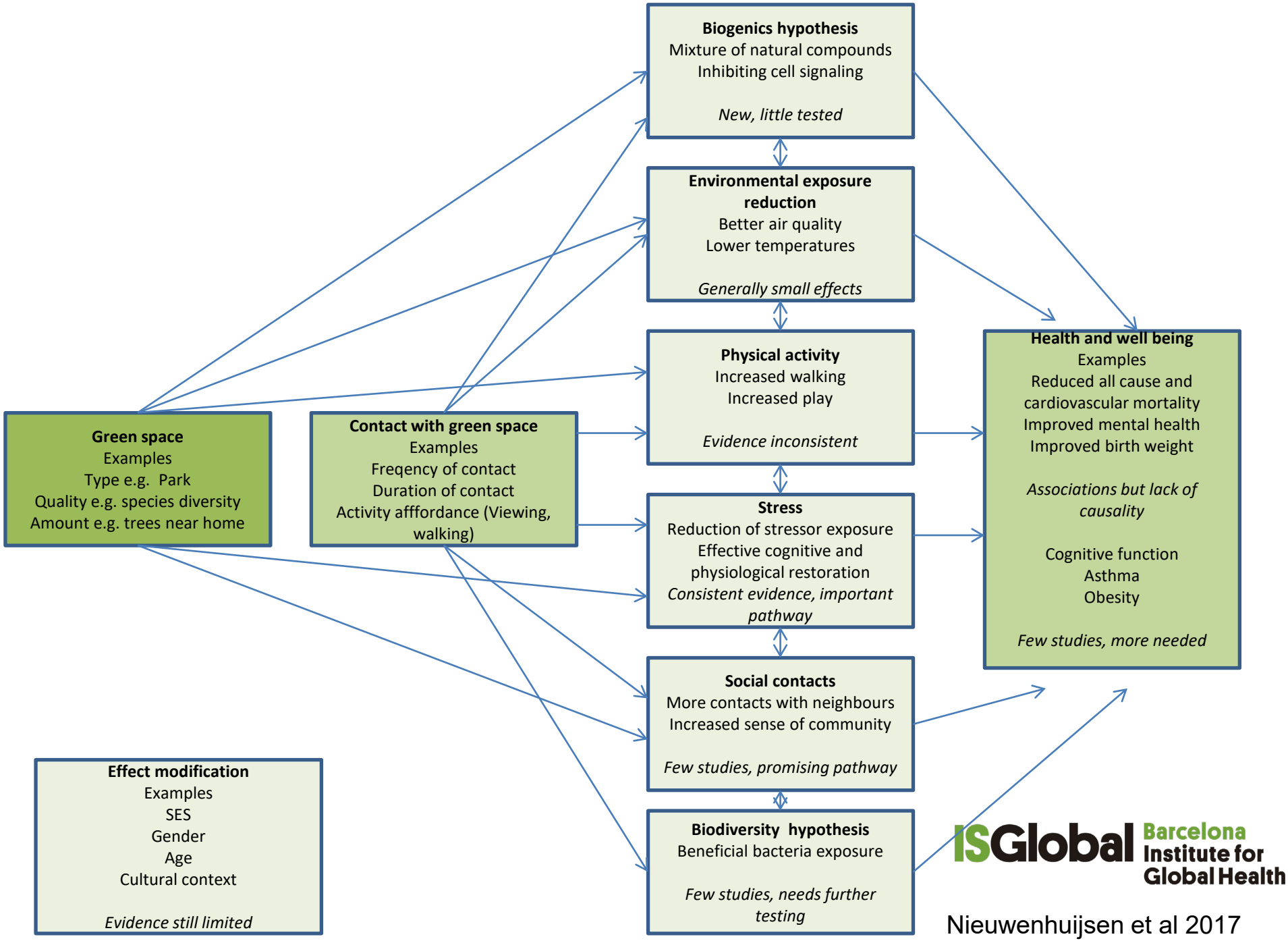
Nieuwenhuijsen et al 2017, Epidemiology



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Nieuwenhuijsen et al 2017

International Journal of
Environmental Research and Public Health

MDPI

Review

Urban Trees and Human Health: A Scoping Review

Kathleen L. Wolf [1,*], Sharon T. Lam [2], Jennifer K. McKeen [3], Gregory R.A. Richardson [4], Matilda van den Bosch [5,6] and Adrina C. Bardekjian [7]

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check for updates

Abstract: The urban forest is a green infrastructure system that delivers multiple environmental, economic, social and health services, and functions in cities. Environmental benefits of urban trees are well understood, but no review to date has examined how urban trees affect human health. This review provides a comprehensive summary of existing literature on the health impacts of urban trees that can inform future research, policy, and nature-based public health interventions. A systematic search

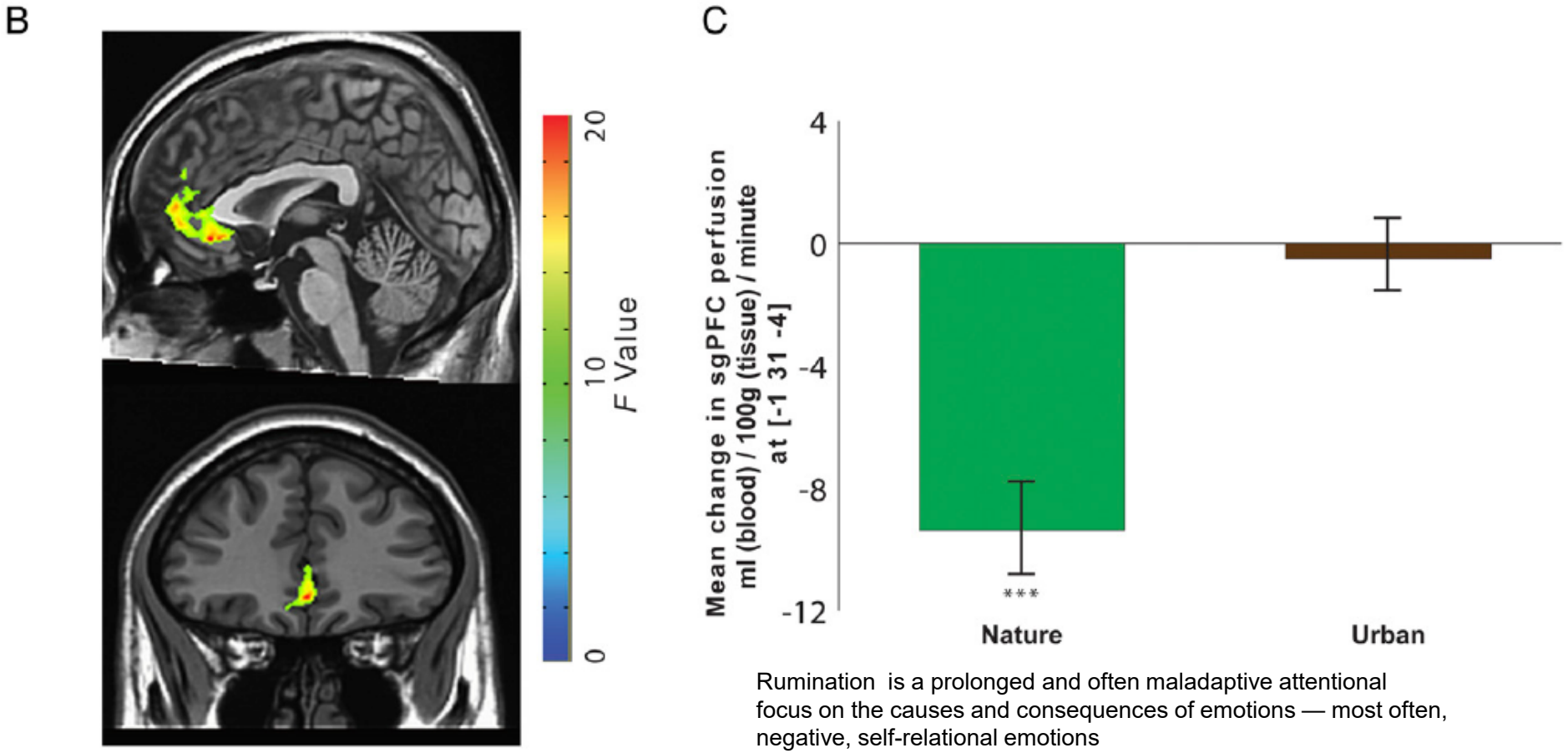
Neighborhood greenspace and health in a large urban center

Omid Kardan[1], Peter Gozdyra[2], Bratislav Misic[3], Faisal Moola[4], Lyle J. Palmer[5], Tomáš Paus[6] & Marc G. Berman[1,7]

Studies have shown that natural environments can enhance health and here we build upon that work by examining the associations between comprehensive greenspace metrics and health. We focused on a large urban population center (Toronto, Canada) and related the two domains by combining high-resolution satellite imagery and individual tree data from Toronto with questionnaire-based self-reports of general health perception, cardio-metabolic conditions and mental illnesses from the Ontario Health Study. Results from multiple regressions and multivariate canonical correlation analyses suggest that people who live in neighborhoods with a higher density of trees on their streets report significantly higher health perception and significantly less cardio-metabolic conditions (controlling for socio-economic and demographic factors). We find that having 10 more trees in a city block, on average, improves health perception in ways comparable to an increase in annual personal income of $10,000 and moving to a neighborhood with $10,000 higher median income or being 7 years younger. We also find that having 11 more trees in a city block, on average, decreases cardio-metabolic conditions in ways comparable to an increase in annual personal income of $20,000 and moving to a neighborhood with $20,000 higher median income or being 1.4 years younger.

Kardan et al 2015

NATURE EXPERIENCE REDUCES RUMINATION AND SUBGENUAL PREFRONTAL CORTEX ACTIVATION



Rumination is a prolonged and often maladaptive attentional focus on the causes and consequences of emotions — most often, negative, self-relational emotions

Fig. 1. The impact of nature experience on self-reported rumination and blood perfusion to the sgPFC. (*A*) Change in self-reported rumination (postwalk minus prewalk) for participants randomly assigned to take a 90-min walk either in a natural setting or in an urban setting. (*B*) A time-by-environment interaction in blood perfusion was evident in the sgPFC. *F* map of significant interactions at a threshold of $P < 0.05$, FWE corrected for multiple comparisons. (*C*) Change in blood perfusion (postwalk minus prewalk) for participants randomly assigned to take a 90-min walk either in a natural setting or in an urban setting. Error bars represent SE within subjects: $*P < 0.05$, $***P < 0.001$.

38 subjects, 90 min walk

Bratman et al 2015 PNAS

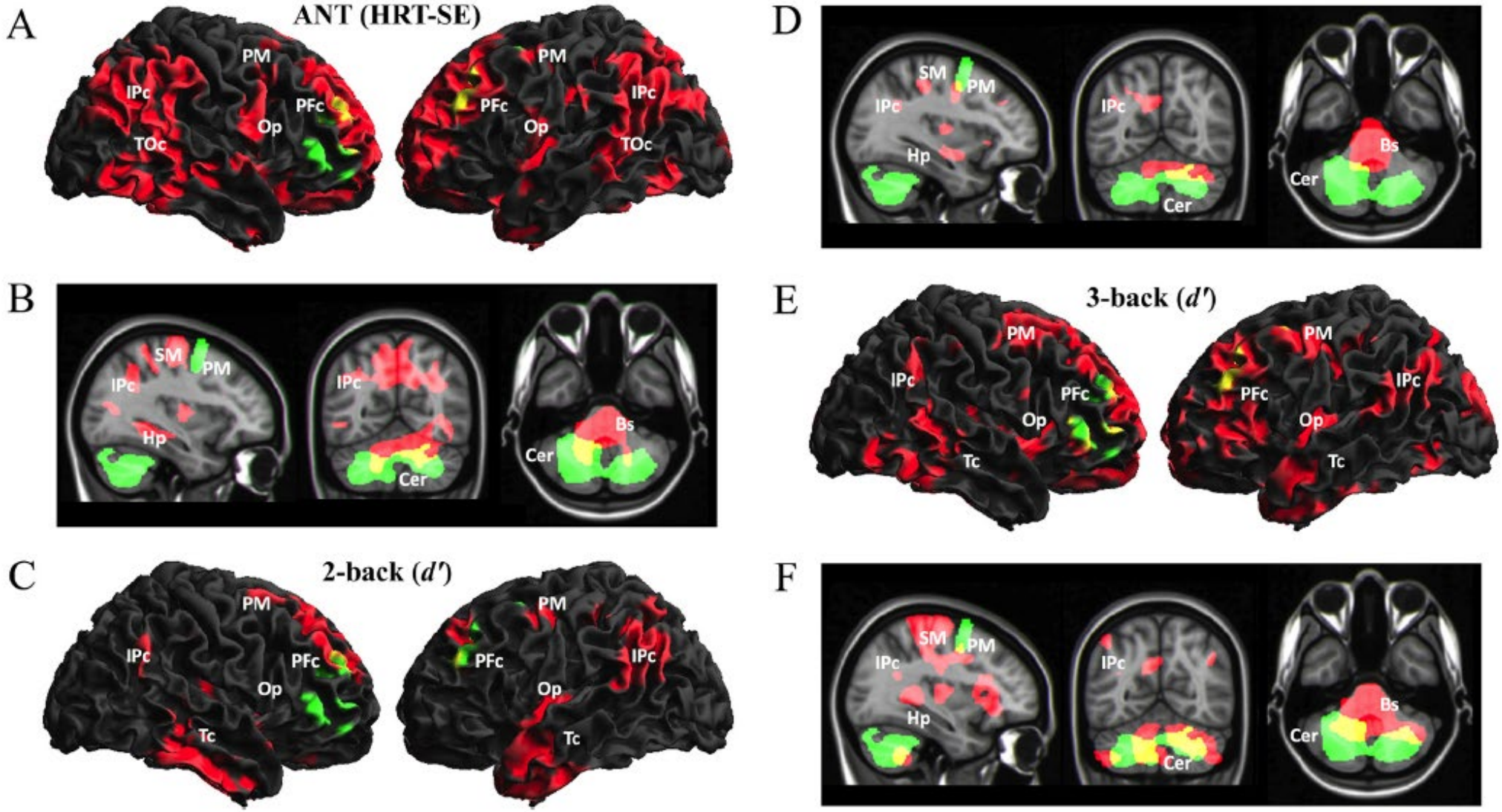


Figure 2. Regional gray and white matter volumes associated with lifelong residential surrounding greenness and cognitive performance. Results are displayed using conventional canonical templates [Cortex_20484 surface mesh in (*A*), (*C*), and (*E*) and MNI152_T1 template in (*B*), (*D*), and (*F*)] in Montreal Neurological Institute (MNI) space with statistical parametric mapping (SPM8; FIL Methods Group 2013) software. Green areas indicate regional volumes significantly associated with greenness (see Figure 1). Results were considered significant with clusters of 2.2 mL (650 voxels) at a height threshold of $p < 0.01$, which satisfied the family-wise error (FWE) rate correction of $p_{FWE} < 0.05$. Red areas indicate regional clusters with volumes significantly associated with cognitive functions: hit reaction time standard error (HRT-SE; an indicator of inattentiveness) in (*A*) and (*B*); 2-back d' (an indicator of working memory) in (*C*) and (*D*), and 3-back d' (an indicator of superior working memory) in (*E*) and (*F*). The overlaps between regions associated with greenness and those associated with cognitive functions are shown in yellow.

Dadvand et al 2018

GREEN SPACE AND WORKING MEMORY

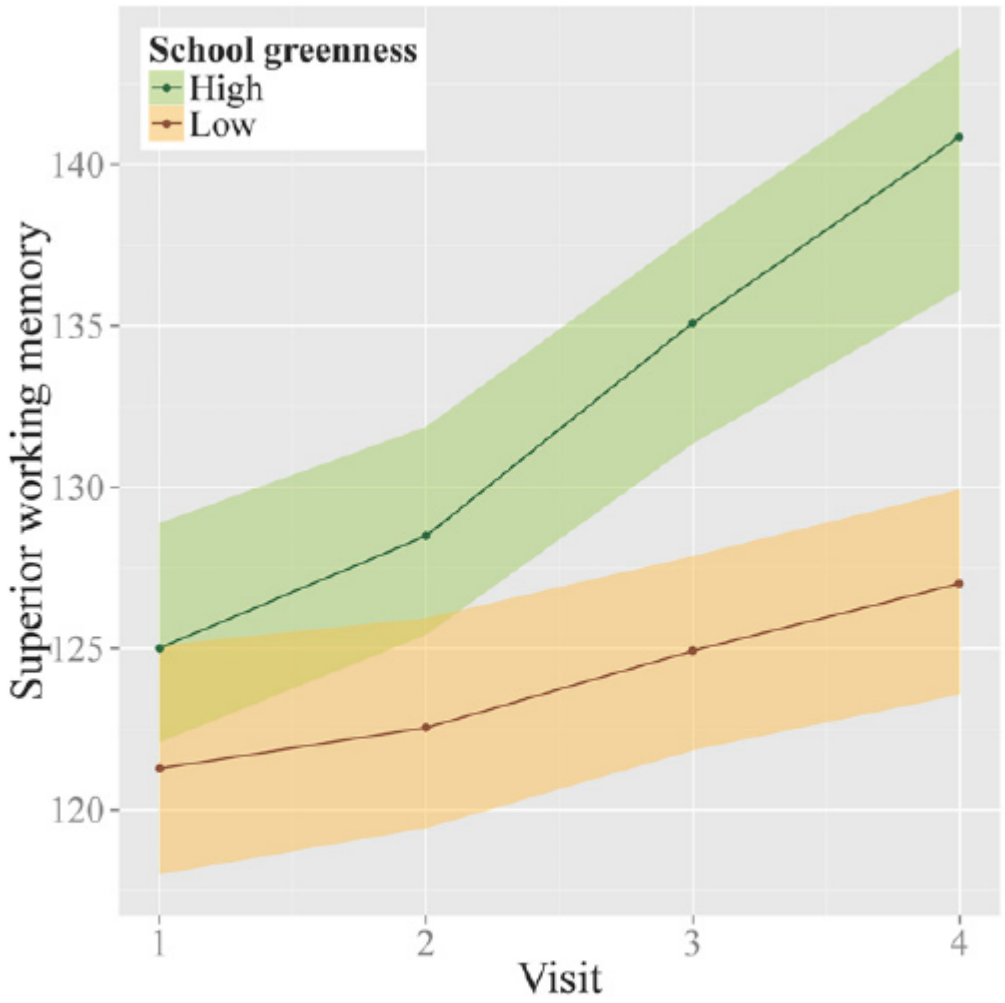


Fig. 1. Twelve-month progress (with 95% confidence bands) in superior working memory for participants with the first (low greenness) and third (high greenness) tertiles of greenness within the school boundaries.

Dadvand et al 2015
PNAS

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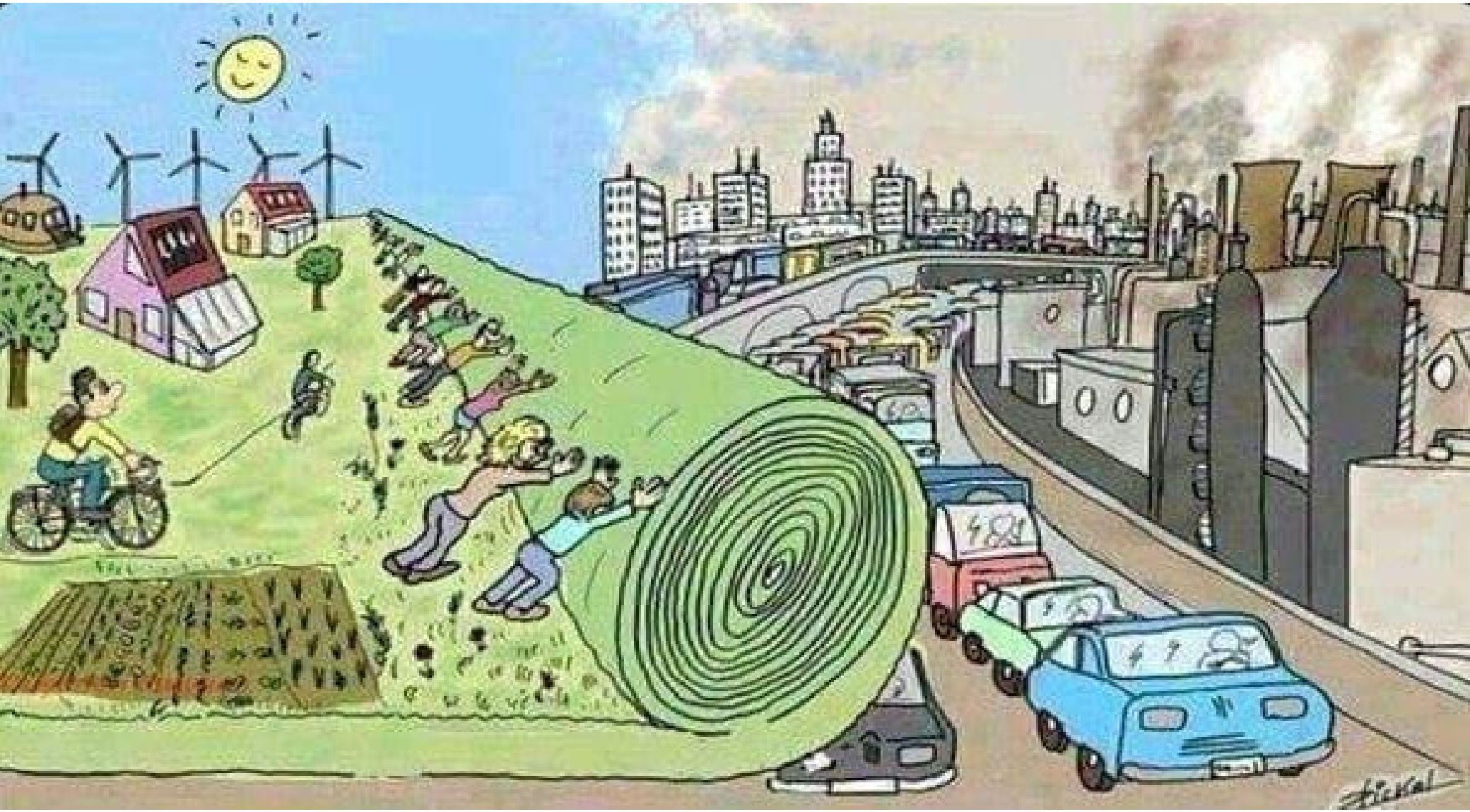
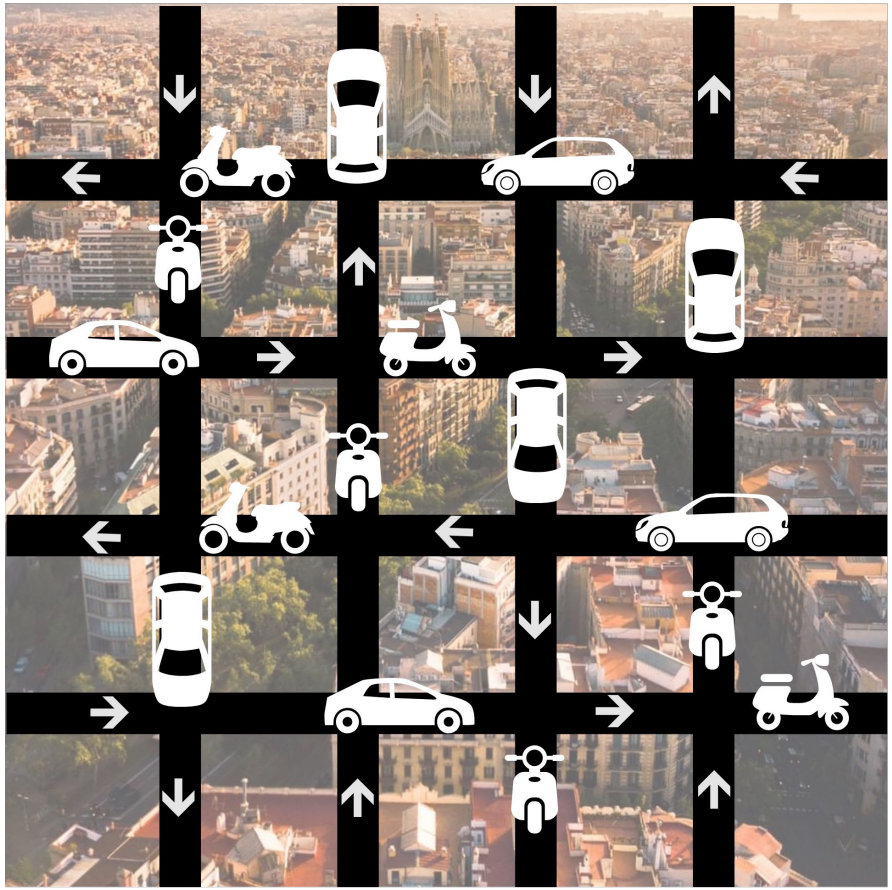
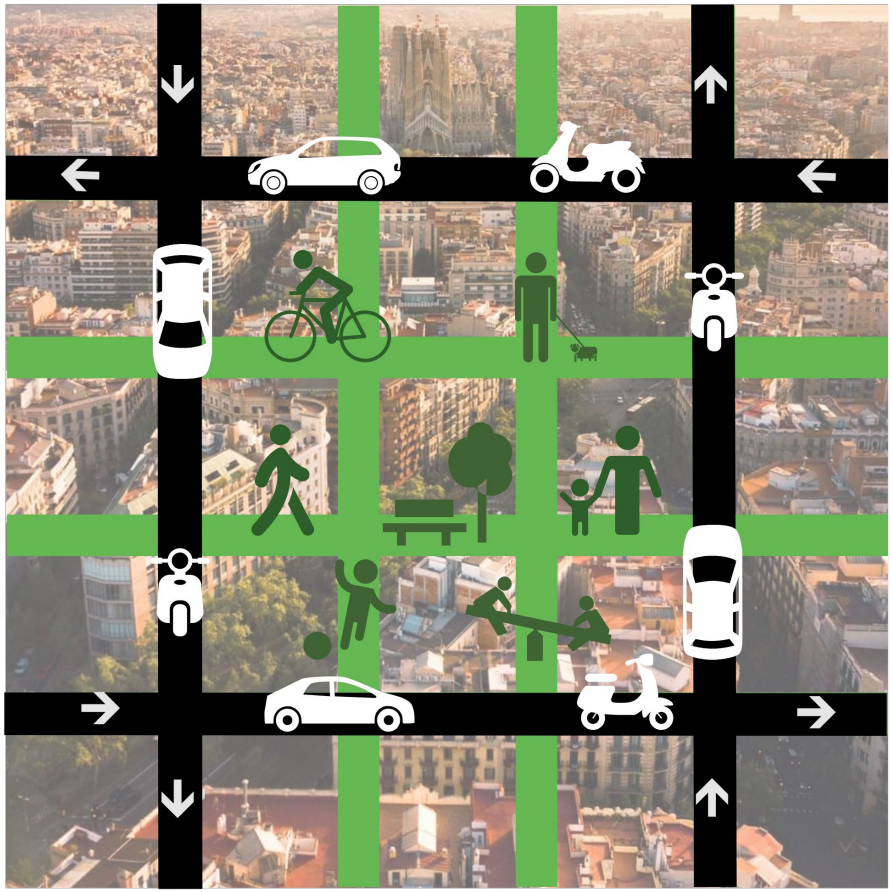
N=2,593 children, 7-10 yrs




Carrer d'Aribau
Carrer de Còrsega
Carrer del Rosselló
Carrer d'Enric Granados
Carrer de Còrsega
Carrer del Rosselló
Carrer d'Aribau
Carrer del Rosselló
Carrer de Provença
Carrer de Muntaner
Carrer de Provença
Carrer d'Aribau
Carrer de Mallorca



Baseline situation



Superblocks model

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Mueller et al 2019, Env Int

Barcelona Superblock San Antoni

Before

After

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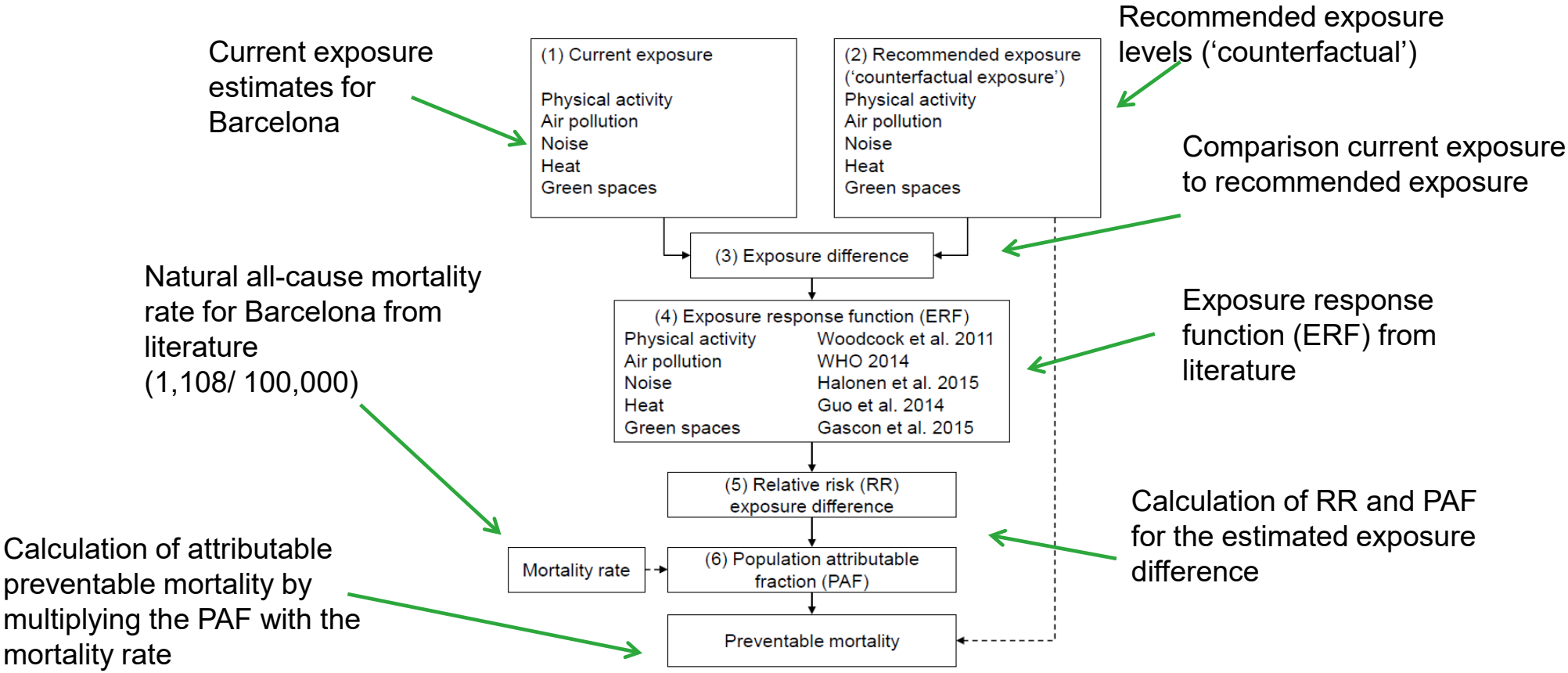
Urban and TranspOrt Planning Health Impact Assessment tool (UTOPHIA)



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Mueller et al EHP 2017; 125: 89-96

BARCELONA SUPER BLOCKS

- **19.2% car reduction**
- **11.5 ug/m3 (24.3%) NO2 reduction**
- **2.9 dB noise reduction**
- **3 fold increase green space (6.5% to 19.6%)**
- **20% Surface temperature reduction**

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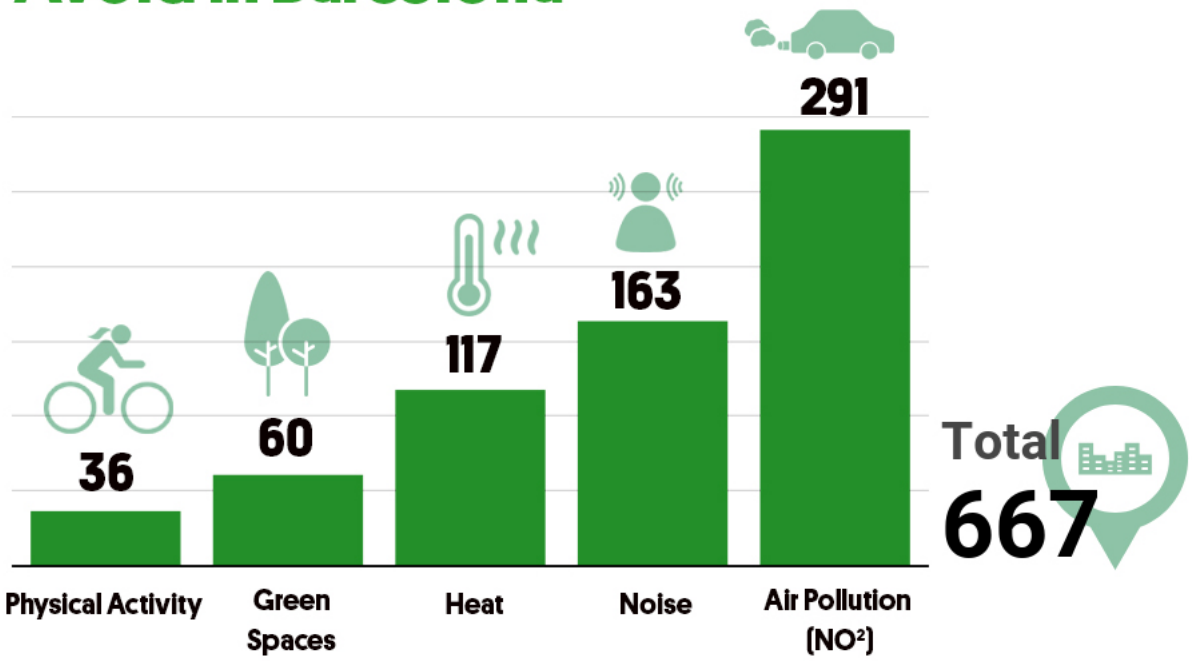
Mueller et al 2019, Env Int

Annual Premature Deaths that the "Superblocks" Model Could Avoid in Barcelona



Source: Mueller et all. Changing the urban design of cities for health: the Superblock model. *Enviroment International.* 2019

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Mueller et al 2019, Env Int

Figure 1. Visualisations for a typical urban terraced street. The four figures are taken from the visualisations used in the Visions 2030 Walking and Cycling Project http://www.visions2030.org.uk/. Each vision represents four different possibilities for urban transport in 2030 in the UK. These visualisations are of a 'typical' Victorian terraced street. Visualisations created by the School of Computing at the University of East Anglia.
doi:10.1371/journal.pone.0051462.g001

Woodcock et al 2013, PLoS ONE

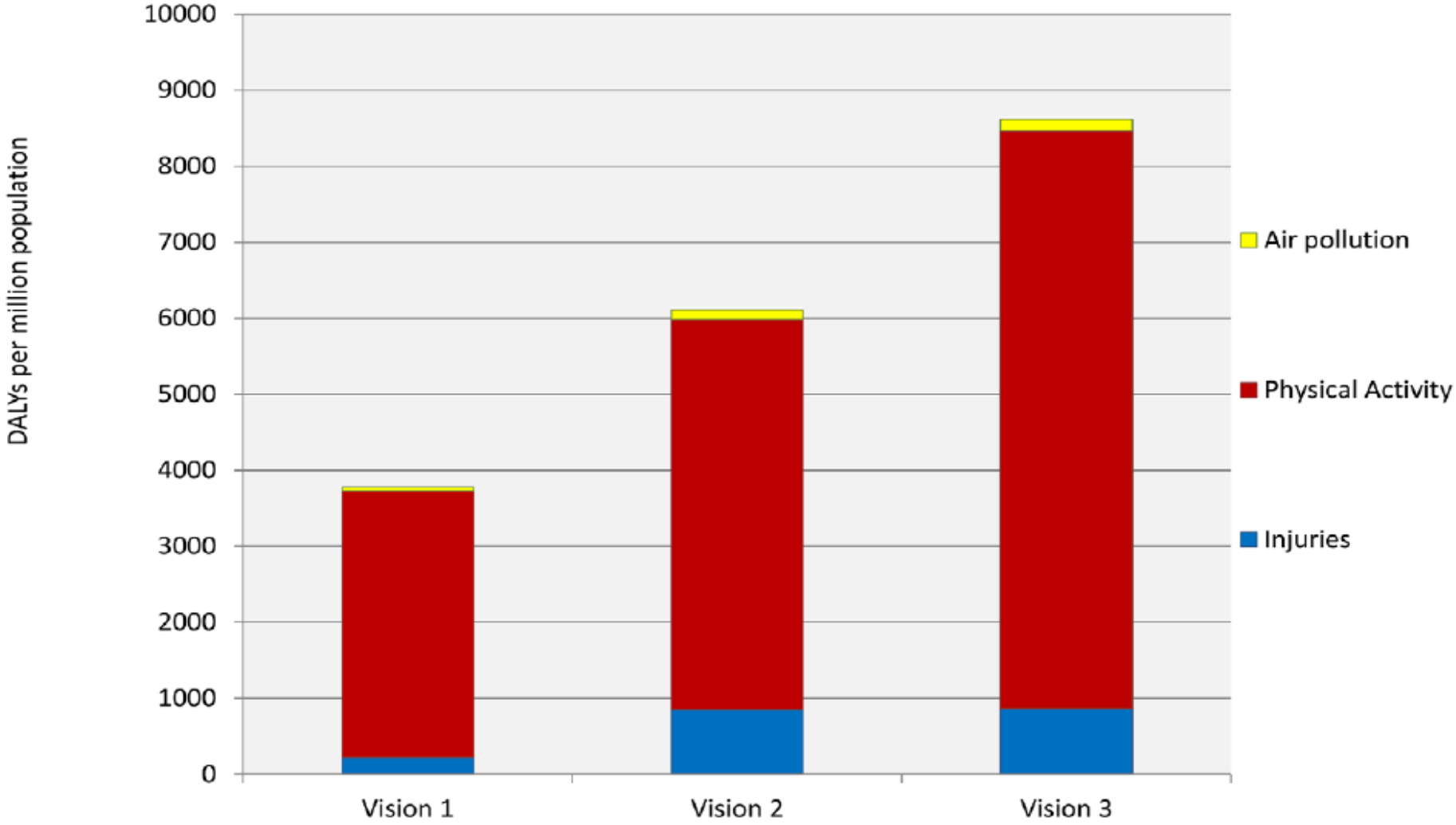

Figure 3. Health gains by Vision and risk factor. Disability Adjusted Life Years gained per million population under each of the three visions, broken down into the proportions attributable to improvements from air quality, increased physical activity and decreased road injuries. See Table 7 for full results.
doi:10.1371/journal.pone.0051462.g003

Woodcock et al 2013, PLoS ONE

Green spaces and mortality: a systematic review and meta-analysis of cohort studies

David Rojas-Rueda, Mark J Nieuwenhuijsen, Mireia Gascon, Daniela Perez-Leon, Pierpaolo Mudu

Summary

Background Green spaces have been proposed to be a health determinant, improving health and wellbeing through different mechanisms. We aimed to systematically review the epidemiological evidence from longitudinal studies that have investigated green spaces and their association with all-cause mortality. We aimed to evaluate this evidence with a meta-analysis, to determine exposure-response functions for future quantitative health impact assessments.

Methods We did a systematic review and meta-analysis of cohort studies on green spaces and all-cause mortality. We searched for studies published and indexed in MEDLINE before Aug 20, 2019, which we complemented with an additional search of cited literature. We included studies if their design was longitudinal; the exposure of interest was measured green space; the endpoint of interest was all-cause mortality; they provided a risk estimate (ie, a hazard ratio [HR]) and the corresponding 95% CI for the association between green space exposure and all-cause mortality; and they used normalised difference vegetation index (NDVI) as their green space exposure definition. Two investigators (DR-R and DP-L) independently screened the full-text articles for inclusion. We used a random-effects model to obtain pooled HRs. This study is registered with PROSPERO, CRD42018090315.

Findings We identified 9298 studies in MEDLINE and 13 studies that were reported in the literature but not indexed in MEDLINE, of which 9234 (99%) studies were excluded after screening the titles and abstracts and 68 (88%) of 77 remaining studies were excluded after assessment of the full texts. We included nine (12%) studies in our quantitative evaluation, which comprised 8 324 652 individuals from seven countries. Seven (78%) of the nine studies found a significant inverse relationship between an increase in surrounding greenness per 0·1 NDVI in a buffer zone of 500 m or less and the risk of all-cause mortality, but two studies found no association. The pooled HR for all-cause mortality per increment of 0·1 NDVI within a buffer of 500 m or less of a participant's residence was 0·96 (95% CI 0·94–0·97; I^2, 95%).

Lancet Planet Health 2019; 3: 469–77

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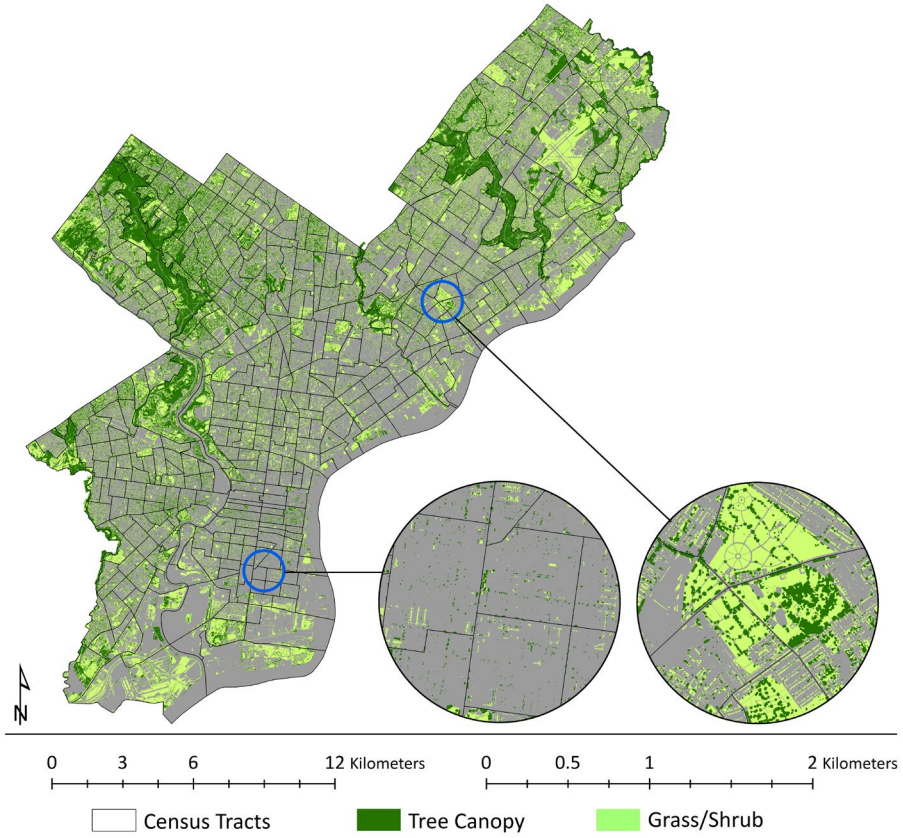
HEALTH IMPACT ASSESSMENT OF PHILADELPHIA'S 2025 TREE CANOPY COVER GOALS (30%)



Land cover analysis in 2008 showed that tree canopy covered 20% of land area

Of the 155 neighborhoods, 19 already met or exceeded the 30% tree canopy goal, and 102 neighborhoods could meet the goal by planting and establishing trees in areas currently covered with grass and/or shrub. The remaining 34 neighborhoods would require removal of impervious surface to meet the 30% cover goal

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Greenworks Philadelphia plan

Kondo et al 2019

DEATHS PREVENTED IN PHILADEPHIA BY INCREASING TREE COVER

	Preventable premature adult deaths		Value (millions, US$ 2015 [95% interval])*
	n (95% interval)	% (95% interval)	
Ambitious increase scenario§			
City-wide	403 (298–618)	2·9% (2·1–4·5)	3865 (2865–5933)
Lower socioeconomic status census tracts	244 (180–373)	3·6% (2·6–5·5)	2339 (1735–3586)
Higher socioeconomic status census tracts	159 (11–244)	2·4% (1·7–3·6)	1526 (1130–2346)
Tree canopy cover (%)			
Quantile 1 (<10%)	196 (144–301)	5·9% (4·3–9·1)	1877 (1389–2890)
Quantile 2 (12–15%)	129 (95–197)	4·0% (2·9–6·1)	1235 (916–1891)
Quantile 3 (16–26%)	75 (55–113)	1·9% (1·4–2·9)	716 (532–1092)
Quantile 4 (>27%)	3 (2–4)	0·1% (0·0–0·1)	28 (2–43)

*Based on value of a statistical life year for 2015 generated by the US Department of Transportation; values are per million (2015 $US). †Five percentage point increase in tree canopy coverage. ‡Ten percentage point increase in tree canopy coverage. §30% total tree canopy cover.

Table 3: Annual preventable premature adult deaths (2014–2025) and economic effects

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Kondo et al 2020

Environment International 99 (2017) 343–350

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No time to lose – Green the cities now

Matilda van den Bosch [a,b,*], Mark Nieuwenhuijsen [c]

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Cognitive bias
The science-policy-practice gap in health and environment topics
Falsification and cautionness of academic language
New scientific methods need new ways of communicating
Economic circumstances

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Multisectorial approach

Multi sectorial and systemic approaches are needed to address current problems and find solutions

ISUH International Society for Urban Health

Global Barcelona Institute for Global Health

Courtesy of Jo Ivey Boufford

Seoul

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ALDERHEY HOSPITAL LIVERPOOL BEFORE AND AFTER

ISGlobal Barcelona Institute for Global Health


Vauban, Freiburg


BEIRUTOPIA

ARTICLE IN PRESS

Environment International xxx (xxxx) xxxx

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Urban and transport planning pathways to carbon neutral, liveable and healthy cities; A review of the current evidence

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Green cities, healthy people

Active cities, healthy people,

Clean cities, healthy people

Social cities, healthy people

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