Direct health benefits from living and working near nature

Manon Emonts

Yoline Kuipers Cavaco

#naturehealth
#naturefit4all

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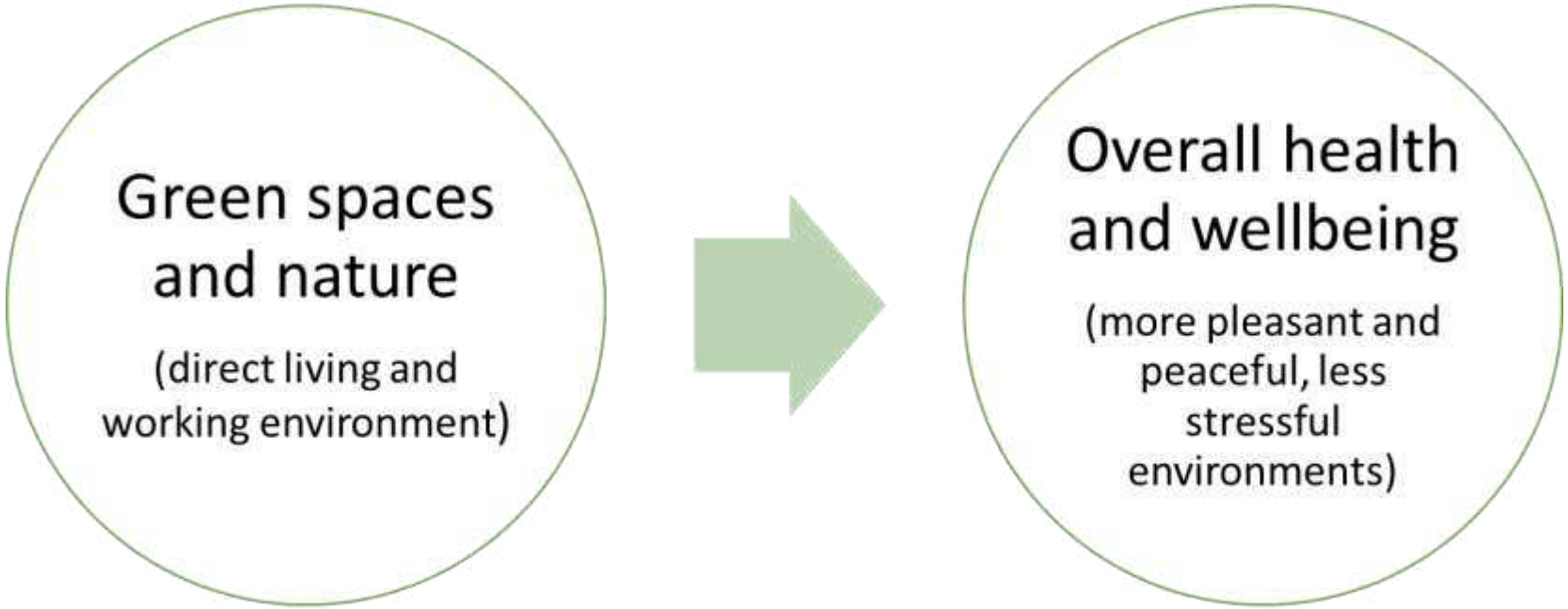
Living near nature



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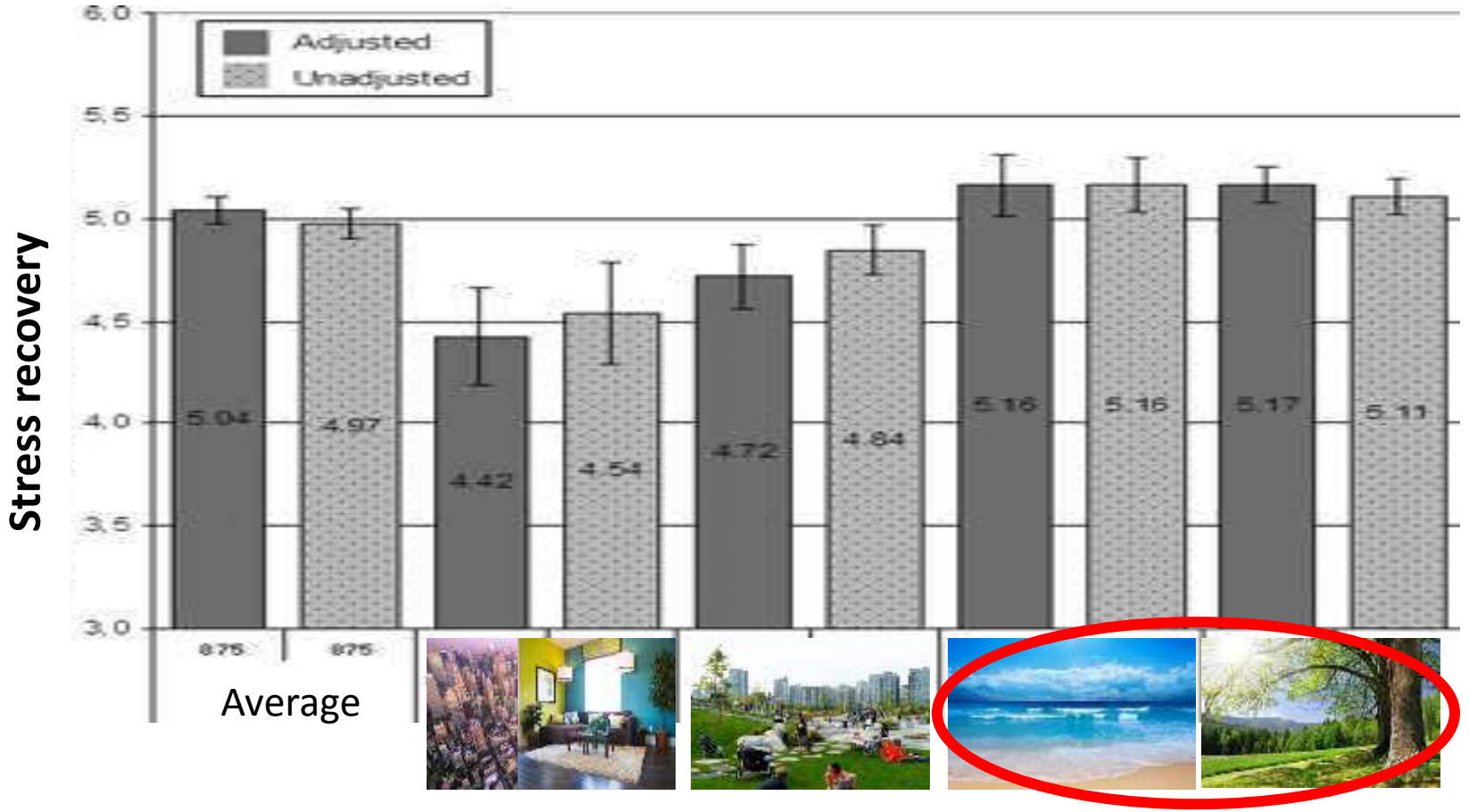
Green and stress recovery



Source: Korpela et al., (2010)

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Proximity of green spaces

Potential effects of green spaces near living environment (<1-3km):

- ↑ Perceived general health, quality of life, wellbeing

  90% of the environment around the home green → 10.2% reported feeling unhealthy.

  10% of the environment was green → 15.5% reported feeling unhealthy. (Maas et al., 2006)
- ↓ No. of mental and physical diseases – e.g. stress and obesity

  Every 4% increase in green space, men's stress levels on average 1 point lower (Scottish Government, 2013)
- Unwind and reflection
- ↑ Longevity
- ↓ Blood pressure pregnant women (<300m from green)

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Mental health benefits

- Nature fosters recovery from mental fatigue and it has a restorative function
  - ↑ mood, concentration, self-discipline, emotional wellbeing
  - ↓ anxiety, depression, loneliness and social support

- Nature as part of therapy: faster recovery from illness

- Nature no effort to observe (e.g. sunshine, leaves) – attention restoration theory (Kaplan, 1995)

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Institute for European Environmental Policy
Collingwood Environmental Planning
ICLEI Local Governments for Sustainability
Luke
milieu
WWF
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NHS FOREST

- National Project in UK - NHS
- Green spaces were created near healthcare sites (guideline for green space design for health and well-being)
- Aim: to improve the health and wellbeing of staff, patients and communities.
- Evidence:
  - rest and relaxation
  - benefits for the rehabilitation and recuperation process

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Allergies

- Various studies suggest that growing up and living in microbe-rich environments can reduce the development of allergies or “atopy”.

→ exposure to certain microorganism such as those present in green environments can positively influence the human immune response (e.g. hay fever)

- Lower prevalence of atopy and atopic diseases in children living in rural areas compared to children living in urban areas

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Direct health benefits and Natura2000

- It is likely that Nature 2000 sites and green infrastructures have a positive effect on:
  - The prevalence of allergies;
  - The overall mental health of people;
  - The longevity of people; and
  - The overall well-being and happiness of people

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Conclusions

- Potential positive effect on health, wellbeing and quality of life;
- Evidence for green in urban areas complex
- Difficult to measure and disentangle

Recommendations

- Increase awareness among urban planners of health/social benefits of green (ensure more green in people's living environment)
- Green to be used by health sector to increase and raise awareness on quality of life

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Yoline Kuipers Cavaco Yoline.Kuipers@milieu.be
Manon Emonts Manon.Emonts@milieu.be

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Health benefits of noise reduction from nature

Yoline Kuipers Cavaco

Manon Emonts

#naturehealth
#naturefit4all

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Noise in the EU

- **Excessive noise**: 2nd worst environmental cause of ill health (1st is ultra-fine particulate matter pollution)
- **Cause**: transportation (road traffic) and industrial activity
- **In the EU:**

  >20% exposed to noise levels exceeding 65 dB(A) during daytime

  >30% exposed to noise levels exceeding 55 dB(A) at night

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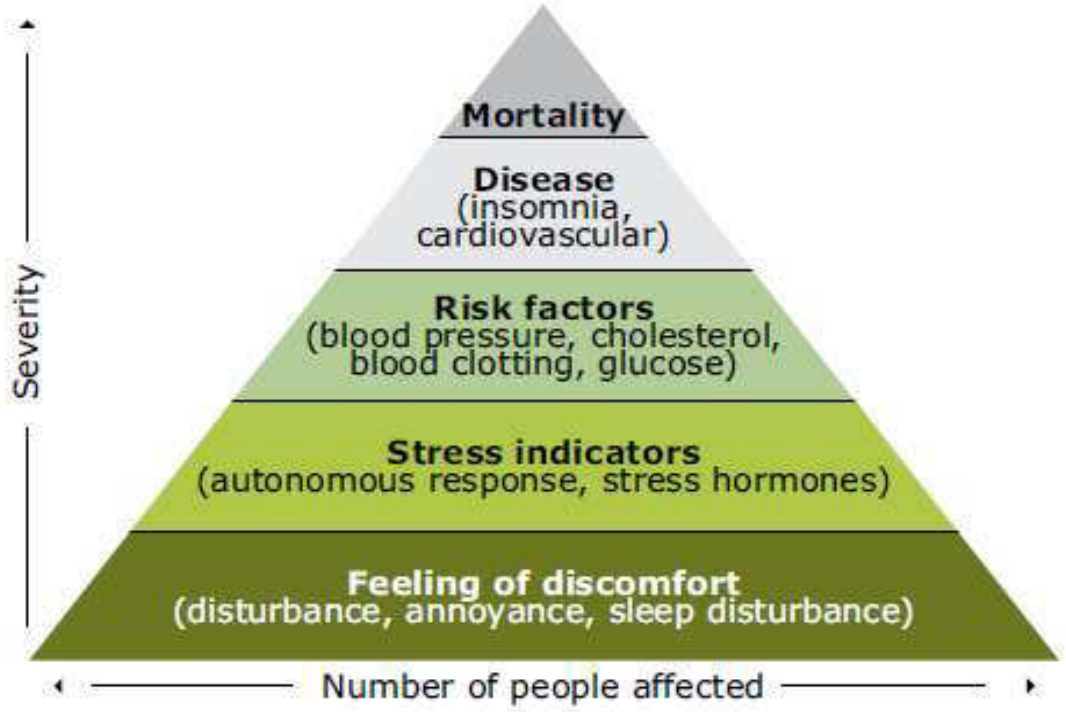
Health impacts (I)

- Auditory effects (hearing impairment, tinnitus)
- Non-auditory effects (annoyance, stress, diabetes, impaired cognitive development of children



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Health impacts (II)

- >1 million HLY lost/year due to traffic related noise
  - 903,000 years for sleep disturbance
  - 587,000 years for annoyance
  - 61,000 years for ischaemic heart disease
  - 45,000 years for cognitive impairment of children
  - 22,000 years for tinnitus

- 10,000 cases of premature deaths/year
- 43,000 hospital admissions in the EU/year

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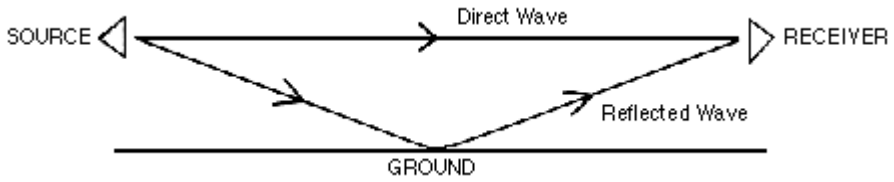
Vegetation reduces noise

- Vegetation can reduce noise by:
  - (1) **redistribution** through reflection, diffraction and scattering of sound;
  - (2) **absorption** of sound energy (transfer into heat)
  - (3) '**acoustical ground effect**': reflected wave (via porous soil) decreases sound that arrives at the receiver directly – particularly low-frequency noise



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Influencing noise perception

- Presence of green areas affects noise perception: reduced long-term noise annoyances + prevalence of stress-related symptoms (Gidlof-Gunnarsson and Ohrstrom (2007)

- Natural sounds influence noise perception: Birds and water sounds reduced the perceived loudness of road traffic noise and reduced annoyance (De Coensel et al., 2011; Nilsson et al., 2010)

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Nauener Platz Soundscape

- Park situated between roads
- Reconstructed to improve soundscape and attractiveness
- Involvement of residents
- 1.5m high 'gabion wall'
  →6 dB reduction in traffic noise in playground
- 'Audio islands': benches with water and bird sounds to mask noise
  → Improved soundscape

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Types of green (I)

- Natura 2000 network can contribute to development of quiet areas (conservation of species requires low levels of noise pollution)
- Tree belts seem to be effective in reducing road traffic if they are well-designed (Hosanna, 2013)
  - A 15 meter deep tree belt can achieve a reduction up to 6 dB(A) at a distance of 50 m, and a 30 meter deep belt up to 10 dB(A)
- Plant vegetation in combi with noise barriers: visual effect, improve acoustic performance

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Types of green (II)

- Earth berms: as effective as traditional noise barriers. Asymmetric berms with non-flat surfaces result in greater noise reductions compared to smooth trapezoidal berms
  - On flat rural floor, stepped earth berms can reduce noise by 4 dB(A) compared with 4m high berm (Hosanna, 2013)

- Vegetative walls: effective in cities. Low-height barriers (1m high) can protect pedestrians, cyclists, and nearby residents from noise, if well-designed and located near sound source (Hosanna, 2013)

- Green Roofs: up to 7.5 dB(A) reduction
- Trees in streets: around 2 dB(A)

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Parc des Hautes Bruyères, Paris

- Former industrial zone: 23 hectares park
- Buffer area between highway and residential area
- Earth berm (60 meter large) along highway
- Silent garden (amphitheatre) 12m below ground
  - Noise levels 20dB lower than rest of park
- Residents at east of the park exposed to 55dB (compared to 80dB at highway)

Tools and Governance

- **EU level**
  - Environmental Noise Directive (2002): noise maps and noise action plans for major sources, to manage noise pollution and preserve quiet areas
  - Noise limit values/quiet area are not defined (up to MS)
- **Local/city level**
  - Infrastructure development (noise reduction measures/ improving soundscape)
  - Incentivise citizens: subsidies for construction of green roofs

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Conclusions

- Potential of nature in reducing noise is small but not insignificant
- Roads: vegetation instead of traditional noise barriers
- City: low barriers close to noise source, green walls and green roofs
- Noise perception and noise-related annoyance reduced by nature

Recommendations

- Can't replace anti-noise measures, but multi-disciplinary impacts of vegetation is interesting tool for city councils and urban planners
- EU: clear definition of 'quiet area' required, and noise benefits of biodiversity should be further promoted

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Yoline Kuipers Cavaco Yoline.Kuipers@milieu.be

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EPIDEMIOLOGICAL STUDIES
PHENOTYPE
Mark J Nieuwenhuijsen
CREAL

PHENOTYPE

FP7 Theme ENV.2011.1.2.3-2; Positive effects of natural environment for human health and well-being. Grant Agreement 282996

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- University of California, Berkeley Campus – United States

BMJ Open

Positive health effects of the natural outdoor environment in typical populations in different regions in Europe (PHENOTYPE): a study programme protocol

Mark J Nieuwenhuijsen,[1,2,3] Hanneke Kruize,[4] Christopher Gidlow,[5] Sandra Andrusaityte,[6] Josep Maria Antó,[1,2,3,7] Xavier Basagaña,[1,2,3] Marta Cirach,[1,2,3] Payam Dadvand,[1,2,3] Asta Danileviciute,[6] David Donaire-Gonzalez,[1,2,3] Judith Garcia,[1,2,3] Michael Jerrett,[8] Marc Jones,[5] Jordi Julvez,[1,2,3,7] Elise van Kempen,[4] Irene van Kamp,[4] Jolanda Maas,[9] Edmund Seto,[8] Graham Smith,[5] Margarita Triguero,[1,2,3] Wanda Wendel-Vos,[4] John Wright,[10] Joris Zufferey,[11] Peter Jan van den Hazel,[12] Roderick Lawrence,[11] Regina Grazuleviciene[6]

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ABSTRACT

Introduction: Growing evidence suggests that close contact with nature brings benefits to human health and well-being, but the proposed mechanisms are still not well understood and the associations with health remain uncertain. The *P*ositive *H*ealth *E*ffects of the *N*atural *O*utdoor environment in *T*ypical *P*opulations in different regions in *E*urope (PHENOTYPE) project investigates the interconnections between natural outdoor environments and better human health and well-being.

Strengths and limitations of this study

- The *P*ositive *H*ealth *E*ffects of the *N*atural *O*utdoor environment in *T*ypical *P*opulations in different regions in *E*urope (PHENOTYPE) project is the largest European project on green space and health.
- The PHENOTYPE project examines simultaneously the possible underlying mechanisms (stress reduction/restorative function, physical

EPIDEMIOLOGICAL STUDIES

AIM

to evaluate the relationships between natural environment indicators and

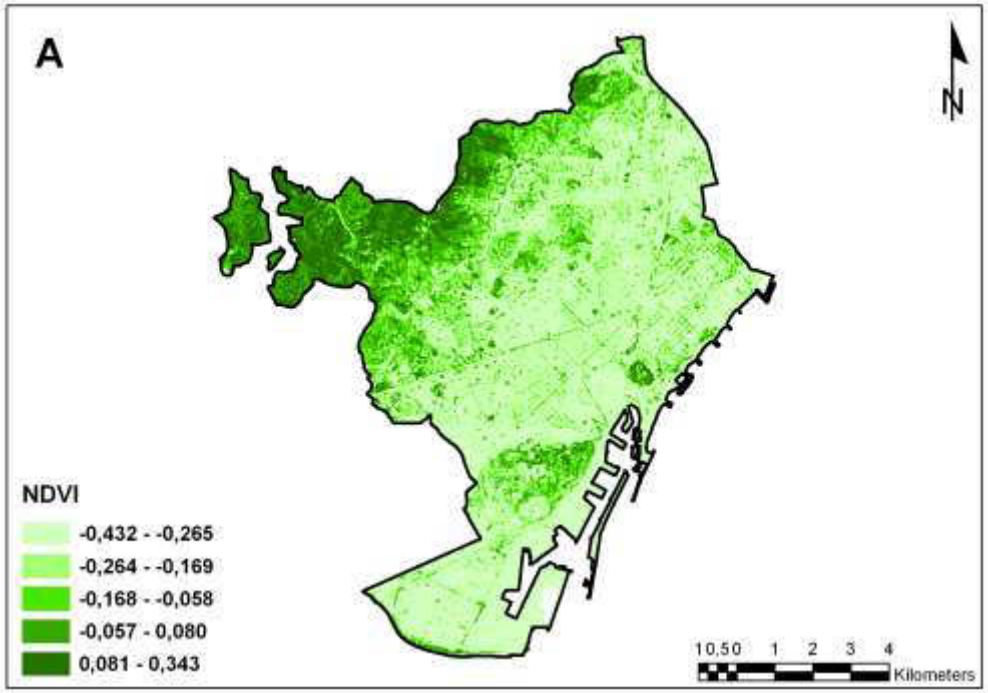
various health outcomes in different regions of Europe.

Methods

Use of existing cohorts, surveys or registries

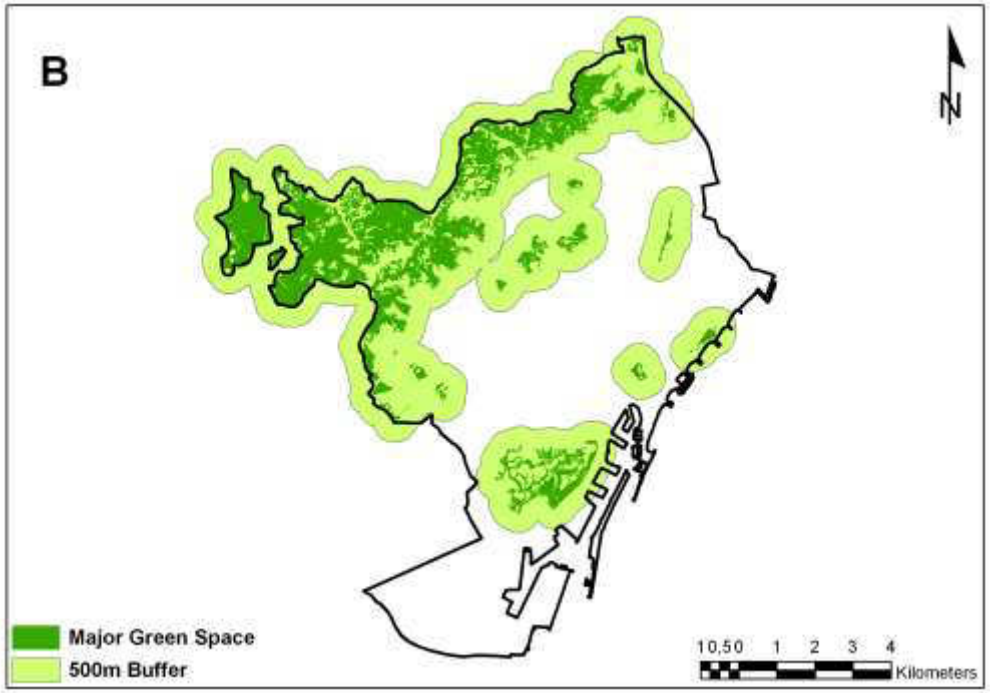
Add green space indicators using remote sensing (NDVI) or GIS based (access to green space)

Analyse the data and writing up



Surrounding greenness

NDVI = normalized difference vegetation index



Access to major green space

Living with X distance of green space

GREEN SPACE AND BIRTH OUTCOMES

Table 2. Regression coefficients (95% confidence interval) for 1-IQR[a] increase in average of NDVI in buffers of 100 m, 250 m, and 500 m around each maternal residential address separately for birth weight, head circumference, and gestational age at delivery.

	NDVI		
Outcome	100-m buffer	250-m buffer	500-m buffer
Birth weight (g)			
Unadjusted	31.9 (7.7, 56.1)*	33.3 (7.7, 58.9)*	44.2 (16.0, 72.3)*
Adjusted[b]	36.1 (16.4, 55.7)*	38.3 (17.1, 59.5)*	44.2 (20.2, 68.2)*
NO_2-adjusted[c]	28.5 (4.3, 52.7)*	29.2 (1.5, 56.9)*	34.4 (1.9, 67.0)*
Birth head circumference (mm)			
Unadjusted	1.1 (0.2, 2.0)*	1.2 (0.1, 2.3)*	1.6 (0.2, 3.0)*
Adjusted[d]	1.2 (0.4, 2.0)*	1.4 (0.4, 2.3)*	1.7 (0.5, 2.9)*
NO_2-adjusted[e]	1.2 (0.2, 2.0)*	1.2 (0.2, 2.3)*	1.6 (0.2, 3.0)*
Gestational age (days)			
Unadjusted	–0.3 (–1.1, 0.4)	–0.3 (–1.1, 0.5)	–0.1 (–1.1, 0.9)
Adjusted[f]	–0.3 (–0.9, 0.3)	–0.3 (–1.0, 0.4)	0.0 (–0.9, 0.9)
NO_2-adjusted[g]	–0.5 (–1.2, 0.3)	–0.5 (–1.3, 0.4)	–0.2 (–1.3, 0.8)

Increase in birth weight and head circumference

Dadvand et al 2012

GREEN SPACE, ASTHMA, SCREEN TIME AND OBESITY

Table 2. Unadjusted and adjusted ORs (95% CIs) for dichotomous outcomes and regression coefficients (95% CI) for BMI *z*-scores associated with 1 IQR increase[a] in average NDVI across different buffers around participants' home addresses, Sabadell, 2006 ($n = 3,178$).

Outcome	100-m buffer	250-m buffer	500-m buffer	1,000-m buffer
Current asthma				
Unadjusted	1.03 (0.87, 1.22)	1.04 (0.84, 1.29)	1.05 (0.84, 1.33)	1.04 (0.86, 1.27)
Adjusted[b]	1.00 (0.82, 1.21)	1.00 (0.78, 1.27)	1.03 (0.79, 1.34)	1.06 (0.85, 1.32)
Current allergic rhinoconjunctivitis				
Unadjusted	0.98 (0.89, 1.08)	1.01 (0.90, 1.14)	1.06 (0.93, 1.21)	1.07 (0.96, 1.19)
Adjusted[b]	0.97 (0.88, 1.08)	0.98 (0.87, 1.12)	1.03 (0.90, 1.18)	1.05 (0.94, 1.18)
Excessive screen time				
Unadjusted	0.86 (0.78, 0.94)**	0.88 (0.78, 0.99)**	0.91 (0.79, 1.03)	0.94 (0.84, 1.05)
Adjusted[c]	0.85 (0.77, 0.93)**	0.84 (0.75, 0.94)**	0.85 (0.74, 0.97)**	0.89 (0.79, 1.00)**
Overweight/obesity				
Unadjusted	0.87 (0.78, 0.96)**	0.90 (0.79, 1.02)*	0.97 (0.85, 1.11)	1.00 (0.89, 1.12)
Adjusted[d]	0.83 (0.75, 0.93)**	0.81 (0.71, 0.92)**	0.83 (0.72, 0.95)**	0.87 (0.78, 0.98)**
BMI *z*-scores				
Unadjusted	–0.04 (–0.09, 0.01)*	–0.02 (–0.08, 0.04)	0.03 (–0.04, 0.09)	0.04 (–0.02, 0.10)
Adjusted[d]	–0.05 (–0.10, 0.00)**	–0.05 (–0.12, 0.01)*	–0.03 (–0.10, 0.04)	–0.01 (–0.07, 0.05)

[a]0.076 for 100-m buffer, 0.105 for 250-m buffer, 0.120 for 500-m buffer, and 0.097 for 1,000-m buffer. [b]Adjusted for child's sex and age, exposure to environmental tobacco smoke at home, having older siblings, type of school (public vs. private), parental education, and parental history of asthma. [c]Adjusted for child's sex and age, parental education, type of school, and having siblings. [d]Adjusted for parental education, type of school, sport activity, and having siblings. *$p < 0.10$. **$p < 0.05$.

Decrease in screen time and obesity

Dadvand et al 2014

GREEN SPACE, ASTHMA, SCREEN TIME AND OBESITY

Table 3. Unadjusted and adjusted ORs (95% CIs) of binary outcomes and regression coefficients (95% CI) for the continuous outcome associated with living within 300 m of parks and forests, Sabadell, 2006 (n = 3,178).

Outcome	Parks	Forests
Current asthma		
Unadjusted	1.54 (1.10, 2.15)**	1.00 (0.58, 1.74)
Adjusted[a]	1.60 (1.09, 2.36)**	1.02 (0.56, 1.87)
Current allergic rhinoconjunctivitis		
Unadjusted	1.17 (0.97, 1.41)*	1.27 (0.95, 1.69)
Adjusted[a]	1.10 (0.90, 1.35)	1.27 (0.94, 1.70)
Excessive screen time		
Unadjusted	1.01 (0.85, 1.21)	0.65 (0.48, 0.89)**
Adjusted[b]	0.91 (0.76, 1.09)	0.61 (0.45, 0.83)**
Overweight/obesity		
Unadjusted	0.94 (0.77, 1.13)	0.79 (0.58, 1.09)
Adjusted[c]	0.90 (0.74, 1.09)	0.75 (0.54, 1.03)*
BMI z-scores		
Unadjusted	−0.04 (−0.13, 0.06)	−0.03 (−0.19, 0.12)
Adjusted[c]	−0.07 (−0.17, 0.03)	−0.06 (−0.21, 0.10)

Decrease in screen time and obesity with forest and increase in asthma with parks

Dadvand et al 2014

GREEN AND BLUE SPACE USE AND BEHAVIOUR IN CHILDREN

Table 2. Unadjusted and adjusted[a] percent change (95% CI) in outcomes associated with an IQR increase in the green space playing time (492 hr) and annual beach attendance (32 days) and with living within 300 m of a major green space (residential proximity), Barcelona, 2011.

Outcome	Green space playing time	Annual beach attendance	Residential proximity
SDQ			
Difficulties			
Total			
Unadjusted	−6.6 (−10.1, −2.9)**	−4.3 (−7.5, −0.9)**	−0.3 (−7.3, 7.2)
Adjusted	−4.8 (−8.6, −0.9)**	−3.9 (−7.2, −0.4)**	−1.3 (−8.2, 6.2)
Hyperactivity/inattention			
Unadjusted	−4.0 (−8.1, 0.2)*	−0.6 (−4.3, 3.2)	−1.8 (−9.4, 6.3)
Adjusted	−2.7 (−7.0, 1.5)	−0.7 (−4.6, 3.2)	−3.0 (−10.6, 5.2)
Emotional symptoms			
Unadjusted	−11.6 (−16.6, −6.2)**	−6.6 (−11.4, −1.6)**	4.8 (−5.6, 16.4)
Adjusted	−8.2 (−13.9, −2.2)**	−3.9 (−9.1, 1.6)	1.9 (−8.7, 13.8)
Conduct problems			
Unadjusted	−3.7 (−9.7, 2.9)	−5.0 (−10.4, 0.7)*	2.3 (−9.2, 15.3)
Adjusted	0.7 (−5.6, 7.5)	−2.8 (−8.2, 2.9)	0.6 (−10.6, 13.1)
Peer relationship problems			
Unadjusted	−17.5 (−24.0, −10.4)**	−17.6 (−23.7, −11.1)**	−2.4 (−16.4, 13.8)
Adjusted	−15.4 (−22.7, −7.4)**	−16.8 (−23.4, −9.7)**	−5.1 (−19.1, 11.3)
Strengths			
Prosocial behavior			
Unadjusted	0.3 (−0.9, 1.5)	1.0 (0.0, 2.1)**	0.9 (−1.3, 3.1)
Adjusted	0.2 (−1.0, 1.5)	1.1 (0.0, 2.2)**	0.7 (−1.5, 3.0)

Less behavioural problems

Amoly et al 2014

RESIDENTIAL GREEN SPACE AND BEHAVIOUR IN CHILDREN

Outcome	Residential surrounding greenness		
	100-m buffer	250-m buffer	500-m buffer
SDQ			
Difficulties			
Total			
Unadjusted	−2.7 (−5.7, 0.3)*	−3.5 (−6.1, −0.8)**	−3.7 (−6.5, −0.9)**
Adjusted	−3.6 (−6.6, −0.6)**	−3.8 (−6.4, −1.2)**	−4.0 (−6.7, −1.2)**
Hyperactivity/inattention			
Unadjusted	−4.4 (−7.6, −1.0)**	−4.2 (−7.1, −1.3)**	−3.9 (−6.9, −0.9)**
Adjusted	−5.0 (−8.2, −1.6)**	−4.5 (−7.4, −1.6)**	−4.1 (−7.1, −1.0)**
Emotional symptoms			
Unadjusted	−0.1 (−4.5, 4.4)	−1.6 (−5.4, 2.2)	−3.4 (−7.2, 0.6)*
Adjusted	−1.4 (−5.9, 3.2)	−2.4 (−6.3, 1.6)	−4.3 (−8.1, −0.1)**
Conduct problems			
Unadjusted	−4.8 (−9.6, 0.3)*	−3.9 (−8.1, 0.5)*	−3.7 (−8.0, 0.9)
Adjusted	−4.8 (−9.4, 0.2)*	−3.6 (−7.8, 0.7)*	−3.1 (−7.4, 1.4)
Peer relationship problems			
Unadjusted	−0.4 (−6.7, 6.2)	−3.6 (−9.1, 2.3)	−2.9 (−8.6, 3.3)
Adjusted	−2.4 (−8.7, 4.3)	−4.9 (−10.4, 0.9)*	−4.6 (−10.2, 1.4)
Strengths			
Prosocial behavior			
Unadjusted	0.5 (−0.4, 1.4)	0.7 (−0.1, 1.5)*	0.7 (0.0, 1.5)*
Adjusted	0.3 (−0.7, 1.2)	0.5 (−0.3, 1.3)	0.5 (−0.3, 1.3)

Less behavioural problems

Dadvand et al 2014

SCHOOL GREEN SPACE AND BEHAVIOUR IN CHILDREN

Outcome	School greenness	Home–school greenness
SDQ		
Difficulties		
Total		
Unadjusted	−5.7 (−12.2, 1.3)	−4.4 (−8.3, −0.3)**
Adjusted	−2.3 (−7.4, 3.1)	−4.5 (−8.6, −0.1)**
Hyperactivity/inattention		
Unadjusted	−5.0 (−10.7, 1.0)*	−5.8 (−9.7, −1.7)**
Adjusted	−2.1 (−7.3, 3.3)	−5.1 (−9.5, −0.5)**
Emotional symptoms		
Unadjusted	−4.5 (−11.7, 3.3)	−1.5 (−6.8, 4.0)*
Adjusted	−2.4 (−9.0, 4.6)	−2.5 (−8.3, 3.6)
Conduct problems		
Unadjusted	−8.1 (−15.9, 0.3)*	−7.2 (−12.9, −1.1)
Adjusted	−1.0 (−8.4, 7.0)	−4.3 (−10.6, 2.5)
Peer relationship problems		
Unadjusted	−9.8 (−23.2, 5.9)	−2.5 (−10.7, 6.6)
Adjusted	−4.4 (−13.6, 5.8)	−4.4 (−12.5, 4.4)
Strengths		
Prosocial behavior		
Unadjusted	1.1 (−0.3, 2.5)	0.8 (−0.2, 1.9)
Adjusted	0.9 (−0.5, 2.3)	0.7 (−0.5, 2.0)

Less behavioural problems

Dadvand et al 2014

SCHOOL GREEN SPACE AND WORKING MEMORY

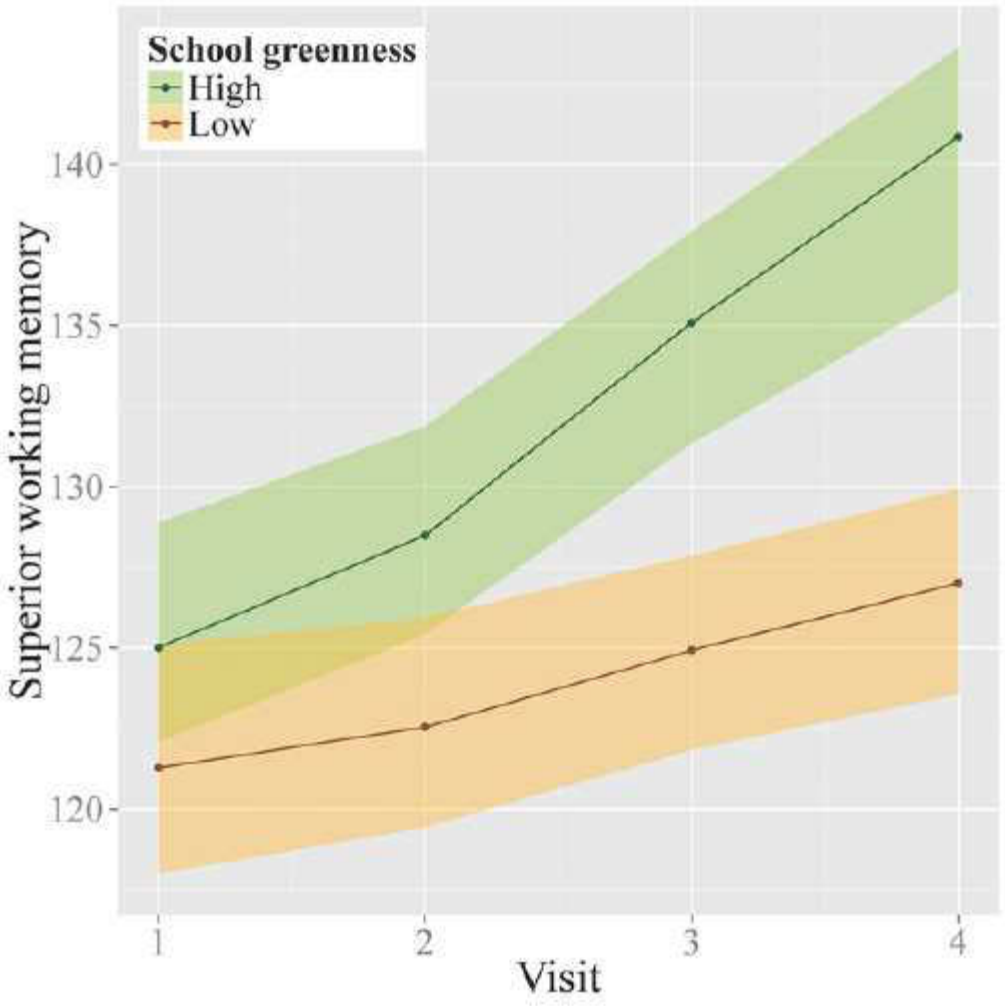


Fig. 1. Twelve-month progress (with 95% confidence bands) in superior working memory for participants with the first (low greenness) and third (high greenness) tertiles of greenness within the school boundaries.

Dadvand et al 2015
PNAS

N=2,593 children, 7-10 yrs

Improved cognitive function

GREEN SPACE AND GENERAL AND MENTAL HEALTH INDICATORS

20% reduction per IQR

	Surrounding greenness OR[§] (95% CI)	Access to green spaces OR[§] (95% CI)
Health indicators		
Less than good self-perceived general health	0.90 (0.83, 0.98)*	0.95 (0.83, 1.08)
Perceived risk of poor mental health	0.79 (0.71, 0.88)*	0.93 (0.79, 1.09)
Perceived depression and/or anxiety	0.81 (0.75, 0.88)*	0.86 (0.76, 0.98)*
Visits to mental health specialists	0.80 (0.69, 0.92)*	0.79 (0.63, 0.98)*
Intake of tranquilizers or sedatives	0.88 (0.79, 0.99)*	0.93 (0.78, 1.11)
Intake of antidepressants	0.80 (0.71, 0.91)*	0.87 (0.72, 1.05)
Intake of sleeping medication	0.89 (0.79, 0.99)*	1.03 (0.86, 1.24)

† Models adjusted for gender, age, education, marital status, socioeconomic status, percentage of population with university studies, health insurance, origin, and degree of urbanization.
§ Odds ratio (OR) reported for all the variables with the exception of social support, where incidence rate ratio is reported.
* p-value < 0.05.

n = 8793 adults

Reduced mental health problems and drug use Triguero-Mas et al 2015

GREEN SPACE DEPRESSIVE SYMPTOMS IN PREGNANT WOMEN

Table 2 Association between NDVI and reporting of depressive symptoms

	NDVI 100 m	NDVI 300 m	NDVI 500 m
Model 5: As model 4+health behaviours††			
Quintile 2	0.89 (0.76 to 1.05)	0.90 (0.77 to 1.06)	0.95 (0.81 to 1.11)
Quintile 3	0.77 (0.65 to 0.91)**	0.80 (0.67 to 0.95)*	0.84 (0.71 to 0.996)*
Quintile 4	0.77 (0.65 to 0.92)**	0.81 (0.68 to 0.97)*	0.85 (0.71 to 1.00)
Quintile 5 (greenest)	0.82 (0.69 to 0.98)*	0.84 (0.70 to 1.00)	0.81 (0.67 to 0.98)*

Odds radio and 95% CI reported; Quintile 1 (least green quintile) reference category.

Table 3 Association between access to green space and risk of depression

	Model 1†	Model 2‡	Model 3§	Model 4¶	Model 5††
Access to green space Yes	0.79 (0.71 to 090)***	0.81 (0.72 to 0.92)**	0.82 (0.73 to 0.94)**	0.88 (0.77 to 0.999)*	0.87 (0.77 to 0.995)*

Odds radio and 95% CI reported; No access to green space within 300 m as reference category.

McEachan et al 2015

N=7547

Reduced depressive symptoms

GREEN SPACE DEPRESSIVE SYMPTOMS IN PREGNANT WOMEN

Table 4 Stratified models for relationship between NDVI and depression (300 m buffer zone) stratified by maternal education (top half of table) and physical activity (bottom half of table)

Education status	Low†	High‡
Model 1: Unadjusted		
Quintile 2	0.76 (0.63–0.92)**	1.12 (0.87–1.44)
Quintile 3	0.70 (0.57–0.984)***	0.68 (0.53–0.88)**
Quintile 4	0.70 (0.58–0.84)***	0.75 (0.59–0.96)*
Quintile 5 (greenest)	0.69 (0.57–0.84)***	0.64 (0.50–0.81)***
Model 5: Adjusted for ethnicity, demographics, SES and health behaviours		
Quintile 2	0.77 (0.63–0.94)*	1.18 (0.90–1.54)
Quintile 3	0.72 (0.58–0.90)**	0.92 (0.70–1.21)
Quintile 4	0.71 (0.57–0.88)***	1.00 (0.76–1.33)
Quintile 5 (greenest)	0.74 (0.59–0.94)*	1.00 (0.75–1.34)

N=7547

McEachan et al 2015

Reduced depressive symptoms particular for low socioeconomic class

GREEN SPACE AND MENTAL HEALTH

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Review

Mental Health Benefits of Long-Term Exposure to Residential Green and Blue Spaces: A Systematic Review

Mireia Gascon [1,2,3,4,*], Margarita Triguero-Mas [2,3], David Martínez [2,3], Payam Dadvand [2,3], Joan Forns [2,3,4], Antoni Plasència [1] and Mark J. Nieuwenhuijsen [2,3]

In total 28 studies were included in the systematic review. We found limited evidence for a causal relationship between surrounding greenness and mental health in adults. Limitation: cross sectional studies

ACCESS TO AND USE OF PARKS AND CARDIOVASCULAR DISEASE

Table 5 Adjusted hazard ratio (HR) of distance to green spaces and park use among Kaunas middle-aged and elderly population and the risk of CVD

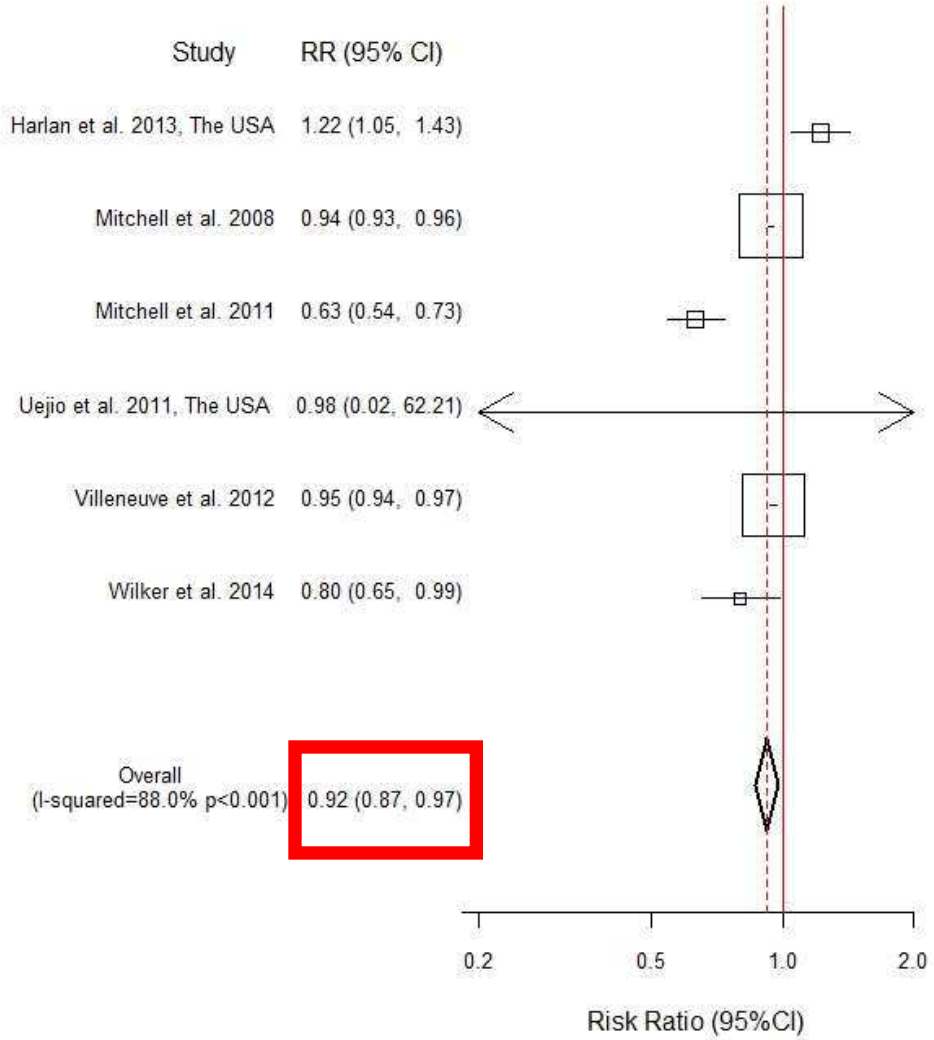
Analyzed health-related factors	Risk of total CVD*	Risk of non-fatal CVD*
	HR (95% CI)	HR (95% CI)
Men and women		
Distance to green spaces		
1st tertile	1 (Reference)	–
2nd tertile	1.20 (0.90-1.61)	–
3rd tertile	1.36 (1.03-1.80)	–
Distance to green spaces and park use		
1st tertile x user	–	1 (Reference)
1st tertile x non-user	–	1.50 (0.83-2.72)
2nd and 3rd tertile x user	–	1.58 (0.95-2.63)
2nd and 3rd tertile x non-user	–	1.66 (1.01-2.73)

N=5,112

Reduction in cardiovascular disease

Tamosiunas et al 2014

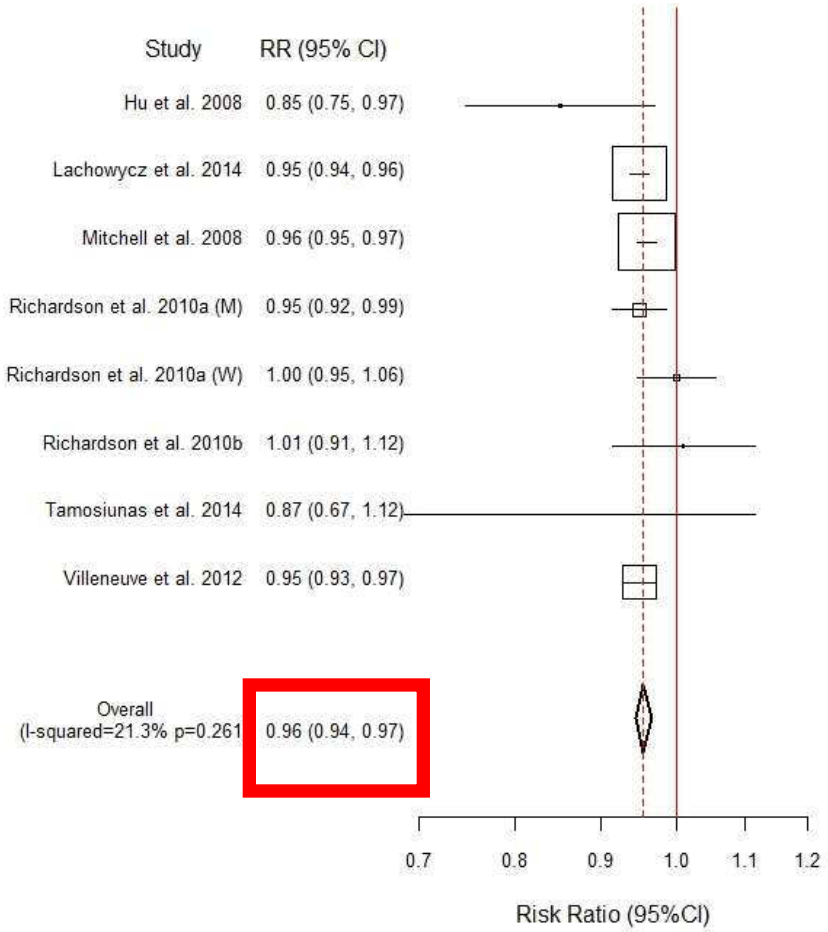
GREEN SPACE AND ALL CAUSES OF MORTALITY



Reduction in all causes of mortality

Gascon et al 2016

GREEN SPACE AND CARDIOVASCULAR MORTALITY



Reduction in cardiovascular mortality

Gascon et al 2015

CONCLUSION

An increase in green space

- Increases birth weight

- Reduces mental health problems in adults/pregnant women

-Improves cognitive function in children
-Reduces behavioural problems in in children
-Reduces sedentary behaviour in children
-Produces mix results for asthma in children

-Reduces cardiovascular disease and mortality in adults
-Reduces blood pressure in pregnant women

Low SES appear to benefit more
Indication that surrounding greenness more beneficial than access

RESEARCH NEEDS

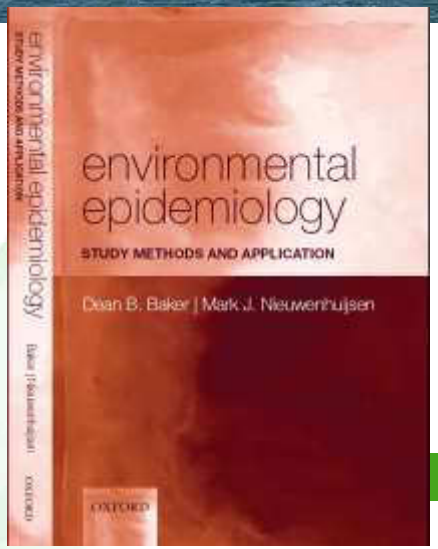
Longitudinal studies

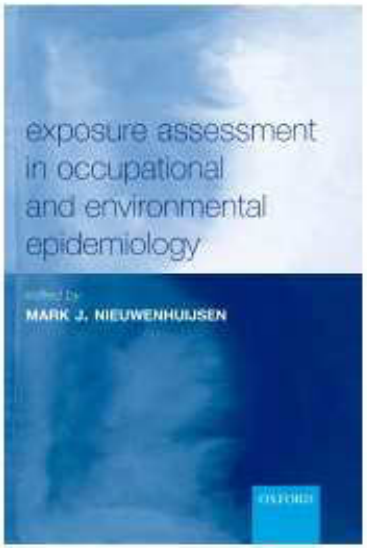
Intervention studies

Contribution of various mechanisms

More on where, when, how much, what type

Quality assessents (e.g. audits)





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Ongoing work

Green space and medication use in the UK

Green space and mortality in Doetinchem

Green space and mortality in the Netherlands

Green space and health in Utrecht

Green space and mortality in Catalonia